YEARBOOK 2023-2024
Honors Academy Bachelor
COLOPHON

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Eindhoven University of Technology

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Bart van Overbeeke, Angeline Swinkels, Confluente, NASA
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Design and Layout
Grefo Prepress

Editors
Lenny Apon, Tiffany He, Rachel van de Pol, Lisa van Os
DEAR HONORS BACHELORS STUDENTS,

I joined the Honors Academy team in January this year, and I’m really pleased with the enthusiasm of the staff, but also with the contribution of the very motivated and active students in the HA. So, I look back on a few interesting months, but the HA looks back on yet another fantastic academic year. In line with our mission, we provided an interdisciplinary program for those students who were seeking extra challenges beyond their regular curriculum. This was offered in a learning environment in which 11 topical tracks were the vehicles in which these students advanced their personal skills. In 2023 we welcomed two new tracks: Radio Astronomy and Nuclear Fusion. This expansion demonstrates the success of the unique approach in which bachelor students can submerge themselves for two years in an engaging interdisciplinary challenge, guided by enthusiastic supervisors. This goes along with a lot of events organized by HA, where students learn from each other, share thoughts and ideas, and demonstrate their achievements to each other as well as to a variety of stakeholders. HA continuously looks for ways to improve these and other activities. The input and contribution of HA students is most welcome.

Many of the Bachelor HA students continue their personal development by participating in official student teams, or in the master HA program. Obviously, we stay in close collaboration with Innovation Space to align with their activities and the student teams. The HA master is more individual and focuses on personal leadership, which is highly appreciated by the students. With the growth of last year, we’re looking for possibilities to upscale the personal leadership program, which is yet another challenge that we take up with great enthusiasm.

I surely hope HA can continue to inspire you and can contribute to your personal development in addition to what you already learn in your regular bachelor programs. I want to thank everybody who contributed to that in the last year, including our staff, Confluente, TA’s, coaches, trainers and coordinators, and of course all active students. I look forward to joining you in another interesting and fruitful new year.

Best regards,

René van Donkelaar
Dean of the Honors Academy
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The goal of Artificial Intelligence (AI) is to enable machines to perform tasks that would typically require human intelligence, such as perception, reasoning, and learning. A recent example for the application of AI is given by image generators, such as stable diffusion, and text generators, such as ChatGPT. As a study topic, AI is highly interdisciplinary, drawing on programming, mathematics, and engineering. In particular, mathematical skills are required to develop and understand the algorithms and models that underpin AI systems. For example, optimization techniques are used to find the optimal models, such as the one minimizing the prediction error. Statistics is necessary for analyzing and interpreting data, and for developing models that maintain desirable statistical properties. Linear algebra is used to manipulate and transform data, for example by the sequential application of linear functions with nonlinear activation in neural networks.

In addition to these core mathematical skills, AI researchers and practitioners need to have a strong foundation in programming, data structures, and algorithms. Finally, AI also involves ethical and social considerations, as intelligent machines have the potential to impact society in significant ways. As such, AI researchers and practitioners need to be aware of the ethical implications of their work and strive to develop AI systems that are fair, transparent, and accountable.
As the track coordinators of the Honors Academy, we have had the pleasure of overseeing a diverse range of projects that showcase the talents and interests of our students. It has been a rewarding experience to see the students grow with the emerging challenges in their projects. We know that the AI track is a particularly tough one, especially for first year students, who did not have a datamining or machine learning course when they started. In addition, the field of AI is not easy to navigate, since it is vast and borrows ideas from multiple mathematical disciplines. We enjoyed guiding the students to develop new skills and getting up to speed with the current state of the art. Through their hard work and dedication, the students have not only created impressive results, but also developed valuable soft skills such as leadership, teamwork, and communication. Further, we can only thank the students for their initiative to contribute to a sense of community and collaboration within the Honors Academy. We would also like to thank the coaches for their valuable contributions, whose efforts made the success of this track possible. We are proud of what the students have achieved and excited to see what they will accomplish in the future.

Coaching the Honors Academy has been an incredibly joyful experience for me, as well as an opportunity to witness the power of artificial intelligence (AI) in education. From the first day, I was struck by the passion, curiosity, and dedication of the students, who were eager to explore and utilize cutting-edge technologies in their projects. The students also explored the use of AI in many different directions and demonstrated how these technologies could be used to solve real-world problems. It was an honor to be a part of that journey. I am grateful for the opportunity to work with such an extraordinary group of young people who are not only passionate about AI but also making a positive impact on the world.

Coaching one of the AI Honors Academy groups has been a very enjoyable experience. The atmosphere in our group sessions is always lively and filled with enthusiasm. It’s impressive to see how the students, despite their rigorous academic schedules, find the time and motivation to immerse themselves in the project. It is notable how they often come up with creative ways to overcome roadblocks and challenges that have emerged in the course of the project. As a coach, it’s gratifying to see that since our collaboration began, the students have not only deepened their understanding of artificial intelligence but have also sharpened various practical skills, including better utilization of the tools at their disposal. It is motivating to see the students’ commitment to setting ambitious goals, which inspires the group to further expand what is achievable.

Being a coach for one of the AI Honors Academy groups has been an incredibly rewarding journey. The energy and enthusiasm that fill our group sessions are infectious, showcasing the students’ remarkable dedication. It’s heartening to see how each member of the group brings their unique strengths to the table, fostering a collaborative environment where ideas flow freely, and innovation thrives. Together, we navigate through complexities, brainstorming solutions, and refining our approaches until we achieve our desired outcomes. What’s particularly gratifying is witnessing the growth and development of each student throughout this journey.
ABOUT THE PROJECT

Our team has worked on creating an easy to use suite of scripts for training a reinforcement learning agent to play a videogame. Such a resource would be a practical, accessible and fun way of teaching students core concepts of reinforcement learning. Our team decided on the GameBoy Advance version of Mario Party as the game of our choice due to its single-player, non-competitive gameplay and vast variety of simple minigames (50!!). Mario Party Advance, therefore, creates a beginner friendly learning environment by minimising the complex burden of agent configuration. Our project does not come without its set of difficulties though. While training agents for over 50 different minigames and the main Mario Party environment is an enormous task in itself, putting all of the agents together to play the game seamlessly is an entirely different challenge that we are set to tackle.

OUTCOMES

At the time of writing, we have created a script for unlocking all the minigames Mario Party Advance has to offer, and for training reinforcement learning agents for a chosen minigame. On top of that we have successfully trained agents for 6 different minigames, which prove to do better than a human player (at least a human player that is part of our Honors team). Having finished developing the scripts, we expect to train agents for many more minigames, and even the main environment of Mario Party in the coming weeks. After all the individual agents are going to be finished, we are set on putting all of them together into a holistic algorithm capable of delegating our individual reinforcement learning agents to play the game on its own.
MEMORIES

Fabrice: After several hours of hooking up the reinforcement learning model to a Gameboy Advance emulator, it was finally time to train the agent to play its first Minigame: ‘Broom-zoom’. We specifically selected this game because of its clear, dense rewards and constrained action space. Despite this, however, training the AI to perform well appeared elusive at first. After iterating over multiple models and hyper parameter configurations, we finally arrived at an agent that could beat the game. There was real satisfaction at having the AI succeed at a game for the first time: the foundation had been built. We were all eager to train AI to play more games in the coming weeks.

LESSONS

• What is the most value lessons learned?
  Organising and structuring our team’s workspace and tools was incredibly beneficial for getting work done and moving forward with our project. At the beginning stages of our project we faced difficulties with the administration and set-up of our tools for all team members. After finalising the set-up of required tools, in the end centralising our team workspace, we have achieved good progress on our project.

• What is your advice for future Honors students?
  Try to achieve an organised team workflow as early into your project as possible. It can be difficult to assign concrete tasks to team members at a project’s inception or beginning stages, yet try your hardest to give everyone specific responsibilities and deadlines, however small they are. This ensures your team’s constant advancement with your project.

• Is there anything else you want to share with your peers or future Honors students?
  Although quality is better than quantity, try to schedule consistent hours for working on your project. That way you won’t wake up one day with tons tasks piled up to be done.

MEET THE TEAM

Fabrice Kusters
• 2nd year Honors student

Vincent Dekkers
• 1st year Honors student

Nichita Climoc
• 1st year Honors student

Tristan Tomilin
• coach
ABOUT THE PROJECT

Our project aimed to enhance the capabilities of GPT 3.5 Turbo by focusing on improving its proficiency in statistics. We fine-tuned this model on a database created by our team, with the goal of developing a version of GPT 3.5 Turbo that could serve as an effective AI tutor for studying Statistics. We sought to achieve a higher level of accuracy and usefulness in statistical explanations, problem-solving, and tutoring interactions.

Furthermore, we envisioned contributing to society in the field of education. By developing an AI tutor that excels in statistics, we aimed to provide accessible, personalized learning assistance. This is especially valuable for students who may not have easy access to human tutors due to financial constraints or geographic limitations. Additionally, such a tool could support a broader understanding of statistics, a fundamental skill in many fields such as science, economics, and data science. This enhancement in educational outcomes enables more people to effectively engage with data-driven environments, fostering a more informed and capable society.

OUTCOMES

For our project, we managed to improve the GPT 3.5 Turbo capabilities to reason and solve Statistics problems. Our final fine-tuned product managed to get a 2-2.5% higher graded on average (on a 0-10 scale) response than the normal GPT 3.5 Turbo model. In this project, we aimed to improve ChatGPT to be better at Statistics, however tackling all areas of Mathematics is a monumental task so we restricted our fine-tuning to a small subset of it. We expect that by using our approach with bigger datasets, greater improvements will be attained in all areas of Mathematics.
MEMORIES

The day OpenAI released their new fine-tuning API features was a big deal for us. It was exciting because it meant we could do a lot more with our project. We spent the day checking out the new features and talking about how this could really help us make our AI tutor better. We were now able to have epoch-based checkpoint creation, a comparative playground, third-party integration, and many more features that we played around with.

LESSONS

Our project to improve GPT 3.5 Turbo’s statistical capabilities has yielded important lessons and insights that we believe will be valuable for future honors students and our peers:

Key Takeaways:
1. Integrating knowledge from multiple domains like AI, machine learning and statistics was essential. It highlighted the benefits of having a range of expertise to solve complex challenges.

2. We found that ongoing testing is critical: hidden problems can appear out of nowhere. We were obliged to constantly refine the model based on real-world usage, which enabled us to further improve performance.

3. Garbage in, garbage out: The training data is the foundation of any AI system. We realized that a high-quality, diverse dataset is vital to building a reliable and effective tool.

Advice for Honors Students:
1. Prioritize applied research: Select projects aimed at addressing concrete, real-world issues. Having this clear purpose provides focus and maximizes the significance of your efforts.

2. Confront obstacles head-on: Challenges are inevitable in any meaningful project. Treat them as chances to grow and adapt. Tenacity and flexibility are invaluable skills that will serve you well in the future. Don’t give up!

MEET THE TEAM

Armand Viorel Ilas
• 2nd year Honors student

Clemente Concha
• 1st year Honors student

Dimitar Dimitrov
• 2nd year Honors student

Sytze Sies
• 2nd year Honors student

Zeno van Cauter
• coach

“AI will probably most likely lead to the end of the world, but in the meantime, there’ll be great companies.”
Sam Altman
ABOUT THE PROJECT

Monitoring consciousness has several applications within the medical sector. Examples considered in the project included anesthesia control and the prediction of regained consciousness after cardiopulmonary resuscitation. While medical practitioners manually carry out much of the analysis today, hospitals like Catharina Hospital Eindhoven (CZE) ask for alternative solutions.

Our Honors research project aimed to advance the field by improving monitoring and diagnosis. A successful attempt would mean enhanced medical care and saving costly resources. In close collaboration with the CZE and associates within the biomedical department of the TU/e, our group worked on developing an accurate and reliable classification tool using machine learning and EEG data.

OUTCOMES

The problem statement that the group initially wanted to address was regarding the prediction of regained consciousness in cardiopulmonary resuscitation patients. However, the data anonymization process at the CZE took longer than expected, and therefore, the project shifted direction to anesthesia control using open-source data retrieved from the PhysioNet platform. Training VGG16 and VGG19 convolutional neural network architectures, we developed high-performing models reaching up to 92.81% accuracy, 92.78% AUC ROC and 91.27% AUC PR. Looking ahead to the next honors year, our project group hopes to refine our existing and increase their explainability. Moreover, we want to explore different techniques for generating synthetic data to handle the problem of data scarcity, a common problem within the medical sector.

Lastly, we are eager to continue working on the initial problem statement again!
MEMORIES

Our honors group’s best memory was visiting Catharina Hospital Eindhoven’s (CZE) neurological department. There, we witnessed how EEG data is collected and learned what features that practitioners look for. In return, the group provided insights into the technical aspects of machine learning and data science. It was a deeply fascinating experience to discuss ideas with professionals from another discipline!

LESSONS

1. What you input into a model is sometimes just as important as the model itself. Making appropriate choices includes both optimizing model performance and explainability.

2. Take initiatives! Depending on the track, the workflow can be highly independent. Don’t wait for anyone to tell you what to do. Instead, find out what you like, work on developing your interests, and ask for help when needed! Honors have great resources and opportunities; Make sure to use them!

3. It’s fun to work in an interdisciplinary team!

MEET THE TEAM

Alicia Larsen
• 1st year Honors student

Patryk Stefanski
• 1st year Honors student

Phat Lê
• 2nd year Honors student

Rajarajeswari Ganesan
• no Honors student

Frans van de Vosse
• no Honors student

Sibylle Hess
• coach

“They say that the data will be ready in 2 weeks. Oh, didn’t they say that already 2 weeks ago...?”
ABOUT THE PROJECT

The goal of the project was to create a novel tokenization technique (an integral part of a transformer A.I. model) which performs better than the techniques currently used by the state-of-the-art transformer models. This increase in performance should be measured through a more efficient training of a language model for a particular task (as in, it learns more with less time). By achieving our goal, our project team would help towards democratizing large language models (LLMs) and open them to a whole wider range of applications.

OUTCOMES

Our project aimed to democratize large language models (LLMs) by making them more accessible for various applications through a novel tokenization technique. We have identified key differences in the different areas of the tokenization research that are crucial in determining the best method that can speed up domain transfer without extensive fine-tuning.

MEMORIES

The best memory of this project is when we got the first adaptive tokenization algorithm working with a BERT model. Even though we didn’t get the expected results, we had a working model utilizing the algorithm which we spent months researching and implementing.
LESSONS

We have dived into different transformer-based models and focused on the importance of tokenization. While most NLP courses and projects focus on the use of pretrained LLMs, we had the opportunity to learn more about different components of the transformers, especially on different methods of tokenization. However, the most valuable lesson learned was to focus on utilizing our available resources fully. By leveraging all available resources, like tests and benchmarks, we could effectively assess our tokenization techniques. This emphasizes the importance of data-driven decision making in research.

Open communication within the team from the outset is vital to address any challenges promptly. Additionally, dedicating time to grasp the core concepts at the project’s beginning sets a solid foundation for success. Also familiarizing yourself with various machine learning topics is highly beneficial. Having a broad understanding of current best practices (SOTA methodologies) in different areas aids project direction and allows for deeper exploration during the Honors year. Prior experience with libraries like PyTorch, TensorFlow, or Hugging Face can be advantageous. Investing a short time to acquire basic knowledge in these tools can significantly benefit your project.

Even if team members have varying knowledge levels, regular meetings and discussions are essential for keeping everyone aligned and ensuring project progress.

MEET THE TEAM

Eleftheria Kolokytha
• 1st year Honors student

Angelos-Ermis Mangos
• 2nd year Honors student

Šimon Sukup
• 2nd year Honors student

Austin - Roose
• 2nd year Honors student

Liu Shiwei
• coach

Huang Tianjin
• coach

“Creating a novel tokenization algorithm for a transformer language model is like throwing a scrabble set into a blender and expecting Shakespeare. It’s not just about chopping up text; it’s an art of predicting which pieces matter most to the puzzle.”
ABOUT THE PROJECT

Our project aimed to revolutionize the way users discover music by integrating a novel visual component – color. We developed an AI-powered music exploration app that links users’ Spotify accounts to a unique “color space.” This space allows users to view the color of their music, which the AI then uses to recommend Spotify tracks that correlate with the mood/aesthetic associated with those colors. The primary goal was to merge our passions for Music and AI and create a more intuitive and enjoyable music discovery experience that goes beyond traditional search methods, offering a playful and visually engaging alternative.

We envisioned our project contributing to society by enhancing how people interact with music. By associating colors with songs, our app introduces a fresh perspective on music discovery, catering especially to visually oriented users or those who perceive strong connections between color and emotion. Our project seeks to refine AI-driven music recommendation systems, uncovering novel insights into the interplay of music, psychology, and visual aesthetics to foster a more personalized and immersive listening experience.

OUTCOMES

Building on last year’s creation of an AI tool for recommending music based on color, this year we honed in on refining the user experience and enhancing our system’s efficiency. We developed a smaller, server-side model to handle the initial processing of audio segments. This approach not only sped up and improved the analysis but also ensured that the user experience on our website remained smooth and responsive.

Two breakthroughs were making the application able to serve multiple users, and the ability to tokenize audio data effectively on the server, which then feeds into personalized user models. This layered modeling approach allows for quicker, more accurate music recommendations without slowing down the user’s interaction with our app. Furthermore, we’ve significantly upgraded our app’s interface and user experience to allow better personalization and more intuitive exploration of one’s musical tastes. Enhancements include more sophisticated visualizations of the colors associated with different tracks, and easier manipulation and exploration via the ‘cube’.
Looking ahead, we plan to expand our music/user database to cover a wider range of genres and artists, enhancing the diversity and appeal of our recommendations. Further research into advanced machine learning techniques will continue, aiming to improve both the accuracy and the personalization of our recommendations. Additionally, we hope to introduce more features such as playlist generation and allowing users to compare their color spaces to their friends. We are also excited about integrating more user feedback into the development process, ensuring that our app evolves in line with our user’s needs and preferences.

MEMORIES

Our best day this year was the mini-hackathon at one of our team member’s places. It was really nice to all be in the same room, a cozier room than perhaps what you would get at uni, hammering out parts of our project together. Being able to bounce ideas off each other instantly was way more effective than trying to coordinate messages from our own houses. Overall it was really fun, we got a ton of work done in the first part of the day and chilled in the latter half. One of our members has an impressive vinyl collection giving it all quite a vibe. It was a great mix of productivity and relaxation, and it really helped us bond as a team.

LESSONS

One of the most valuable lessons we learned this year was the importance of structured collaboration and time management. Engaging in sprint sessions and mini-hackathons not only fostered a strong sense of teamwork but also proved to be highly productive. These experiences underscored the effectiveness of breaking larger tasks into manageable pieces and tackling them with intense focus early in the quartile. This approach allowed us to achieve substantial progress quickly and afforded us more flexibility as exams approached the end of the quartile. Additionally, to future Honors students, focus on doing what you enjoy doing. Choosing projects that genuinely interest you can transform obligatory tasks into passionate pursuits, and joining groups with people that align with your goals and mindset adds much more than one may imagine.

MEET THE TEAM

Alessandro Preiti
• 2nd year Honors student

Andreas Sinharoy
• 1st year Honors student

Kiril Iliev
• 2nd year Honors student

Luis Fernández Gu
• 1st year Honors student

Paul Söntgerath
• 1st year Honors student

Sibylle Hess
• coach

“When it comes down to it, there are very few people who swing the bat.”
ABOUT THE TRACK

In this track the students learn about algorithmic problem solving and related computing skills, and put that to the test by participating in competitive programming contests.

The students in the track typically engage in various activities ranging from participating in and training for programming contests to executing research and company projects. While the first year students focus on developing their algorithmic problem solving skills, organizing training sessions and participating in programming contests on various topics (algorithms, algorithm engineering, AI, cybersecurity, algorithmic trading, etc.), the second year students combine participating in programming contests with a research project or company project. All students also participate in the track seminar, where they conduct research into one of their favourite computer science topics and share this with the entire track in presentations of 30-45 minutes. Overall, the students do not only improve their technical skills in programming and problem solving, but also further improve their professional and personal skills along the way.

7 projects
33 students
I hope to see everyone again next year, and for those who finish honors this year, I wish you a successful remainder of your academic career!

COACHES

Thomas van Dijk
Coach

Hi, I’m Thomas and I joined the TU/e halfway through the academic year as assistant professor with a focus on algorithm engineering. After spending 12 years at German universities, getting to coach this honors track was the perfect “welcome home” to Dutch academia. Two groups of motivated students from diverse backgrounds provided a great introduction to the positively international vibe in Eindhoven and reminded me of my early years as a student myself, attending programming competitions out of sheer curiosity - to mixed success, admittedly. But it’s the journey, not the destination, right? Few things are as rewarding as rising to a challenge with a team of friends.

Seeing a new generation excited about similar things is a nice reminder of the enduring charm of algorithmic and computational thinking, where theory and practice come together and enable things that are, frankly, beyond the scope of what can be expected of a run-of-the-mill developer. These guys and gals are going to make a difference, and it has been an honor (pun intended) to contribute to their growth.

Willem Sonke
Coach

This year I coached two groups of first-year Honors students in the Competitive Programming and Problem Solving track. It was inspiring to see the progress they made in their problem solving skills. In the beginning of the year they already got solid results on the EAPC. Later in the year, Google's Code Jam and Hashcode competitions were cancelled. Some of the students then found and participated in several programming-related contests I didn’t even know of (including an algorithmic trading contest?) Another group developed an interest in CTF (capture the flag) competitions and at some point was participating in CTFs almost every week for practice – the results speak for themselves. I’m hoping to see all of them in the next year and am looking forward to their results and the projects they will take on!
ABOUT THE PROJECT

Our track is all about solving challenges and complex problems using clever and sometimes unorthodox programming techniques. We also love to compete using these skills and compare our skill levels.

So naturally, we wanted to contribute to this environment! Our idea was to create a programming contest, which presents a challenge significantly different than what our peers are accustomed to. What is so different? Well, our contest requires the participants to think more like engineers, utilizing all available materials and tools at their disposal to solve one complex task inspired by real life. Last but not least, we want people to have a bit of fun while competing, so opened the competition to teams instead of individuals (since everybody knows teamwork is always more exciting!)

In a way, our contest has the general goal of expanding and diversifying the community of people excited about competitive, creative and task-oriented programming! In our opinion anybody can do it and everybody should!

OUTCOMES

Our project has a relatively short timespan as it started in the beginning Q2 and will end in the middle Q4, so all our deadlines were tight. However, we managed to set-up the problem set, the contest systems and the logistics in a timely manner (of course that could not have happened without the great support of our coach)!

As time was not on our side and we had many bumps in the road, not every aspect of the organization and creative process was perfect, but with adequate support we pulled through and faced all challenges. We certainly have learned a lot about the subject matter and we hope another team of Honors students will pick-up the project for next year!

The final result is still to be observed (as of time of writing), as the contest is going to be held on the 18th of May. It looks like we will have a very healthy attendance and we are excited to host the event!
MEMORIES

A very happy memory of ours was the day we got to present our project idea to the rest of our track, so it could be approved. These presentations are always light-hearted and fun, especially in our case! Our coach even had an idea how to make the project a bit better, which was definitely welcome!

And we cannot forget the EAPC (Eindhoven Algorithmic Programming Competition) - the first contest of the year! It is always a giant event with many people and the teams are always fierce!

LESSONS

• Never assume something is easy, never assume people know what you are talking about from the get go, have a back-up option for everything.
• Do your thing! The Honors academy provides possibilities for everyone to do something interesting, just keep an open mind. Also, always rely on each other, you are a team and have to pull out the project together!
• It is never too late to start something new, go join that sports club or that committee!

MEET THE TEAM

Ferit Ismailov
• 2nd year Honors student

Sali Basri
• 2nd year Honors student

Jan van Baast
• 2nd year Honors student

Anass El Ouasdad
• 2nd year Honors student

Kevin Verbeek
• coach

“Did you test this before sending it to me? No, but the code will test your limits, good luck!”
ABOUT THE PROJECT

The goal of our project is to get high-schoolers more excited for studying computer science through means of gamification. As of now there is a shortage on the labor market for developers and people in ICT. Getting high-schoolers excited for computer science hopefully leads to more students in computer science, who will be able to make a large impact on the world.

OUTCOMES

We created a game that teaches people about graphs and the DFS algorithm. We were not able to cover as many topics as we wanted. Therefore, we encourage people to continue extending the game, for example with BFS and Dijkstra’s algorithm, although any basic algorithm could work.

MEMORIES

One of the most memorable and enjoyable highlights of this Honors year has been organizing and participating in the Competitive Programming and Problem Solving social event. We wanted to organize an event in which both 1st year and 2nd year Competitive Programming and Problem Solving Honors track students could come together, socialize, and have fun. We, as 2nd year students, also had the opportunity to share the progress that we made on our projects. To add some extra fun into the mix, we played a lively game of bingo to break the ice and learn more about each other. All around, it was a fantastic experience, blending learning, bonding, and plenty of laughs!
LESSONS

Throughout the project, we learned that game development, or any project for that matter, takes more time than you think it should, and that it is important to take this into account when making a planning for your project. Thus, we would like to advise future Honors students to overestimate how much time everything will take when making your year planning, because then you’re probably right ;) Furthermore, to prevent tasks from dragging on longer than they should, we would recommend to plan regular meetings or work sessions, set internal deadlines and plan testing sessions/revisions. But our most important advice would be: have fun! Honors allows us to work on this really cool project with really cool people, but even the coolest of projects will become dull if you let it. So plan that bonding activity, take part in that event, join that committee! Because in the end, those will be the things that make your Honors experience exceptional.

MEET THE TEAM

Daan van Uffelen
• 2nd year Honors student

Evy Zandbelt
• 2nd year Honors student

Maud van Bokhoven
• 2nd year Honors student

Tudor Popescu
• 2nd year Honors student

Willem Sonke
• coach
ABOUT THE PROJECT

The goal of the project is to implement an algorithm to compute stenomap glyphs from the paper “Stenomaps: Shorthand for shapes” by Bettina Speckman, et al.

This is part of a bigger project in the ALGO cluster of the Computer Science and Mathematics department called “Cartocrow”, which is a library implementing geometrical algorithms from various papers in a robust and well-documented manner.

Being more of a research project within academia, the contribution to society of this project is mainly in advancing knowledge and innovation.

OUTCOMES

The main outcome of the project is the full implementation of the algorithm together with some examples, and, ultimately, the integration of the algorithm into the Cartocrow library.

MEMORIES

Working together as a team to figure out how to implement pruning of the branches of the medial axis in an efficient yet correct way.

LESSONS

• When organized well, teamwork is very powerful.
• Start working on your project as soon as possible.
MEET THE TEAM

Diego Rivera Garrido  
- 2nd year Honors student

Iliyan Teofilov  
- 2nd year Honors student

Ivan Georgiev  
- 2nd year Honors student

Alexia Bojian  
- 2nd year Honors student

Willem Sonke  
- coach

“It’s not about ideas. It’s about making ideas happen.”
ABOUT THE PROJECT

Unlike the other Honors tracks, CPPS does not follow the traditional route of having students working on a project (at least for the first year). Instead, we focus on developing our programming and problem solving abilities all-year-round and participating in contests.

While the primary goal is skill development, the broader contribution does lie in preparing ourselves to tackle real-world challenges. Our main goal is to become experts in computational problem-solving, contributing to technological advancements and efficient software solutions across various domains.

OUTCOMES

We took part in many competitions, but our most significant result is reaching the Northwestern Europe Regional Contest (NWERC) stage of the International Collegiate Programming Contest (ICPC), one step away from the World Finals. Given this was our first year in the Honors track, this was an unexpected result, but a welcome one. For the next year, we plan to push ourselves more, hoping to be able to finish in the top 10 at NWERC or maybe even get to the World Finals.

MEMORIES

The experience of the ICPC contests will remain a long lasting memory. It felt very rewarding to put the skills learned through the Honors Program in practice, talk with like-minded individuals and learn about the industry from event sponsors.

LESSONS

The most valuable lesson we learned is that the most important skill for Honors is time management: being able to make the time to do your Honors work is what makes the most difference, especially in our track where practice makes perfect. As a result, our main advice for new Honors students is to get started on your deadlines early. It really makes a difference.
MEET THE TEAM

Vladimir Lazar
• 1st year Honors student

Cezar Mitrea
• 1st year Honors student

Mircea Roata-Palade
• 1st year Honors student

Neda Novakova
• 1st year Honors student

Veselin Todorov
• 1st year Honors student

Vesela Petkova
• 1st year Honors student

Kevin Verbeek
• coach

“Binary search is our greatest enemy.”
ABOUT THE PROJECT

The goal of our efforts was to participate in programming competitions and improve our problem-solving skills through algorithmic exercises. The primary idea was to equip us with an analytical approach when facing complex problems, ultimately benefiting both us and the society in the future, when we eventually transition to solving real-world challenges. We aimed to achieve that through regular sessions where we collaboratively discussed algorithmic exercises, seminars to expand our knowledge, individual practice, and, finally, competing together.

OUTCOMES

Our “project” for this year was to train ourselves to properly analyse problems, learn algorithms and good practices of how to solve them and become more collaborative. As a result everybody learned techniques to solve various problems, from calculating shortest paths to optimising resources and much more. Additionally, working together strengthened our teamwork skills which are crucial for winning competitions.
MEMORIES

The best memory of this Honors year has to be the EAPC. For some of us, it was the first time we had ever competed in a tournament. We had very little experience with algorithms, as the tournament was at the beginning of the year, and we only practised for a few weeks to familiarise ourselves with the problems and how to approach them.

What made the EAPC so memorable was the feeling that even with little experience we were able to solve some problems. This really motivated us to do more problems and have a fun experience with our group.

Another amazing experience that we had was the Honors Intro Weekend where we got to meet other ambitious students, have interesting discussions, play lots of fun games and party.

LESSONS

One of the most valuable lessons we have learned this year is how important good teamwork is and maintaining good relationships with your teammates. We improved on these during contests and social events. When it comes to hard skills, think before you code is one of the best takeaways we have from this year’s contests, particularly don’t always go for a greedy solution, often it won’t work.

For any future Honors students: don’t leave things until the last minute and be proactive and take initiative as that is the only way to learn. You will have deadlines months in advance, so start working on the assignments, like the PDP, as soon as possible.

MEET THE TEAM

Aeden Lindelauf
• 1st year Honors student

Tomasz Soróbka
• 1st year Honors student

Miłosz Słowiński
• 1st year Honors student

Niki Ivanov
• 1st year Honors student

Anže Lešnik
• 1st year Honors student

Mihail Abramov
• 1st year Honors student

Thomas van Dijk
• coach

Willem Sonke
• coach

“YEEEE AAAAAA HHHHHHHHHH”
Aeden Lindelauf
ABOUT THE PROJECT

The first year of the Honors Competitive Programming and Problem Solving track does not involve working on a specific project. We learn a lot about data structures and algorithms and different ways to apply it in various abstract, but specific contexts - competitive programming problems. This teaches us to write efficient code and greatly enhances our problem-solving ability. Apart from participating in contests we also gave seminars. Here we had to research various algorithms that are useful in contests. Our group covered the A* algorithm, Linear Optimization, Push-Relabel algorithm, Min cost flow, Tree Isomorphism, and Number Theory. We also gave each other feedback and asked questions related to the topic presented. These seminars not only improved our research skills, it also helped improve our holistic skills like our presentation and collaboration skills. Having mastered these skills, we prepared ourselves to deliver a societally relevant project in the second year in a way that is both effective and efficient in real-life applications.

OUTCOMES

We participated in various programming competitions and just solved different competitive programming problems. As a benchmark for comparison, we first participated at the Eindhoven Algorithmic Programming Contest. Considering that the competition was the first competitive programming contest for all members of our team, we were quite happy with the results. As a potential improvement, we could have gathered together with the team more often to solve problems together instead of solving them individually which wouldn’t only allow us to solve problems faster, but also provide a better learning experience as now you not only need to figure out a problem for yourself, but also be able to explain it to the peers if necessary. Following months of practice, learning about important topics within the CPPS field, we noticed a significant improvement in our collaborative programming skills and we are excited to use the skills we have learned in real-life applications next year and participate in the EAPC where we are confident that we can deliver a much better performance.
MEMORIES

Our best memories were when we got together with our friends and spent hours discussing and solving various programming problems until late at night. Over time these sessions led to strong friendships within our team. One of the greatest joys is when we spend days working and debugging a problem and gavel finally gives us the green check mark telling us our code is correct. A perfect example of this was when a member from another Supergroup exclaimed in ecstasy at the EAPC when they finally fixed their code near the end of the contest. We also had lots of fun at the socializing event where we bonded with all members of our track.

LESSONS

Make sure to find people who are just as excited as you about the project(s) you do, no matter whether it is within your group or even the track, as this would greatly increase your satisfaction from doing a project, but also will make it more productive. Do not get discouraged when you get stuck on a problem instead discuss your approach with your teammates and coach who can provide their unique perspectives and valuable insights. Knowing how to solve a problem is different from being able to implement the algorithm under time pressure. Make sure to practice solving questions under time restrictions when you are preparing for contests. Ensure to be active in your Honors track and take the tagline “#ownyourfuture” seriously as you need to take charge and pave your path within your track.

Being an honor’s student is a lot more fun than it sounds. Not only do you get to learn a lot about topics you are passionate about, but these tracks allow you to expand your network and meet more people who share the same interests as you.

MEET THE TEAM

Mukil Krishna Balamurugan
• 1st year Honors student

Egor Karasev
• 2nd year Honors student

Bhuvan Vankadari
• 2nd year Honors student

Kasra Gheytuli
• 1st year Honors student

Florian Waas
• 1st year Honors student

Daua Karajeanes
• 2nd year Honors student

Thomas van Dijk
• coach
ABOUT THE PROJECT

A Capture-The-Flag (CTF) is a cybersecurity competition where participants, often individuals or teams, compete to solve a variety of game-like challenges related to cybersecurity. These challenges typically cover a wide range of topics within cybersecurity, including cryptography, reverse engineering, web security, binary exploitation, digital forensics, and more.

Our project, TrojanCTF, is organized by Eindhoven Student Hacking Association Trojan, in cooperation with WhiteHats and IEEE. The event features numerous challenges ranging in various categories, a prize pool of over 1000 euros, a guest lecture from WhiteHats on hands-on hacking, and of course, free snacks, lunch, and dinner.

Our main goal was in two aspects: to establish a community of cybersecurity enthusiasts at TU/e and to contribute to narrowing the skill gap in the cybersecurity sector. By hosting a large-scale CTF on the TU/e campus, we aim to create an environment where people of any background can participate in the CTF, sparking their interest and nurturing their potential in the field of cybersecurity. Beyond the immediate impact on the TU/e community, our aspiration was to contribute to the broader societal need for skilled cybersecurity professionals. There is a pressing need for cybersecurity talents as cyber threats becoming increasingly prevalent and we aimed to do our part in helping to close the skill-gap in the cybersecurity sector.

OUTCOMES

Throughout this year, we have poured relentless effort into TrojanCTF. Among the most significant results so far include establishing strategic partnerships with IEEE, securing a generous sponsorship from WhiteHats, and garnering 110 sign-ups within 5 days of promotion. Additionally, we also received valuable advice from Computer Science professors with our organizational and infrastructural work.

However, we did encounter some unexpected outcomes along the way. Due to organizational constraints, our initial plan for a two-day on-campus event had to be adjusted to a single day on-campus and the other day online, resulting in a packed schedule. Moreover, since the event falls on a weekend, the holidays this year didn’t play to our advantage when we tried to plan the best date for the event. At the time of writing, we are still currently working hard to prepare for
the event and we are determined to ensure the success of TrojanCTF.

Moving forward, we aim to capitalize on the momentum generated by our successful partnerships and promotional efforts. This could involve exploring opportunities for future collaborations with industry partners, expanding our organization to host even more events, and implementing feedback to continually improve the quality and impact of our TrojanCTF.

**MEMORIES**

Our work with E.S.H.A. Trojan and the promotion of the TrojanCTF test events gave us many great opportunities, but the most unforgettable was our experience at the 37th Chaos Communication Congress (37C3) in Hamburg, Germany. At the Congress, we attended numerous interesting lectures, ranging from SMTP smuggling to hacking lawnmowers, and learned about novel real-life security vulnerabilities. Beyond that, we had the opportunity to meet amazing people with whom we shared meaningful ideas and discussions. We gained a lot of real-world knowledge about what the cybersecurity world looks like and got a taste of what it is like to be part of the community.

**LESSONS**

During this year, we have learned many valuable lessons, and one of the most important ones in that regard is about building a strong and solid community. For us, such a community would be interested in cybersecurity and willing to actively participate in the field, without relying solely on our efforts. It is very important to create a community that lasts for longer than just this year, to carry on the association.

This is one of the main reasons we wanted to create a student association, to be able to keep this hacking enthusiasm going even when we’re not around to run the association. We hope to do this by handing over the control to a new board for next year, so they can keep up the spirit of the community.

Throughout the year, we have built this community through CTF trainings and other events, that keep people engaged and active.

**MEET THE TEAM**

Techna Huynh  
• 2nd year Honors student

Teun Peters  
• 2nd year Honors student

Gabrielius Rosinas  
• 2nd year Honors student

Andrei Tudor Popescu  
• 2nd year Honors student

Rijkman Pilaar  
• no Honors student

Sander Simson  
• no Honors student

Kevin Verbeek  
• coach

“CTFs are like games of hide and seek, except the flags are really good at hiding.”
ABOUT THE TRACK

The Empowerment for Health & Wellbeing track is an ambitious, hands-on and human-centered endeavor into developing solutions for the health of people. Students aim to contribute meaningful innovations and designs to society, and to help inspire the next generation of systems in healthcare.

In this track, students pursue a variety of health-related topics, such as Nutrition, Artificial and Virtual Reality, Sports (injuries), Medication Adherence and Medical Devices. In these projects, students generate deep insights through engaging with stakeholders, doing both literature and field research as well as synthesizing all their findings into working prototypes (hardware and software) and thinking about the business/market element of development. The track builds on our multidisciplinary nature; we engineer interactive products, do qualitative interviews with patients and caregivers, run lab tests as well as putting our prototypes into the hands of users in real contexts.

4 projects
22 students

TRACK COORDINATOR

Victor Donker
TRACK COORDINATOR

My name is Victor, part-time lecturer at Industrial Design and honored to be track coordinator of Empowerment for Health & Wellbeing. I am an experienced designer, entrepreneur and marketeer in the high tech and medical device industry. After completing my BSc & MSc in Industrial Design and during my Engineering Doctorate (EngD) in User System Interaction, I started as an entrepreneur in the healthcare sector. I have co-founded the company Usono, a company with which we develop smart solutions for medical ultrasound imaging. It’s great to combine my (commercial) responsivities as company owner with educational work at TU/e. I basically love to help other people and combine my industry activities with lecturing and coaching at TU/e. Coaching 9 students that work on a project for software, hardwell and business development with Usono is just the perfect example.

I can only say I enjoyed it a lot again this year! This
track for me is all about creativity and real-life, hands-on approach to major challenges in healthcare. It’s very exciting and I’m very keen to share my experience, expertise, and network in the industry with eager students. Seeing young talents struggle and tackle challenges is motivating to me. I have deep respect to all students that take up the extra challenge and show their patient for healthcare. Thanks to all students for your efforts and motivation last year. I can’t wait to look what upcoming years will bring us.

COACHES

Astrid Kappers

My name is Astrid Kappers. I am a full professor (part-time) working in the Departments of IE&IS and Mechanical Engineering of Eindhoven University of Technology. I am coaching the NaviSense team. This team has the very ambitious goal to design and hopefully actually create a haptic navigation device for persons with visual impairments. The team already learned that it is a good way to start with interviewing the target population to get a good idea of what these persons need, want and hope for. I enjoy the contacts with this team, and I very much appreciate them sharing their personal ambitions and thoughts with me during the individual PDP meetings. I am impressed by how much time they are willing to spend on their project.

Maarten Paulides

Maarten Paulides is Full Professor and Chair of the Care & Cure research lab of the Electromagnetics group of Eindhoven University of Technology (TU/e). He is also Scientific Director of the Center for Care and Cure Technology Eindhoven (C3Te) at the departments of Electrical Engineering and Applied Physics of TU/e. In this role, Paulides facilitates and stimulates cross-disciplinary research and valorisation in the area of medical applications. Further, he is (honorary) Associate Professor at the Department of Radiation Oncology at Erasmus MC Cancer Institute in Rotterdam. Paulides specializes in electromagnetic simulations, antenna design, hyperthermia technology, magnetic resonance imaging and MR-guided intervention. Validation has always been a focus point of his, leading to expertise in clinical studies and treatment assessment.

Kemal Sumser

Hello, I’m Kemal Sumser, a postdoctoral researcher at the Department of Electrical Engineering, Electromagnetics for Care+Cure Lab. My research passion revolves around the use of radiofrequency waves for the treatment of cancer and neurological diseases. My research expertise is in magnetic resonance imaging (MRI), MRI guidance and computational modelling for personalised treatments. I am particularly interested in hyperthermia for oncological applications and focused ultrasound for neuromodulation. This semester marks my debut as a coach in the Honors Academy, where I’m guiding a diverse team of students in monitoring glycogen stores during prolonged exercise. The project resonates with my background in electrical engineering and as a runner. I’m looking forward to continuing to coach at the Honors Academy and exploring innovative ways of using radio frequency waves to monitor psychological markers.

Rong-Hao Liang

Dr. Rong-Hao Liang is an assistant professor in the Future Everyday Group, Department of Industrial Design and the Signal Processing Systems Group, Department of Electrical Engineering at TU Eindhoven, The Netherlands. His research focuses on designing and engineering intelligent sensing systems and user interface technology for ubiquitous computing and embodied human-computer interaction (HCI). He also co-chaired and co-organized several international conferences and regularly served as a technical program committee member for premier ACM (Association for Computing Machinery) conferences, including CHI, UIST, and DIS. He has more than 70 peer-reviewed publications and more than 10 patents, has been awarded one Best Paper Award and several Honorable Mentions.
ABOUT THE PROJECT

Body measuring instruments have become increasingly important in enhancing athletes’ performance and adjusting preparations to their specific needs. One of the key metrics for athletes is the energy fuel available in their muscles, which is primarily stored in a molecule called glycogen. Knowing the level of energy present in the muscles can allow athletes to appropriately tailor their nutrition to improve their performance in competitive events and training sessions. While measuring instruments have significantly evolved over time, there is still great room for improvement and innovation. Currently, there are no practical ways of measuring athletes’ glycogen levels, the primary alternative being muscle biopsies. This method is not only invasive and painful to the athlete but also a time-consuming and complex procedure. In addition, muscle biopsies take time to be processed which means that they do not give real-time outputs. These factors together make this way of measuring glycogen unattractive to athletes.

The goal of our project is to create an accurate and precise wearable device that can measure the current glycogen levels inside the human body. This wearable device should be able to measure glycogen levels non-invasively and provide real-time outputs. As this goal would take several years to be realized, this year’s main goal was to create consistent outcomes of glycogen measurements via in-vitro lab tests by our measurement device through the utilization of electromagnetic sensing. We envision that this will lay the foundation of the project for the upcoming years.

With our project, we hope to enhance athletes’ performance as they can make sure that their body is correctly fueled before and during their athletic events. However, the outcome of this project lies beyond the scope of athleticism. As this, in future, could be used in life-saving situations for astronauts, firefighters or soldiers.

OUTCOMES

Through our work, we gained much improvement and proficiency in the sensor and the development tools used for the sensor. We conducted multiple lab trials, establishing the effects of factors such as the depth of the sample being measured, and the conductivity and permittivity of materials on our measurements. Additionally, we recreated work accomplished by an innovative thesis in the field, improving certain characteristics of the experiment setup to get more consistent results. During this period, we have also taken
key measurements on the dielectric characteristics of glycogen, which will enable us to recreate this expensive solution through cheaper materials by creating phantoms (objects that mimic the properties of human tissue).

In this year, we have created a solid foundation for future progress on this project. Our next steps will be working with TU/e researchers to develop phantoms for easier lab testing, as well as looking at alternative sensor designs that may be more suited to our purposes. We are also planning to test the sensor’s efficacy on humans soon, aiming to improve the existing design to better suit measurements on the human body.

**MEMORIES**

The best memory from the Honors year is the impromptu pool night in Luna, a beloved building on campus. The evening started off with the intention of going to the golf course for some bonding time, but we found out it was closed. Instead of giving up on our plans, we headed over to Luna for a different kind of fun, where we found a pool table and decided to make the most of the evening.

The atmosphere was warm and lively as we laughed at each other’s attempts, especially the ones that were hilariously off-target. We played round after round of pool, taking turns and teasing each other with every shot. While we played, we also enjoyed some cold beers, which added to the casual and fun vibe of the night.

The best part of the evening was how it brought us all closer together. It was a perfect opportunity to unwind and enjoy each other’s company, away from the stress of our academic work. Luna provided the perfect setting for our gathering, and the simple pleasure of playing pool and having fun together made the night unforgettable. It was a cherished memory of camaraderie and shared laughter that highlighted the joys of friendship and spontaneity.

**LESSONS**

Most valuable lesson learned: The lesson that most stuck out to us was the importance of exploring and getting our hands dirty. We realized that our progress sped up the most in the moments when we did our own explorations through tests and experiments, figuring out the intricacies of complex software and sensors. This contrasted with what we learned from our academic courses, where our goal was to learn from other people’s work.

Advice for future Honors students: Taking initiative is a fundamental pillar of the Honors program, but it is easy to take it for granted. Being proactive is a consistent practice. It requires active participation in what may seem like trivial tasks, such as setting up meetings, organizing space for experiments, and dividing roles. However, without this consistency, the initiative is often lost. For any future Honors students reading this, your consistent effort will be what allows you to best take advantage of the opportunities presented by this program.

**MEET THE TEAM**

Olaf Hermans
• 1st year Honors student

Yash Rana
• 1st year Honors student

Egesu Karadede
• 1st year Honors student

Philipp Liehe
• 2nd year Honors student

Charalambos Kypridemou
• 2nd year Honors student

Maarten Paulides
• coach

Kemal Sumser
• coach
ABOUT THE PROJECT

Try to imagine being blind and needing to navigate through a building with complex layout. How would you handle going from the entrance door to your appointment without knowing where to go or how to get there. In the Netherlands alone there are 367,000 people struggling with these kind of problems on a daily basis. They are either partially or completely visually impaired. While navigation, obstacle detection, element recognition, and orientation are generally really annoying problems, the bigger problem arising from these is that visually impaired people are unable to find their way autonomously in an unfamiliar environment. It will always be a struggle for them to go somewhere on their own. With this project we try to create a sense of freedom and reduced anxiety. This way visually impaired people can get actively engaged in society without having the struggle of always having to ask someone for help.

OUTCOMES

To achieve our goal we have worked on 3 different outcomes of our project. First and most importantly we conducted a set of interviews among Dutch, Spanish and British participants, all of whom are visually impaired. Secondly, we have conducted thematic and semantic analysis on all interviews, and have produced a display of the results. Lastly, we have participated in the TU/e contest as a team. This was used as a way to pitch our ideas to experts and trying to develop our product at a fast pace.

The most significant, unexpected and interesting results obtained in this project came from the interviews. We have learned many new aspects which are important to consider when designing with visually impaired people. Next to this we also got some unexpected answers, like “you could develop a robotic guide dog”. When we started with this project we knew close to nothing on what the life of a visually impaired person looks like. Through conferences, museums, and interviews, we now have a lot of new insights and are in a better position to help our end-user.
MEMORIES

For the past year we have not only been working on the project. We have also made some nice memories as a team. The most memorable ones being the times we visited other places, sometimes for the sake of our project and sometimes just for fun as a team bonding activity. The first event we visited for this project was an event displaying new innovations for disabled people. Most people present at this event were visually impaired themselves, therefore it led to a better understanding of the struggles that they have. Next to this, we also went to the MuZIEum in Nijmegen where we could experience what it is to be blind ourselves. We entered a completely dark environment and we walked on stairs and over bridges, navigated ourselves with the help of a white cane, climbed on a boat and ordered a drink at the bar, all without the help of our vision! The MuZIEum offers more than just this experience in the dark and it is definitely worth going there (also just for fun)! Next to the project-related visits, we also went to the Zoo in Overloon for some team bonding where we saw, among other things, the kangaroos being fed.

LESSONS

One of the most essential lesson we learned from our project was the importance of creating with the target audience rather than just for them. By conducting interviews and engaging with individuals with vision impairments, we gathered unique insights into their everyday struggles and the limitations of currently available aids - perspectives we would not have realized on our own. These interviews quickly formed the foundation of our project, directing our design approach and shaping our understanding of our target group’s needs and preferences. Through these interactions, we better understood our potential user’s day-to-day struggles, often so different from our initial theoretical assumptions.

Based on our experience, our advice to future researchers and designers would be to dedicate sufficient time to discussing your ideas with the people whose lives you aim to improve. Because if we listen to those who are willing to share their experiences, then we can actually create a real impact.

MEET THE TEAM

Jilke Nooijen
• 2nd year Honors student

Kirsten Heinen
• 2nd year Honors student

Juan Pintado Benavent
• 2nd year Honors student

Alicja Napieralska
• 1st year Honors student

Astrid Kappers
• coach

“Design with blind people, not for blind people.”
ABOUT THE PROJECT

In our Sensing for Preventive Healthcare project, our focus lies on crafting a sensor aimed at preventing cardiovascular diseases. Looking ahead, we aspire to extend its capabilities to address type 2 diabetes as well. Our goal is to develop a wearable sensor designed for all-day, everyday use, providing continuous monitoring of vital signs such as blood pressure, heartbeat, and ECG in a comfortable, non-intrusive manner. This sensor will deliver precise monitoring, enabling timely detection of any deviations from normal health patterns. By empowering individuals with this technology, we aim to foster greater control over their health, encouraging proactive steps towards improvement, and ensuring timely alerts for medical intervention when necessary.

OUTCOMES

At the start of this year, as we embarked on our new project, extensive research was our initial step. We looked into various aspects of preventive healthcare, exploring potential angles and strategies for helping the world. Initially, we contemplated creating a non-invasive glucose meter, conducting thorough research and engaging in discussions with researchers and medical professionals. However, we eventually pivoted towards a more holistic approach, focusing on a general sensor to address the four most prevalent chronic diseases: cardiovascular disease, type 2 diabetes, cancer, and cognitive disorders.

For this year’s demoday objective, our aim narrowed down to the creation of a functional prototype primarily geared towards detecting cardiovascular diseases. Alongside prototype development, we will conduct user studies to gather feedback and insights, and concurrently work on establishing the backend infrastructure for data storage and visualization.

Looking ahead to the coming year, we intend to incorporate the feedback garnered from user studies into refining our prototype. Additionally, we plan to augment the sensor capabilities by integrating a sweat sensor to facilitate the measurement of glucose levels, thereby further enhancing our preventive healthcare solution.
One standout memory from this Honors year? Definitely those chill group study sessions. Picture this: a nice vibe, and a bunch of us tackling our projects like true engineers and designers. Sure, we had our serious moments, but mostly it was about bouncing ideas off each other, burning some electronics (by accident) and generally just having fun. It was like a little community coming together to conquer the academic world, one brainstorming session at a time. Good times, good vibes, and a lot of fun.

The key lesson we’ve gleaned this year is the importance of initiating your final prototype early on, even if it’s far from perfect initially. The initial iteration might not meet expectations, but the process of prototyping offers invaluable insights beyond what mere literature research can provide.

**MEET THE TEAM**

Albert Szabo  
• 1st year Honors student

Giulia Muzzi  
• 1st year Honors student

Daria Ritzi  
• 1st year Honors student

Zita Godrie  
• 1st year Honors student

Rong-Hao Liang  
• coach

“The doctor of the future will give no medicine but will instruct his patient in the care of the human frame, in diet, and the cause and prevention of disease.”

Thomas Edison
ABOUT THE PROJECT

Ultrasound technology has become an integral component in sports medicine, particularly within the musculoskeletal imaging sector. Among the numerous sports-related injuries, knee injuries stand out as the most prevalent among athletes. These injuries often involve sprains and tears of soft tissues, such as in the ligaments and the meniscus, posing a significant obstacle to an athlete's training and competitive performance.

The problem is that the current sport rehabilitation process is very time-consuming, as it often requires intricate manual manipulation of the transducer as well as complex diagnosis of the resulting image by the practitioner. This can prolong athletes' recovery time and delaying their return to play. Therefore, Our goal is to streamline this process through the development of a wearable ultrasound device. This innovative device will empower physiotherapists and sport coaches to diagnose muscle injuries with enhanced precision. Our product enables a dynamic knee health monitoring system accompanied by a comprehensive software package for automatic detection. Additionally, our team also involves market analysis for potential product distribution of the wearable ultrasound package. Therefore, this wearable ultrasound can make a significant contribution in musculoskeletal injury rehabilitation industry.

OUTCOMES

We have three outcomes within our project. We have developed and functional universal probe adapter for the ultrasound linear probes along with its production plan. We conducted an experiment and were surprised to find that one of our first designs out-performed every other variant we created. Perhaps this is the power of intuition, perhaps it was beginner’s luck, but in either case that design will serve as the foundation upon which we will optimize the final design. If you are taking this project on, see if you can get access to even more probes to make the adapter even more universal. Moreover, we have a user-friendly dashboard that can analyze ultrasound images and help users understand them. During the process, we didn’t expect to implement design aspects from a previous different use case into our project, which makes it have a more accurate results. Finally, alongside the dashboard is a knowledge sharing
platform aimed at building a valuable Usono client community, providing educational service - online and offline - and the infrastructure for the sharing of research and cases developed with the Probefix.

**MEMORIES**

We had an Interstellar movie night where most of our team was there. It was an insightful moment for the team to discuss the theories behind the movie and we had a fun bonding drink afterwards to get to know each other.

**LESSONS**

Working with a multidisciplinary team with quite a big number of students where we learnt to combine business, software and hardware side to sell a novel product. We also quickly learn to keep track of our progress or it is easy to get lost.

Our advice for future honors students:
- Do not wait to be told what to do, always bring something to the table even if nobody asked for it.
- Start early, stay curious.
- Make friends with your team members, they can get you food at the honors events if you forget to sign up! (speaking from experience)

**MEET THE TEAM**

Alisha Hidayat
• 1st year Honors student

Yash Deshmukh
• 1st year Honors student

Lucas Kiewek
• 2nd year Honors student

Vera Van Beek
• 2nd year Honors student

Malaika Shankar
• 2nd year Honors student

Keanu Lim A Po
• 1st year Honors student

Lii Schmidt
• 1st year Honors student

Alexandra Liskayova
• 1st year Honors student

Amani Asharaf
• 2nd year Honors student

Victor Donker
• coach

"Can everyone PLEASE fill in the lettuceMeet?"
ABOUT THE TRACK

Students from our Track contribute to forwarding the energy transition by addressing climate and energy related problems through research in, design of, and sometimes even implementation of energy innovations.

Our students developed this year five multidisciplinary teams and focused on the following topics: how to make use of bubbles as an energy source (Team Bubbl/e), make a sustainable homemade battery for every one (Team Voltalgae), make use of car batteries for off grid applications (Team Sparke), make use of bacteria to create chemicals and fuels (Team CyanO₂) and convert rust electrochemically into iron fuel (team FeNIX).

The teams have been busy developing their ideas, designed their first prototypes and contacting the first interesting parties. For persevering and looking at the positive side of things, the teams should all be very proud of themselves. All students worked nearly independently within the teams, took responsibility and above all ensured a positive atmosphere to work in, even in busy study periods. Well done!
TRACK COORDINATOR

Han van Kasteren
TRACK COORDINATOR

Facilitating the projects of excellent students at our university has been a privilege as our students always persevere to a point where they are able to amaze you. It’s often not the objectives they reach as a team, but the steps they take as individuals to make this happen, because they are part of this well-functioning, highly ambitious track.

I am always surprised with what the teams come up given the original idea and the often completely different amazing end result. What I learned on top of this, is that our students are resilient. They are highly motivated for, and dedicated to, their team’s objectives. Therefore, they manage to deliver. I thank the students of our track for their continued dedication and effort.

COACHES

Yali Tang
COACH

This year I work with two teams FeNIX and Bubbl/e in the Energy Transition track. Team FeNIX is a new team, which works on an innovative iron electrolysis technology for seasonal storage of renewable energy. It’s a small team with 3 (+1) members, but every single member is super motivated and energetic. Team Bubbl/e is a second-year team working on an innovative idea using bubbles as a medium to recycle the wasted flow energy. They are highly motivated and dedicated to this objective. The team has shown maturity in aspects of both personal and project development. I am very glad to work with these young, energetic, smart students. And I am so happy to witness their personal development as well as their professional achievement on contributing to different energy-transition solutions.

Christina Papadimitriou
COACH

Serving as a coach for the Honors Students Academy, particularly mentoring the Spark/e team, has been an incredibly unique and fulfilling experience. This has been the first time for me to serve as a coach for Honors Energy Track. Working with such talented and driven individuals has been both humbling and inspiring. The team’s resilience in facing challenges head-on has not only strengthened their bond but also provided invaluable insights and lessons for future endeavors. I am confident that each hurdle we encountered together became an opportunity for growth, fostering a culture of innovation and determination within the team.

Mark Cox
COACH

I have been working for Honors Energy Track since 2015 as a coach. Like every honors year, this year it has been a pleasure to see students grow in their personal development and see them achieving results and contributing towards new energy solutions. I am especially proud of how honors students realize their dreams despite a lot of scientific and practical challenges by working in mixed teams and with fellow students and external partners. The honors students often contribute to the solutions of societal problems by developing or contributing to the development of sustainable technologies and products in the quadruple helix context. With a mix of creativity, energy, collaborative mindset each year the magic happens, and amazing projects are developed or pursued and engineers of the future prepare themselves for their upcoming role in society.
ABOUT THE PROJECT

Climate change and global energy crisis requires the use of sustainable methods to reduce carbon dioxide emissions. So, it is vital to develop energy efficient carbon capture techniques. The major driving force is the prominent global temperature rise and governmental regulations. What if it was possible to generate energy out of the flow of gasses, while simultaneously absorbing the carbon dioxide from flue gasses in industries? That is precisely the concept of a theoretical bubble column power generator (BCPG). We aim to create and optimize a working model that can be used to reclaim energy out of the carbon capture through amine absorption process. The BCPG is a novel concept that uses multiphase flow phenomena and Faraday’s law to generate electricity. Magnetic nanofluids are used, containing dispersed magnetic nanoparticles (MNPs). When placed under an external magnetic field, the MNPs align themselves to this field. Therefore, when a stream of bubbles is made to pass through, it disturbs the MNP alignment and according to Faraday’s law, emf is induced. So, this can be converted into a technology to gain energy out of movement of gasses, making carbon capture more energy efficient.

OUTCOMES

We successfully made progress with the lab experiments and measured voltage despite a lot of unexpected technical difficulties. So, we have a clear proof of concept now with experimental validation of our concept. We made progress with modelling too, where we developed a mathematical model on python to estimate how much energy can be obtained from the two phase flow theoretically. On the business side, we successfully purchased our merch this year. Furthermore, we are participating in the TU/e contest. This really helped us to create a slide deck to pitch our idea, gain more insight into business model and also develop a clear picture of the market and the competitors.
MEMORIES

We conducted one of our team meetings outside in the sun with ice cream. It was an on the spot plan with good weather and excellent company. That was really enjoyable.

LESSONS

• It is not possible to do everything and things usually take more time than anticipated. It is important to have a meticulous planning of your work. Furthermore, we also realised that it is important to update everyone on the progress. Since we were all working on different aspects, it became difficult sometimes to keep track of what everyone was doing and how far they were with their tasks. It is also important to keep track of the academic commitments and inform the group of your responsibilities on time to avoid any miscommunications.

• Have a long term planning of your work. It is also helpful to have clear goals from the beginning and have backup plans in case of unexpected turn of events. Enjoy the process and learn a lot on the way!

MEET THE TEAM

Bagavathi Mohan Neela
• 2nd year Honors student

Jakub Grecner
• 2nd year Honors student

Maki Vrasdonk
• 2nd year Honors student

Amir Mousawi
• 2nd year Honors student

Anna Prokhorova
• 2nd year Honors student

Jimena Botella
• 2nd year Honors student

Mark Cox
• coach

Yali Tang
• coach

“Isn’t it cool that you can generate electricity out of gas flow?”
ABOUT THE PROJECT

For many industries, such as the cement and chemical production industry, carbon emissions cannot be avoided. To meet the standards expected by agreements, their emission need to be lowered but current carbon capture technologies are expensive and inefficient. Team CyanO2 seeks to provide industry with an alternative solution in the form of a photobioreactor that uses cyanobacteria to capture carbon dioxide from the production of cement and produces useful chemicals, such as a biodegradable plastics or biofuels, in return.

Cyanobacteria are currently intensively researched on a lab scale, as they are widespread, thrive in a variety of environmental conditions, and demonstrate great promise for carbon uptake through photosynthesis. Our goal is to scale up and optimise this technology and promote its more extensive use.

When capturing carbon dioxide, the bacteria uses it to produce a chemical: bicarbonate. However, genetic modification of the bacteria can lead to to produce a different chemical, which can then be resold to lower the cost of running the reactor. By transforming the captured carbon into another chemical, disadvantages of current carbon capture technologies such as pressurising and storing carbon dioxide long-term are circumvented.

OUTCOMES

Our first focus in the beginning of the project was on literature research, particularly focusing on cyanobacterial metabolism and the possible chemicals produced by genetic modifications. The most promising options emerged to be various biofuels and polyhydroxybutyrate (PHB), which prompted us to investigate the sustainability of each chemical by contacting various experts in those fields. PHB is a particularly exciting potential product due to its ability to degrade under a wide variety of conditions, water-insolubility, and biocompatibility. Blending PHB with other biodegradable polymers can improve its physical properties such as crystallinity and glass transition temperature, which is a topic we would like to research further.

In the second half of the year our efforts were split between working on a bioreactor prototype, which will be used to conduct experiments for determining the
optimum conditions for carbon uptake and subsequent chemical production, and on developing a business case by participating in the TU/e contest.

Unexpected outcomes of our work have been the complexity of evaluating the sustainability of biofuels and the ambiguity of the safety of cyanobacteria and the subsequent lab safety considerations of our project. However, we are still in the first year of our project and are confident in our ability to carry the project out, as we are currently quite on track. Within the next year, we are going to focus on conducting experiments and designing an upscaled version of the current prototype.

MEMORIES

Pitching our project to external partners during the TU/e contest has been one of the nicest experiences for us, as it showed us that people have a genuine interest in our work. Additionally, establishing team dynamics and getting to know each other on a more personal level during our team bonding activities has been very valuable.

LESSONS

• Trusting in yourself and having confidence in your idea are one of the most important things when working on a project like this. Self-doubt can be healthy when it takes the form of constructive criticism and leads to refinement of your project, but more often than not it just obstructs your progress and costs you the support of stakeholders.

Furthermore, while not necessarily a tangible lesson, being part of Honors has pushed us to improve our time management skills and our approach to contacting experts and other stakeholders.

• It is important to be honest to yourself about why you joined Honors – whether it is about your interest in a particular project, the possible accolades you would receive, or the challenge to your personal skills – and it is important to be honest about whether that motivation is enough to keep you engaged and committed continuously.

Being honest with your team about your interests and level of engagement is also crucial in making the experience enjoyable rather than it feeling like a burden. While it may have been said many times already, prioritising your mental health and your studies is exactly what you should be doing - but it should be made clear through open communication with your team.

MEET THE TEAM

Cristina Jiménez Pelarda
• 1st year Honors student

Gabrielle Mathieu
• 1st year Honors student

Matylda Guz
• 1st year Honors student

Raya Dimitrova
• 1st year Honors student

Mark Cox
• coach
ABOUT THE PROJECT

Renewable energy production is booming, but storing the excess power remains a challenge. For instance, solar and wind energy production relies on sunshine and wind speed, leading to unevenly energy production in time and space. The limitations of the traditional battery storage include capacity and environmental impact from material mining and e-waste. While alternatives like hydrogen exists, safety and scalability issues remain.

The goal of this project is to provide a fully automated, efficient, scalable and affordable energy solution, scaling up the existing technology to industry level. By converting iron rust to iron powder through chemical electrolysis, the generated clean electricity energy can be stored as chemical energy, such that storing excess energy generated during peak production periods and release it when demand is high or renewable energy generation is low. Automation will improve efficiency and storage capacity, paving the way for a future free from energy shortages. Overall, our project sought to make a meaningful contribution towards a cleaner, more sustainable future for society, and mitigate the impacts of climate change.

OUTCOMES

We have developed several conceptual designs for the large-scale device, accompanied by an analysis of each design. These designs are geared towards achieving a fully automated production process for iron powders and optimising the overall production efficiency. Additionally, we are currently in the construction phase of the pilot device, which will be later used to test the complete production process. Through modifications to the size and shape of the cathode plate, as well as the production process mechanism, we aim to determine the optimal combination. This information will be valuable for the future steps, which involve the actual construction of the large-scale device.

MEMORIES

Working on the team project resulted in countless meetings between us, which in turn brought us closer together, making each meeting more fun and enjoyable than the last. However, working towards the meet and great with partners event for the TU/e contest was by far the most memorable experience. Preparing for the event already was a unique experience for us, as most
of us were not really comfortable with pitching and hence the practice sessions were filled with laughter. The preparation did pay off in the end, as the event was a pleasant and unique experience for all of us. We enjoyed the opportunity to talk with people from industry and talented individuals that are interested in our project.

LESSONS

The most valuable lesson learned from the Honors program is likely to vary for each individual, but a common theme is the importance of intellectual curiosity and interdisciplinary thinking. Engaging deeply with diverse subjects and perspectives can encourage a broader understanding of the world and encourage critical thinking skills that are invaluable in both academic and real-world contexts.

For future Honors students, my advice would be to embrace challenges and opportunities for growth. Don’t shy away from difficult courses or unfamiliar topics; instead, see them as chances to expand your knowledge and skills. Also, take advantage of the resources available to you, whether that means seeking out mentorship from professors, participating in research opportunities, or connecting with peers who share your interests.

To my peers and future Honors students, I would encourage you to make the most of your time in the program by actively engaging with your studies and the broader academic community. Take time to reflect on your goals and interests, and don’t be afraid to pursue paths that might seem unconventional. Remember that the Honors program is a unique opportunity to explore your passions and develop into a well-rounded thinker and leader.

“tbh no one really cares about the quote.”

some random dude

MEET THE TEAM

Zeyu Cai
• 1st year Honors student

Alexandros Varnavides
• 1st year Honors student

Karolis Juzikis
• 1st year Honors student

Sriram Ramesh
• no Honors student

Augustas Pugžlys
• no Honors student

Yali Tang
• coach
ABOUT THE PROJECT

The core objective of Spark/e was to address the critical challenge posed by the intermittency of renewable energy sources and the difficulty in storing this energy for peak demand periods. Our solution capitalizes on the potential of bidirectional charging technology, which allows electric vehicles (EVs) not only to consume power but also to supply it back to the grid. This innovative approach aims to optimize the use of renewable energy by storing excess generation in electric vehicles during off-peak times and utilizing it during peak hours, thereby reducing dependency on non-renewable power sources.

By facilitating a smarter energy management system, our project contributes significantly to solving one of the major hurdles in the expansion of renewable energy—its variability and storage. Our technology enables electric vehicles to act as mobile energy storage units, which can help balance supply and demand in the energy grid and mitigate the effects of renewable energy intermittency. This not only makes renewable energy more practical and reliable but also promotes a reduction in carbon emissions by integrating more sustainable practices into everyday energy use. Ultimately, our project supports the development of a more sustainable, efficient, and resilient energy infrastructure, fostering a greener future and encouraging the wider adoption of both renewable energy and electric vehicles.

OUTCOMES

Our project achieved several notable milestones, such as coding a simulation of the bidirectional charging process, which serves as a crucial step toward real-world application. This software simulation has helped us to validate our theoretical models and understand the dynamics of energy flow between electric vehicles and the grid. Additionally, comprehensive market research was conducted to tailor our business model effectively, ensuring that our approach aligns with market needs and stakeholder expectations. Moreover, the establishment of an outreach division was key, since a team website was successfully developed.

An unexpected turn in our project was our initial attempt to develop a physical model to demonstrate our concept to potential stakeholders. While this endeavor started with enthusiasm, it soon became apparent that the resources and time required outweighed
the benefits. This experience, however, taught us valuable lessons about resource allocation and project management, shaping our strategic decisions moving forward.

Although we have made significant progress, there is still much work to be done. The outlook for Team Spark/e is optimistic, with plans to continue refining our software and expanding our simulation to cover more scenarios and integrate more complex grid interactions. We suggest focusing future efforts on enhancing the software’s functionality and beginning pilot tests with potential CPO partners. Additionally, continuing to engage with stakeholders and gathering feedback will be crucial in iterating our solution to better meet market demands.

**LESSONS**

The most valuable lesson we learned was the importance of adaptability and teamwork in the face of challenges. The project taught us that innovative solutions come from the ability to pivot and adapt strategies when unexpected situations arise. Embracing each team member’s unique perspectives and strengths was crucial in overcoming obstacles and refining our project. This experience has profoundly shown us that flexibility combined with open communication and collaborative synergy can drive success even under the most demanding circumstances.

To future Honors students, our advice is to embrace every challenge and opportunity with openness and enthusiasm. Engage deeply with your projects and take full advantage of the resources and workshops offered. Cultivate a team environment where open communication is fostered, as this will not only enhance your project but also enrich your personal and professional growth.

We want to remind both our peers and future students that the journey through the Honors program is as significant as the project outcomes. Cherish the process and the relationships you build along the way.

**MEET THE TEAM**

Clara Arroyo Estevez  
• 1st year Honors student

Ignacio Llorden Lafont  
• 1st year Honors student

Juan Llorden Lafont  
• 1st year Honors student

Frank Schellekens  
• 1st year Honors student

Arianna Pasterkamp  
• 2nd year Honors student

Emma Borst  
• 2nd year Honors student

Rokas Bubulis  
• 2nd year Honors student

David Warrand  
• 2nd year Honors student

Han van Kasteren  
• coach

Christina Papadimitriou  
• coach

“The mind that opens to a new idea never returns to its original size.”

Albert Einstein
ABOUT THE PROJECT

As team Voltalgae, we are researching a technology called biophotovoltaic cells, or in easier words: using the photosynthesis of algae to generate energy. This way it becomes possible to work together with nature instead of against it. Most sensors are currently powered by lithium batteries, while our technology doesn’t need lithium. Decreasing the lithium consumption is important, because lithium is a scarce material and because communities living near lithium mines are currently experiencing more and more water shortages due to the mining of lithium.

OUTCOMES

Right now, we are experimenting with the technology to find a reliable proof of concept. So far, we have managed to see that the algae do in fact generate a small power. In the coming time we want to build a more robust setup and optimize the conditions for the algae. We are also participating in the TU/e contest again and we are preparing to recruit new members next year, since we would like to continue as a team much longer!

MEMORIES

We managed to do our first experiments this year. Seeing the technology with our own eyes was amazing!

LESSONS

Our most valued lessons are to take initiative and to never take no for an answer right away.

Our advice for future Honors students is: trust the process of setting up your project. It is a bumpy road, but you'll get there.

Another thing important not to forget for all Honors students is to use this time to really get to know your teammates and do fun bonding activities as well!
MEET THE TEAM

Sacha Dekker
• 2nd year Honors student

Leyna Calderón
• 2nd year Honors student

Guillermo Valdivia
• 2nd year Honors student

Dora Marušić
• 1st year Honors student

Winnie Ye
• 1st year Honors student

Anna Petőfi
• no Honors student

Han van Kasteren
• coach

“We love Henk.”
(our turtle mascot)
ABOUT THE TRACK

The innovation theme of our track is Artificial Intelligence for High Tech Systems. High tech systems have a significant positive impact on changing and shaping our modern lives and societies. Recent advancements in Artificial Intelligence (AI) take this change to the next level of smart high tech systems.

This year we focused on the design, perception, planning, and control challenges of smart high tech systems with relevant use cases varying from mechatronic systems, autonomous racing cars, quadrotors, human-robot interaction, and brain-machine interfaces. Our students found a lot of chances to learn and apply advanced AI, systems, and control knowledge to real engineering challenges. In addition to developing hard skills, we also offered our students many opportunities to develop and improve important soft skills such as presentation, communication, and teamwork.

Our first-year program was organized in modules that cover different AI, mechatronics, and Robotics topics on coordinate transformations, deep learning, deep perception, robot programming with ROS, robot localization and mapping, and autonomous navigation. Students presented their creative work at the end of each month and received constructive feedback from both coaches and peers. In the second year, students continue with their own innovative challenges on smart high tech systems.
TRACK COORDINATOR

Amritam Das
TRACK COORDINATOR

I am an assistant professor at the Electrical Engineering Department. I have a PhD in control systems, specifically focused on mechatronic, high-performance systems. I have always been fascinated by the interplay of artificial intelligence, mathematics and neuroscience. My vision is to understand how mathematical knowledge about the human brain can be complemented with medical imaging data to have better understanding on perception, intelligence, more importantly, the global behavior of the human brain. My ultimate goal would be to use these knowledge bases for combatting neurological deases, provide energy efficient AI solution for engineering systems.

COACHES

Elena Torta
COACH

I am an assistant professor at the Mechanical Engineering Department. I have a PhD in autonomous robots and human-robot interaction and substantial industrial experience. I have always been fascinated by autonomous robots and artificial intelligence. I want to find the best way(s) autonomous robots can integrate into human daily and work life to make it better. This is applicable to robots in the household but also to medical robotics. My passion for autonomous robots that help people and artificial intelligence is what I try to transmit to the honors academy students.

Valentina Breschi
COACH

I am an assistant professor at the Electrical Engineering Department. I have a PhD in Control Engineering with a focus on system identification. I have a keen interest in how system theoretic concepts and data can be merged to learn accurate, yet interpretable, models and controllers. I believe that this is key to get new insights on the world and how to shape it, especially in those situations in which one cannot fully rely on first principles. This is applicable to several domains, including a better understanding of how to model and control complex high-tech systems, biological ones and social behaviors.

Sofie Haesaert
COACH

I am an assistant professor at the electrical engineering Department. I have a PhD in Electrical Engineering with a specialization in control theory and formal methods. My research line includes fundamental research in formal methods for control in cyber-physical systems. This means that I investigate with tools of logic and math whether a control system is reliable and safe. I also do research on the automatic design controllers for autonomous systems.

Zhiyong Sun
COACH

I am an assistant professor at the Electrical Engineering Department. I have a PhD in Control Engineering that specializes in multi-agent coordination and formation control. My main research topics include autonomous multi-robot systems, learning-based control and networked control systems. My research lab (Autonomous Motion Control Lab) at the Control Systems group has focused on autonomous drones and cars with intelligent control, such as formation control, flocking and swarm. We aim to explore the best way how autonomous robots interact with other robots to achieve a global collective task.
ABOUT THE PROJECT

The goal of our team is to explore the applications of spiking neural networks from neuromorphic computing and eventually implement them on a neuromorphic chip at the end of our honors program. Our team is aiming to leverage the brain-like capabilities of spiking neural networks for studying neurological disorders such as epilepsy, Alzheimer’s, and Parkinson’s disease.

Neuromorphic computing is a rapidly evolving and revolutionary field that integrates principles from various disciplines such as computer science, biology, mathematics, electronic engineering, and physics. This interdisciplinary approach aims to design computer systems and hardware inspired by the biological structures of the human brain and nervous system, particularly neurons and synapses. This biological setup is replicated in neuromorphic computing to create systems that are more adaptable, versatile, and energy-efficient than traditional computer architectures.

Neuromorphic systems exhibit several unique characteristics that set them apart from conventional computing models. Firstly, these systems operate on a highly parallel structure where numerous neurons and synapses can function simultaneously, unlike the sequential operation of von Neumann architectures. These systems are also designed to be event-driven, performing computations only when necessary, which is a stark contrast to traditional systems that continuously process data, leading to high energy consumption. Their event-driven nature and massively parallel nature, where typically only a small portion of the entire system is active at any given time while the rest is idle, results in one of the most promising characteristics that have been driving the development of neuromorphic computing: their extremely low power operation. They can often operate on orders of magnitude less power than traditional computing systems.

Spiking neural networks are a particular type of artificial neural network in which the function of the neurons and the synapses in the network are more inspired by biology than other types of traditional neural networks. The key difference between traditional artificial neural networks and SNNs is that SNNs take into account timing in their operation, which can be directly coupled with neuromorphic hardware to harness their low power consumption advantage.
OUTCOMES

Within the first year of our honors program, we have focused on gaining a comprehensive understanding of both traditional and spiking neural networks. Because our team project is more research-oriented, we spent a lot of time understanding how the spikes work, how they are encoded, and how they propagate through the network. We practiced implementing them through various datasets and training methods, most notably using the MNIST and N-MNIST (neuromorphic MNIST). These are large datasets of handwritten digits that are widely used for training and testing in the field of machine learning. We then tried to create a benchmark for comparing regular neural networks with spiking neural networks, calculating the efficiency of the two algorithms and estimating how much computational power each requires, thus highlighting the main advantage of neuromorphic computing, low power consumption.

Additionally, we also wanted to explore the industry around neurocomputing by getting in contact with professionals and asking them questions about the field they work in. Our interviews helped us better understand the scope of spiking neural networks and the gap they fill in the industry, building a bridge between academia and the market, and guiding us through our project.

MEMORIES

Some of our best memories from the Honors Academy are when all tracks come together for the personal development activities. It is a great networking opportunity to get inspired by their projects and discuss potential collaborations, but also to form connections and start new friendships!

LESSONS

1. Start early and be proactive! You have a lot of flexibility to personalize your project, but this also means that you have more responsibility to structure your work efficiently.
2. The Honors Academy is an amazing networking opportunity, so try and make the most out of it. All students enrolled in this program are highly motivated and interested in their professional development, so this is a great time to expand your network and meet new people!
3. Do not be afraid of falling into rabbit holes as it is part of research, learn to climb out from them. Pitfalls are unavoidable, so it’s important you know when to ask for help and guidance.
4. Enjoy the journey!

MEET THE TEAM

Mara Dimitriu
• 1st year Honors student

Khanh Lo
• 1st year Honors student

Amritam Das
• coach
ABOUT THE PROJECT

The story of our project starts from Ellie, Ellie is an elderly grandmother that has a service robot helping her at home. One day she asked the robot to get her her coffee mug but instead, the robot made a mistake and gave her the cup filled with hot chocolate. Not a big deal. But what if Ellie had asked for her diabetes pills and the robot made a mistake? Problems like this requiring active perception are usually tackled by AI. However, this it is riddled with limitations. Primarily, the sheer amount of data and time needed to train it. Secondly, it is not 100% accurate and cannot treat all cases, especially with occlusions. We aim to make an algorithm tailored for semi-structured environments like service robots in elderly homes that can improve active perception and identification of objects in various places using only the mesh of the objects or their geometric data. Without the need for any training or data. our goal is to publish a research paper about this algorithm go to Robo-Cup with it and then have it open-sourced for the use of anyone.

We aimed to contribute to society by addressing the limitations of current AI solutions and making advancements in assistive technology that could benefit not only the elderly but also service and assembly robots in warehouses used for various technologies.

OUTCOMES

The outcomes of our project include the development of an algorithm with promising potential to enhance active perception in semi-structured environments. While we have not yet achieved all our intended results, significant progress has been made in algorithm refinement and testing. One of the most significant results is the algorithm’s ability to identify objects accurately using only their mesh or geometric data, without the need for extensive training data. Unexpectedly, we encountered challenges that delayed our participation in Robo-Cup, but this setback has not deterred our team’s determination to continue refining the algorithm and pursue other avenues for publication and dissemination. Moving forward, we plan to further validate the algorithm’s effectiveness through rigorous testing and evaluation in real-world settings. Additionally, we aim to collaborate with other researchers and organizations to explore potential applications and refine the algorithm for broader use in assistive technology and robotics.
MEMORIES

The best memory from this year was the day we realized that we were actually making an impact. Working on a project which was very loosely defined at first made it difficult to see what the end result would become, as our algorithm’s applications were not well chosen at the beginning of the project. However, once we started making real progress, particularly as we started testing the developed algorithm, a shared sense of fulfillment and purpose was felt within the team. This is what makes projects like this truly motivating. Once we manage to actually apply our developments to real-life scenarios, this feeling of fulfillment is surely going to resonate further within us.

LESSONS

With this in mind, it becomes clear that perseverance is something that cannot be left out when working on real innovation. As nobody has done it before you, it is very easy to feel lost in your own progress. However, it is important to continue trying, as any development is still a learning goal for your project.

Furthermore, reflecting on past mistakes and on the overall direction of the project is truly important. This ensures that you don’t repeat the same issues, and that you are able to apply those learning experiences to improve the overall development of your innovation.

MEET THE TEAM

Youssof Madbouly
• 2nd year Honors student

Tom van Eemeren
• 2nd year Honors student

Egor Obidin
• 2nd year Honors student

Ema Šujster
• 2nd year Honors student

Dragos Diaconu
• 2nd year Honors student

Marom Sverdlov
• 2nd year Honors student

Andres Diaz
• 2nd year Honors student

Elena Torta
• coach
ABOUT THE PROJECT

Our goal for this project is to program 18 drones to fly autonomously and form a “TUe” logo shape. This is done by making use of the motion-capturing cameras of a VICON system and concepts such as formation control, trajectory planning, and collision avoidance. As drone technology becomes more and more popular, it can be used for various applications such as rescue, exploration, or delivery. By completing this project, we will be able to gain theoretical knowledge and practical skills, that will help us investigate various uses of drones further and bring us closer to implementing them in our society.

OUTCOMES

In the beginning, we had to learn how to calibrate and operate the VICON system that controls the drones and we learned how to configure the drones such that they are recognised properly and are ready to fly. The next step was to make the drones hover for a short while and land right after, which proved to be more challenging as we increased the number of drones from 1 to 6. Shortly after, we were able to plan different types of trajectories using MATLAB, the first one being a horizontal heart shape. This taught us more about the algorithms used to plan a smooth trajectory from one point to the other. Since our goal is to use 18 drones, we needed to make sure that these drones do not accidentally cross paths and collide, therefore, we wrote a python script that makes sure to keep a safe distance between two drones while one of them is flying and the other one is controlled by us. The collision avoidance proved to be successful in our tests, but it is yet to be implemented for a larger number of drones, while they are all given a specific trajectory. We then stepped closer to completing the goal of our project by looking into formation control, and how we can achieve the shapes that are required for the logo. During our work we have reached some unexpected outcomes. The most important one, is detecting the disturbances caused by the wind coming from a drone’s propellers. While flying the drones in a vertical formation, the lower drones would destabilise due to the air current created by the drones above them. To tackle this problem, we created the “T”, “U” and “e” shapes slightly tilted, with the higher drones further away from the origin on the y-axis and the lower drones closer. As a result, we reached a successful demo in which 6 drones go through all the letters, by morphing one letter into the next.
However, combining all the functionalities and implementing them on 18 drones together is a challenge. The complexity of the system, calibration errors, and limitations in resources have caused difficulties. We have not yet implemented the final collision avoidance algorithm, but we have until now worked around collisions, by planning trajectories ahead. The next step of the project is to try different collision avoidance algorithms and find the most optimal solution on the formation with 18 drones.

MEMORIES

The best memory of our group must be the first time we successfully drew a heart shape with a crazyflie drone in the laboratory. This was our first successful demo using a trajectory made in MATLAB and the first step towards the goal of the project. (And it worked on the first try!).

LESSONS

The challenges that we faced during the project helped us to develop the problem-solving skills as engineers. Working with a physical setup that none of us had any experience on has introduced challenges that we needed to solve. As a team we learned how to work collaboratively and patiently to tackle each problem we faced. We have gained quite some experience with working with the system, and we are now able to spot errors and solve most problems by ourselves, which is a big accomplishment for us.

Our advice for future honors students is to seek and seize opportunities. Honors academy gives you a chance to work on amazing projects with gifted people under supervision of experts in a field. The project itself is an extraordinary experience, but you can learn even more during your honors program if you explore different possibilities and project additions on your own. What do you want to add to the project? What do you want to learn more about? How would this contribute to your project and ultimately to our society? What would you like to research while having the support of your coach? After clearly specifying your personal goal, which can be almost anything, your coach can guide you and help you to achieve it. That is why our advice is to use this opportunity and learn skills that you always wanted to acquire.

MEET THE TEAM

Briana Anamaria Isailă
• 1st year Honors student

Marcel Mińkowski
• 1st year Honors student

Qianyu Dong
• 1st year Honors student

Zhiyong Sun
• coach

Ming Li
• co-coach

“Drones overall will be more impactful than I think people recognize, in positive ways to help society.”

Bill Gates
ABOUT THE PROJECT

The goal

Eindhoven and the surrounding area are of course known as the Brainport of the Netherlands, as many technological companies are based here. These companies do a lot of experiments, for which they need specific setups. Companies often have to make these setups themselves which cost money and time, and that for lower quality results.

We set as a goal to build a multifunctional experimental setup which different companies could use to conduct their experiments. The setup will be able to do two things:

• Control temperature and flow rate of a liquid
• Control the heat distribution on a metal surface

The first application can for example be useful to control ink in a printer, and the second application could be used to cool down a wafer in a specific pattern to prevent bending and deformation.

The setup

The setup will consist of a pump, a thermal mass, a small reservoir, and a big reservoir. The pump will make sure the liquid flows from the big reservoir through the setup. The solid thermal mass will have a trajectory inside it, where the liquid flows through and will be heated up from the bottom. This thermal mass can be replaced by blocks with different trajectories. The outflowing liquid will then be stored in the small reservoir.

The fluid will get heated up by the block and the block gets cooled down by the fluid. The resulting fluid temperature and surface heat distribution are highly dependent on the shape, size and length of the trajectory inside the block. The exact effects of these factors have been researched in this project using simulations. Next year we will work on building the setup physically.

OUTCOMES

Our team has reached significant milestones, thanks to our detailed CAD designs and thorough simulations of thermal masses and setups. We’ve spent some time exploring different shapes for the thermal masses, getting creative with different shapes and pattern ideas without worrying about manufacturing constraints. Whether spirals, rectangles, or variable area designs, each shape has provided valuable insights into how heat spreads. These experiments have deepened our
understanding of thermal behaviours and its relevance to our specific application.

Our simulations have depicted heat distribution and flow characteristics across these various shapes, bringing us closer to our goal of controlling the temperature of the output liquid and managing heat distribution on the thermal mass's surface. While we’ve made promising progress, we recognize that unexpected challenges may arise. Nevertheless, our achievements thus far serve as a solid foundation for next year.

Moving forward, we stand prepared to seek guidance from professors and industry experts should we encounter difficulties. Collaborating with fellow students will be essential as we navigate potential obstacles, ensuring adaptability and innovation. With a strong foundation and a commitment to continuous improvement, we are confident in our ability to proceed with our plans, including building the physical setup and control system, after fully designing and studying the virtual model.

MEMORIES

To complete this project, we have had two 4-hour work meetings a week as a team. So that if we ran into any problems with building or simulating the virtual setup, we could consult each other to find a solution. As running some simulations, such as the pump, has proven to be more complex than initially expected. However, finally receiving good results on a simulation that you worked on for a while as a team made it fully worth it.

LESSONS

As the project has so far mainly consisted of building virtual models and running simulations, it has provided us mostly with skills in designing these models. This has already proven to be useful in other projects. Furthermore, it was not uncommon during this project to get stuck on something, so the value of working in a team has really come forth. With the help of other perspectives and different experiences we were often able to solve the problem or find a workaround. This has not only thought us the value of a team, but also how and when to ask for help or to offer help. Other lessons we have learned are mainly related to working with software. These lessons include: saving your progress as much as possible to prevent losing it in case of a crash, checking the available memory before running a simulation, and manage your files well.

MEET THE TEAM

Nam Nguyen
• 1st year Honors student

Owen van de Bij
• 1st year Honors student

Bas Wijnsma
• 1st year Honors student

Amritam Das
• coach

“Your hard drive is full!”
Bas Wijnsma
ABOUT THE PROJECT

Our project aims to develop a real-time prediction system for neuron spiking activity. Initially, we undertook the task of labeling single neuron data points as either “spike” or “no-spike” with minimal bias, employing k-means clustering and thresholding techniques. Subsequently, we utilized this data to train various Machine Learning models to predict future neuron spiking based on current activity patterns. Additionally, we created a GRU (Gated recurrent unit) model predicting the values of the future activity of the neuron. By accurately predicting neuron spiking in real time, our project contributes to advancing neuroscientific research and potentially facilitating early detection and treatment of neurological disorders.

OUTCOMES

Both methods of labeling gave extremely similar results, confirming their accuracy and unbiasedness. The model we created to predict if a neuron is going to spike in the next 5 time points by the previous 5 achieved accuracy of 90%. Our GRU model predicting the next 5 values of the neuron’s activity based on its previous 10, with mean average error of just 1.10. Therefore, we demonstrate that with our models, neuron activity can be predicted in real time and used for analysis. However, it’s important to note that our current models do not account for the influence of neighboring neurons on each other and we plan to focus on that in the future.

MEMORIES

One of the standout moments of the Honors year was during our initial meetings when we had the chance to bond as a team and brainstorm ideas for our project. We had the freedom to choose in what direction we want to develop our project and skills based on our interests. There were so many opportunities that we spend a lot of time animatedly discussing and building our project concept during and after the meeting. Guided by our coach’s expertise, we translated our ideas into a concrete action plan, setting the stage for our exciting journey. This moment encapsulated the spirit of creativity, collaboration, and empowerment that defined our Honors experience, setting the tone for the inspiring work ahead of us.
LESSONS

The most valuable lesson learned is that theoretical knowledge alone is not sufficient; practical experience is essential for true understanding. No matter how much one learns from books, lectures, or research, it can never fully translate into the depth of understanding gained through real-world experience. In practice, one encounters nuances, challenges, and unexpected situations that textbooks cannot fully prepare for. This highlights the importance of gaining hands-on experience, whether through internships, practical projects, or fieldwork. Only by applying knowledge in real-life situations can one truly grasp its complexities and nuances, leading to a deeper and more holistic understanding.

Our advice for future Honors students emphasizes the importance of both communication and planning. Foster open communication with your teammates and coaches as collaborating, seeking guidance, and articulating ideas significantly improves the overall outcome and learning experience. Additionally, effective planning enables students to break tasks into manageable steps, set realistic goals, and allocate resources effectively, reducing stress and preventing procrastination. So, embrace the habit of planning early on, and it will serve you well throughout your academic journey and beyond.

### Analyze
Analyze the single neuron data

### Label
Label the data (spike/neutral)

### Compare
Compare labeling methods and choose the best one

### Predict
Predict when a neuron is going to spike and its exact future values

MEET THE TEAM

Gabriela Chavgova
• 1st year Honors student

Gaurav Sharma
• 1st year Honors student

Niko Ratković
• 1st year Honors student

Valentina Breschi
• coach
ABOUT THE PROJECT

The goal of our project is to enhance road awareness, and consequently road safety, through the implementation of communication between autonomous vehicles and traditional vehicles. While the rise of (partially) autonomous vehicles has sparked concerns about road safety, they also present a lot of opportunities to enhance safety and awareness beyond previous capabilities. Our idea is to establish a shared risk field amongst multiple vehicles, enabling them to anticipate potential risks that are not directly visible. If we manage to achieve this goal we would have a tool that could significantly increase the road awareness and consequently decrease the amount of accidents. We hope to achieve this goal and present our findings in a research paper.

OUTCOMES

In our first year, we concentrated on acquiring the skills to guarantee the success of our project in the following year. This included technical skills like ROS and PreScan and generally learning a lot about working with remote control vehicles, but we also gained a lot of professional skills, like reading and writing research papers. We successfully figured out the mathematical formulas for constructing a risk field and developed a real-time heatmap visualization that showcases this information. Additionally, we have started the outline for a research paper, which we hope to complete in the upcoming year.
MEMORIES

As we dedicated the first part of the year to literary research, we couldn’t wait to finally work with the physical cars. However, in our early lab attempts technical issues showed up at every turn, making it very hard to achieve anything. But, eventually we reached a milestone in our progress, the car listened to our commands! It was an incredible moment where we finally became “car whisperers.”

LESSONS

Our advice for the future students would be to also make sure that they create nice experiences through this special journey. It’s a wonderful chance to not only widen your knowledge, but to also meet great people who are just as passionate as you in this field.

MEET THE TEAM

Ismail Hassaballa
• 1st year Honors student

Nora Baljé
• 1st year Honors student

Daniel Tyukov
• 1st year Honors student

Sofie Haesaert
• coach

“You should do everything in your power to befriend the TA’s.”
ABOUT THE TRACK

We live in a hyper-connected world. Social media networks such as Facebook and Instagram link different people from all over the globe. Moreover, the internet no longer only consists of just computers but connects a great variety of smart devices, from thermostats to self-driving cars.

Typically, such networks are large, consisting of millions or even billions of entities, and have a truly complex structure. These complex networks enable new information to spread very rapidly. Sometimes, news even reaches a fraction of the world population in a matter of hours. This interconnected world thus gives rise to new and exciting possibilities for society. However, it also introduces new challenges to society. For example, networks are used by some people and organizations to influence others negatively, by spreading false information very effectively.

In this Honors Academy track, multidisciplinary teams of students are challenged to identify real-world network problems that have a huge impact on society. Through stimulating activities, the students learn to work in a team, do research in network science, and communicate their findings to experts and a general audience. The final deliverable is a research program that the team will execute in their second year, which will have a true impact on the future of our networked society.
In this fourth year of existence of the track Networked Society, we had three student teams. One group of four first-year Honors students started their journey in network science. I really liked that this team initiated discussions with several experts to learn about their research topics. These discussions were instrumental for identifying the exciting research challenge that this team is planning to execute their next Honors year. Two teams of second-year Honors students did work on the research projects they defined last Honors year. Both teams operated very professionally, exemplified by setting up interactions with external stakeholders and efficient distribution of work among the team members. I enjoyed seeing all our students developing generic research skills and being fully committed to their projects. I am most proud of the very pleasant and open environment that our students created. It was a true pleasure working with all these students.

Pim van der Hoorn
TRACK COORDINATOR

This year we had eleven students in total. Although this is the largest number in our tracks’ short history, given the improvements we made during the last year we could manage this number without any major problems. The two groups of second-year students have worked hard on their research program. I was pleasantly surprised by the dedication of the students towards their project. One group successfully delved into some very difficult software tools and the other managed to set up a collaboration with researchers from a different university to get hold of the right data for their project. The first-year students also made excellent progress on their project and I am very much looking forward to next year, when they will execute it. It makes me happy to see that the students in our track get inspired by their research project and own ideas and that they create an environment in which they can work together effectively. I look back on a successful Honors year and am excited for what next year will bring.
ABOUT THE PROJECT

As of now 56% of the global population lives in urbanized areas. By the year 2050 the UN predicts this number will rise to 68%. As societies grow they build more cities and expand existing ones. This process of urbanization often comes at a cost of loss of biodiversity. Throughout our research we want to understand how to expand current urban infrastructure without compromising biodiversity by unwittingly removing plant or animal species from urbanizing regions.

In order to tackle that issue we employ network science - mathematical framework that allows for investigating intricacies of various complex systems spanning from cryptocurrencies, to particle simulations to railway planning.

In our project we delve into the relation between cities’ topology and their biodiversity. We want to understand what exactly makes a city biodiverse and how we can further advance urbanization in a more aware manner. By doing so, we aspire to contribute to the creation of urban environments that are both livable for humans and hospitable to native wildlife, thereby fostering ecological sustainability in urban planning.

OUTCOMES

Our project has led to several significant achievements. Firstly, our deepened grasp of network science allowed us to precisely analyze the interdependencies between city topology and urban green spaces. This expertise enabled us to uncover previously hidden patterns in urban ecosystems. Secondly, our research findings on the importance of the issue have been documented and shared widely through an article in “The Network Pages” journal. This publication identifies best practices and areas needing improvement in the field of ecological integration.

Finally, by constructing a network model of Eindhoven using tools such as MSPA analysis, the InVEST model, and graph theory, we mapped the city’s green infrastructure. This model provides a clear visual and quantitative understanding of urban green spaces, laying ground for future research on urban expansion in relation to biodiversity.
MEMORIES

Throughout our second year, we bonded significantly over our shared commitment to our work, which culminated in the successful publication of our first academic piece of literature. This milestone was not only a testament to our dedication but also a crucial step in establishing our presence in the academic community. Moreover, we are deeply grateful for the support and guidance we received from other research teams. These teams, who independently assessed our progress, were instrumental in refining our approach. They provided invaluable feedback that helped us navigate the complexities of our research and offered practical tips that were pivotal in advancing our project. Their insights not only enriched our understanding but also strengthened the robustness and relevance of our work, ensuring that we could contribute effectively to the field of urban planning and biodiversity. This collaborative spirit and external expertise helped us to move forward with greater confidence and clarity, setting the stage for further developments and research in our ongoing pursuit of sustainable urban environments.

LESSONS

This year, we learned the crucial importance of communication in successfully completing a long-term project. Clear discussions about planning, organization, and setting expectations proved essential. From this experience, we strongly suggest that future teams not only prioritize these aspects but also try to enjoy the journey. Maintaining enthusiasm about your work, even during challenging times, is vital for fostering productivity and creativity.

One of the biggest and most painful lessons we learned was the importance of starting early. Projects often experience delays, and an early start can provide a much-needed buffer. Additionally, we learned to be critical during our research and literature reviews. Not all articles maintain the same level of credibility, and the quality and source of the data are incredibly important. We advise future teams to scrutinize their sources thoroughly to ensure their research foundation is as robust and reliable as possible. These lessons have been instrumental in shaping our approach and will undoubtedly benefit future projects in our field.

MEET THE TEAM

Bartu Demirci
• 2nd year Honors student

Igor Dmochowski
• 2nd year Honors student

Roshni Kukreja
• 2nd year Honors student

Marcos Ruibal Ortigueira
• 2nd year Honors student

Erik Steur
• coach

Pim van der Hoorn
• coach

“Are you guys hungry?”
Igor Dmochowski
ABOUT THE PROJECT

The Networked Society Honors track offers a two year long program; the first year is the orientation phase of the team. The main goal of this first year was to find a suitable research topic for the team and define meaningful research questions, which can later be used to conduct our research project in the second year. To arrive to one specific topic, several steps had to be taken. First, network science was studied to gain an understanding of the basic principles of networks. Then multiple topics from various scientific fields that benefit from network science were investigated in detail. By studying these complex systems describing our world, we obtained vital information about how network science can contribute to society. Finally, the team explored multiple, socially relevant topics as possible research area for the second year. As a team, we strive for high-quality work; by defining our topic we also took into account sustainability issues and the social contribution of our project in addition to our own interest and technical feasibility.

OUTCOMES

The outcomes of our project for this year are a draft article of a blog post that we will publish on the Network Pages next year (https://www.networkpages.nl/) and several research questions about the topic of neurological interactions taking place on brains with tumors. By the end of this academic year, we plan to write our draft article in order to introduce brain networks into broader audiences while initiating a different perspective on brain networks. After finding research questions, we will carry out a network analysis and write a scientific article to deliver our findings.

Moreover, we investigated different topics while learning about the fundamentals of network theory. Initially, our research scope included four topics of our interests, which are transportation networks- how transportation affects the access of certain demographics to healthcare and education, astrophysical interactions such as galaxy detection and finding habitable planets using astrochemical networks, then social media networks, and finally brain networks of patients who have neurological disorders such as Alzheimer, epilepsy, or brain tumors. After investigating all these topics, we narrowed down our research interests into transportation and brain networks by defining possible research
directions and considering the data availability. One of the unexpected outcomes was dealing with optimization problems within transportation networks. This led us to focus on brain networks as graph theory is solely fundamental to understand neurological interactions of brain regions. At the moment, even though we were able to identify a research direction, we still need to carry on an extensive analysis to define a research question that we want to possibly answer.

MEMORIES

As a team, we’ve of course also had plenty of fun! With the numerous bonding activities and dinners together we became a very tightly knit team, enjoying all the work we do together. The best moment however was the bowling bonding activity. Regardless of our bowling skills, which we have to confess, were utterly terrible, it was a great experience! I believe there were almost more scores of 0 than anything else, and no one reached more than 200 points after 2 hours, but failing and learning from it brings the team together! And, of course, the laughter that came from our wonderful skills made for a great evening. Of course, to then drink away our defeat it was time for some delicious cocktails, to finish the evening in the best way we could have!

LESSONS

In the first year of our Honors track, we started our journey with the ambition of finding one specific research topic for the upcoming year. As a team, we came from similar yet diverse academic backgrounds. We had little to no knowledge on what the vast field of Network Science was, and what we could do within it. On top of this, we had limited experience with conducting research of this magnitude. It was a big unknown, exciting but equally scary.

However, as time passed, we started to learn more about each other and our individual interests. It also became clear what direction we wanted to take. At the end, it all worked out.

The big takeaway from our experience? Starting a new project might be daunting, but it gets easier. The important thing is to have big ambitions, but also set small and feasible goals to accompany them.

Another valuable lesson we learned is the importance of communication. If there is one thing that helped us the most, it was the open discussions we had, where we shared our struggles regarding the project. We also ensured that we could ask for guidance from each other and also from our coaches at any time. With this approach, we managed to adapt and adjust our plans according to our evolving needs. It was crucial to remind ourselves that we are not alone in this.

So, to all the future Honors students, remember to embrace the unknown, dream big, don’t hesitate to ask questions, and get the most out of your Honors experience!

MEET THE TEAM

Begum Aydinatay
• 1st year Honors student

Henrietta Szalai
• 1st year Honors student

Lynn Schuurman
• 1st year Honors student

Murathan Ozdemir
• 1st year Honors student

Erik Steur
• coach

Pim van der Hoorn
• coach
ABOUT THE PROJECT

The goal of the networked society track is to conduct research in the field of networks with the aim of identifying an important societal problem and formulating possible solution strategies. We want to make a meaningful contribution to society by using networks to learn about the hidden interactions of microorganisms in the human gut.

In the 1st year, our team conducted a broad analysis of the use of network science in various fields that were of interest to us. We explored the use of networks in areas spanning from quantum computing to art history. Ultimately we decided to spend this year applying our network knowledge to the human gut microbiome.

The gut microbiome is the collection of all the microorganisms (bacteria, fungi, and the like) that live in our digestive tracks. These microorganisms help us digest food. As well as play an increasingly important roles in all areas of our health from supporting our immune system to regulating our mental health. Network science is an important tool for learning more about the gut microbiome as the microorganisms living in our gut do not lead solitary lives, but are actually part of incredibly complex interaction chains. Network science can help untangle these interactions and give a comprehensive model of the inner workings of our gut.

Our team partnered with a research team in Amsterdam to study how the microbiome responds to different antibiotics. Antibiotics play a critical role in modern-day medicine, and save countless lives each year. But it has become clear in recent years that the overuse of antibiotics can have negative consequences, for both individuals and societies as a whole. That is why we decided to investigate how the interactions between microorganisms change in response to antibiotic use. We hope that this knowledge will help to deepen the understanding of the impacts of antibiotics on gut health.

Overall, our project aims to contribute to the field of networks by identifying and addressing important societal problems or challenges. We strive to propose innovative solutions and share our research findings with a wider audience, ultimately making a positive impact on society’s understanding and utilization of network technologies in medical sciences.

OUTCOMES

We are soon to publish a blog post on the application of network science to the gut microbiome, that will be published on The Network Pages (https://networkpages.nl). This platform will enable us to share our research findings and potential solution strategies with a broader audience.
audience, creating awareness and encouraging further discussions in the field.

We have been hard at work on analyzing the response to antibiotics from a network perspective, and will be continuing the analysis as our time with the Honors Academy comes to a close. We hope in the coming year to publish our findings in a scientific journal.

However, the most important outcomes will have been the team learning more about the scientific method, how research is conducted, as well as further developing our domain-specific and soft skills.

MEMORIES

The best memory of this Honors year was attending Microbiome Friday’s at the University of Amsterdam. It was extremely helpful to talk to experts in the field of the microbiome, and ask for advice on the more biological side of our research. It was at these events where we met a great researcher who provided us with the data we are using for our analysis. Not only were these events an amazing opportunity to expand our Honors project, but they also gave us the chance to practice our soft skills, like pitching, networking and communicating with fellow researchers.

Not only were these events extremely enriching for our professional development, but they were also great team building events, as we got to spend time together as a team and get to know each other better.

LESSONS

As a group, we confidently agree that the most valuable lesson we learned is the immense power and potential of networks. Throughout the track, we delved into their various aspects, from social networks to technological ones, and how they have transformed the way we live and interact with each other. We learned that networks have the ability to connect people, information, and resources from all corners of the world, and how this connectivity has led to unprecedented levels of innovation, collaboration, and growth. Additionally, we discovered how important our gut microbiomes are to our health and how networks can help us understand them better.

Overall, this track has given us a deeper appreciation for the importance of networks in our modern world and how they can be applied in various areas to bring about positive change and answer otherwise complex questions by delivering a new perspective.

Our advice would be to stay curious and focus on connecting the concepts learned as part of your Honors track with your personal interests. With a sense of curiosity and an open mind you will discover ways of integrating your passions into your Honors project. In that way, you will create a more meaningful and rewarding experience and you will be able to see your current endeavors from a fresh outlook. So, our advice to future Honors students is to embrace the curiosity that led you to this program, and use it to explore new ideas and connect with your personal interests.

Besides, we believe that one of the most valuable pieces of advice we can offer to future Honors students is to prioritize cooperation with their fellow team members. Honors work often involves collaborative projects, and it is essential to develop strong communication skills and a willingness to work together in order to achieve success. One key aspect of effective teamwork is learning how to listen to and respect the ideas and opinions of others, even if they differ from your own. Additionally, it is important to establish clear goals and expectations for the project and reconcile your Honors and university duties. By working cooperatively, Honors students can leverage the strengths and skills of each team member to achieve a higher level of success than they could individually. So, our advice to future Honors students is to prioritize cooperation and communication in their group work, and to approach collaborative projects with an open mind and a willingness to learn from others.

MEET THE TEAM

Jakub Wrzesień
• 2nd year Honors student
Kajetan Knopp
• 2nd year Honors student
Alisa Kondratyev
• 2nd year Honors student
Erik Steur
• coach
Pim van der Hoorn
• coach

“Success comes from a combination of willingness to achieve and organizing to track progress.”
Bartu Demirci
ABOUT THE TRACK

The track ‘Nuclear Fusion Power for the Netherlands’ was launched this year, at a super exciting time because the international race for fusion power is accelerating. Private companies are working on demonstrator fusion power plants, governments are engaging in competitive national programs and public-private partnership programs are blossoming. The challenge for our team of twelve Honors students was ‘what does it take for the Netherlands to become the host of one of the first fusion power plants?’ Specifically, we asked them to look at the non-technical roadmaps: site selection, licensing procedure, supply chain development, infrastructure, integration in the power system, public license, and political support, … Whereas worldwide tens of thousands of highly specialized engineers work on the technology of nuclear fusion, only a handful of people are concerned with the non-technical roadmaps. So, our student team could really make difference here – and they did! They took the city and seaport of Rotterdam as their case study – working closely with the foundation ‘Rotterdam Reactor’. And we adopted the SCRUM methodology, whereby the students worked on sub-challenges in 6-week ‘Sprints’, in teams of four in varying composition. They remained a single, coherent team, exchanging progress in biweekly plenary meetings. As a team they fearlessly sailed these uncharted waters, and we – coordinator and coaches - learned so much!
TRACK COORDINATOR

Niek Lopes Cardozo
TRACK COORDINATOR

Working with the honors team has been amazing this year. We gave them a challenge, a real challenge – questions we, coordinator and coaches – don’t know the answers to, and the rate at which the team tackled these has been jaw-dropping. Given some directions in the beginning, they quickly developed into a self-organized team. The combination of different disciplines proved very useful, and the cultural diversity, too, was both constructive and felt as hugely enriching by the students. We organized field trips, which were both highly useful content-wise as very helpful for the bonding in the team. Taken all together, I am really pleased with how this first year went. The students did a great job on the challenges and made big strides in their personal development. It’s been a joy.

COACHES

Timo Bogaarts
COACH

As a coach of the Honors track, I was able to witness the enthusiasm and excitement of the students of this track from up close. The tasks given to them were not laid out in advance, so the students had to not only solve problems but also define these problems themselves. The topics included the economics of a fusion reactor, the communication strategy, and the requirements for a suitable site for a power plant. These facets of fusion power are often neglected, and it was very refreshing to hear the students’ view on them. Overall, it was a very rewarding experience, with a trip to Oxford where we’ve talked with fusion start-ups. Overall, a very useful project!

Maikel Morren
COACH

Over the past year I have had the privilege of being able to oversee small groups of students tackle ill-posed problems and become masters of their craft in an awe-inspiring short timespan. By participating as coach in the honours academy over the past year, I was able to learn much from the bright minds of the students about the severely overlooked socio-economic aspects hindering the widespread integration of fusion-generated energy in our daily lives. This experience has broadened the horizon in my own field, which we academics typically only bother to examine technologically.

Jos Scholte
COACH

As a PhD student, I usually delve deep into a specific technical problem of building a nuclear fusion reactor. For this honor track we did everything but that. Which made it both challenging and interesting as a coach to moderate. These points were also brought forward during our trip to Oxford where we’ve talked with fusion start-ups. Overall, a very useful project!
ABOUT THE PROJECT

The 2023-2024 academic year marked the introduction of the new Honors Track, “Nuclear Fusion Power,” in the Netherlands. The inclusion of this track in the curriculum was prompted by a recent spike in investments in fusion start-up companies, each attempting to make the power of the stars available on Earth. While a fully operational fusion power plant is still far off in the future, the journey towards it must begin now. With the anticipation of a 1GW fusion plant by 2050, this track embarked on the task of drafting comprehensive roadmaps for its establishment in the Netherlands.

The project’s objective is to prepare Dutch society, policy and regulation frameworks, supply chains, infrastructure, expertise, economics, ecology, and potential plant locations. Our aim is to catalyze social acceptance, political engagement, spark regulatory frameworks, prepare a supply chain, foster economic preparedness, and create site assessments.

We started by looking into the public opinions about fusion and saw that the general opinion is positive once the people understand what is fusion and how it differs from conventional nuclear energy (Fission). So far, we have published the first version of the website and will continue updating it with the help of experts of social sciences and scientific writing to build the best platform to learn about the future of energy and Fusion.

Throughout the year, different goals were set for the individual teams with the hope of combining all research into a comprehensive story that we would present on the demo day. The main goal would have been the roadmaps that lead the a fusion site in Rotterdam by 2050, but this was split into multiple smaller projects.

For the communication team, the main goals were centred around informing the locals about fusion power and preparing them for a potential site in the future. The outcome of this was a set of communication guidelines and the start of a website that will be used for communication with the citizens of Rotterdam in the future.

The siting team worked on the specifics of the site, centring mostly on its location and through-put. The outcomes of this team are a handful of sites and their evaluations, along with what has to happen to make this site ours. In case none of these sites seem to be viable, a comprehensive checklist was made to analyze any site for a possible location for fusion.

For the supply chain team, the goal was to study and understand matters surrounding the scalability and implementability of fusion. Topics such as material sourcing limitations, legislature, financing, and energy market were all analyzed and findings were reported accordingly. As a result, in the final report of the team, guidelines and necessary future steps were outlined.

However, it was not all successes. Mainly, the chicken-and-egg problem arose many times during this year. For example in the problem of licensing and regulations. Based on the technology that is used on-site, different regulations will apply. However, to know which technology will be used, we have to decide on what kind of site will be built, which is based on the regulations.

There were also some unexpected outcomes, like for the energy system research. While it is known in the energy sector that heat is a larger energy consumption than electricity, the energy system of the Netherlands seems wholly unequipped to deal with this demand. This is as much an opportunity for fusion, as it creates huge amounts of heat that can be used for industry, as it is a risk.

OUTCOMES

Throughout the year, different goals were set for the individual teams with the hope of combining all research into a comprehensive story that we would present on the demo day. The main goal would have been the roadmaps that lead the a fusion site in Rotterdam by 2050, but this is split into multiple smaller projects.

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MEMORIES

Iter trip
From the 21st of February to the 23rd, we went on a trip to ITER in France. And a trip it was; indeed, it was more trip than ITER, since what would already be a long (~12 hour) bus ride instead became longer. While a rocket moves by expulsion of mass, this is not often expected of a bus. Nevertheless, ours did partake in this unexpected method of propulsion as a full side panel was thrown loose. Unfortunately, this did not provide much of a boost, so when a panel on the bottom of the bus was also trying to escape, we decided to lock it up tighter in a way only a bus full of certified TU/e engineers can; by sticking it full of duct-tape. The bus driver was very considerate to any passengers who might decide the removal of bus parts was getting too scary for them, as the side door was opened, permanently. To show our resolve to stay the course, we locked the door with multiple belts, tieraps and a scarf. Luckily, these measures made sure the ride only took around twice as long as expected! This however is not the only instance on which fate blessed us. Being the superheroes we are, we were able to stop an instance of some particularly nasty crime. Incredible work. At some point, supposedly, we arrived (although the concept of time was at this point largely lost to us). One of the two excursions evaded us while we were travelling, but the namesake of our trip was still on the agenda. We began our foray into the bastion of science known as ITER, admired the enormous creations and incredible constructions and were taught about the international peace that fusion brings to warring nations. All of that with complementary cheese. This day of science was followed by pizza, beer, card games and a life-size chess game with Victor on the frontlines. Unfortunately, all good things must come to an end, but the same does not hold for bad ones and the trip was not yet over. The journey back started the day after the ITER tour, putting our time at-location on an astounding one whole day. However, we lucked out in that every part of the bus remained firmly attached on the way back by the might of duct tape. In the end, more than half of the trip was spent in a bus, but as Albert Einstein put it:
“A gezellige bus is better than a ongezellige Aix-en-provence”

Oxford trip
On the 8th of May, we organised a study trip to Oxford to visit a handful of companies working on fusion energy in the region. The trip started with rather extensive planning, taking many trains and buses in the process. As it turns out, Eindhoven to Oxford takes a rather long, and we faced a couple of issues, however, in the end, we got to the hotel with only a minor delay, but quite tired from a whole day of travelling.

On the first day, we visited the UK Atomic Energy Authority, the UKAEA; they have some stunning machines and research. Namely, JET, an incredible fusion reactor of time was largely lost to us). One of the two excursions evaded us while we were travelling, but the namesake of our trip was still on the agenda. We began our foray into the bastion of science known as ITER, admired the enormous creations and incredible constructions and were taught about the international peace that fusion brings to warring nations. All of that with complementary cheese. This day of science was followed by pizza, beer, card games and a life-size chess game with Victor on the frontlines. Unfortunately, all good things must come to an end, but the same does not hold for bad ones and the trip was not yet over. The journey back started the day after the ITER tour, putting our time at-location on an astounding one whole day. However, we lucked out in that every part of the bus remained firmly attached on the way back by the might of duct tape. In the end, more than half of the trip was spent in a bus, but as Albert Einstein put it:
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On the first day, we visited the UK Atomic Energy Authority, the UKAEA; they have some stunning machines and research. Namely, JET, an incredible fusion reactor looking into inertial fusion. They showed us around their facilities, including a gun requiring 3kg of gunpowder per shot and firing a payload at 7km/s.

On the second day, we got to visit the facilities of Tokamak Energy. They are working on spherical tokamaks and high-temperature superconducting magnets. They have some stunning machines we are really fortunate we got to visit and gave some interesting talks about the non-technological aspects of fusion energy. All of the companies we visited were fantastic to visit and we learned so much about fusion energy and everything that surrounds it.

Afterwards, we had some free time in Oxford’s centre, so we, of course, went to chill in a park, visited the university, took a tour of the bookstores in Oxford and, of course, some drinks in a local pub with the team. We had a great time, we got to know each other better!

LESSONS

Most valuable lessons learned
In our opinion, the most valuable lessons we have learned over the course of the honours programme is the absolute importance of teamwork and cooperation for the success of a project. With the strengths and capabilities of each of our team members, we were able to realize our goals, that we alone could not accomplish. We see time and time again, in the world around us, in the immense international projects such as ITER, that humanity is at its most capable when we work together, to alleviate our weaknesses and to elevate our strengths. And in our case, the long evenings of sorting out heaps of sticky notes, and chaotic brainstorms have certainly brought us closer together, for better or worse! Through each bright idea shared and Poké Bowl eaten.

During our excursions we also learned a lesson in resilience, we faced challenges at every turn, and our plans failed, but perseverance helped us overcome these setbacks. We have pushed each other forward to be the best and most passionate students we could be. Our little moonshot may seem impossible until we work towards it together.

What is your advice for future Honors students?
The main advice we would give to future honors students would be to prioritize your mental well-being. Make sure that you spend an adequate amount of time on your coursework and honors but also, try to find do things that you enjoy. Dedicate some hours in the week to doing only honors work to make sure that your work doesn’t pile up until the last day. Next, if you are going on a trip, make sure to pack enough food for the commute as you never know if there will be any unforeseen delays. Finally, make sure to remember to keep your eyes open for opportunities to work on your personal and professional development.

Is there anything else you want to share with your peers or future Honors students?
As a big group, one of the best things about our team is the cultural diversity. There are at least 7 different nationalities from all around the world. This makes every interaction fun and unique, giving us the opportunity to learn from each of these different cultures. Stuff some of us might find crazy or have never heard about, is completely normal to others, which makes many conversations eye-opening adventures. We get the chance to look at the world and the problems we are facing through an assortment of lenses. Everyone is open to listen and share about their own cuisine, traditions, language, fun facts, jokes, values, natural and historical wonders of their country, etc. One of the last activities we look forward to as a team is a potluck dinner, which will surely be one more fun and delicious moment to share together.

MEET THE TEAM

Marijose Sanchez Vela
• 1st year Honors student

Robin Pino
• 1st year Honors student

Victor Vermeulen
• 1st year Honors student

Eren 1liter Çağ
• 2nd year Honors student

Kiia Kaarevista
• 1st year Honors student

Michal Jagaja
• 1st year Honors student

Jasper Bekkers
• 1st year Honors student

Luuk Droogendijk
• 1st year Honors student

Nela Gawrychowska
• 1st year Honors student

Laura Triginer Salvatella
• 1st year Honors student

Metin Mert Tutaş
• 1st year Honors student

Fernando Varela
• 1st year Honors student

Timo Bogaarts
• coach

Maikel Morren
• coach

Jos Scholte
• coach

“Life is too short, try to make the most of it.”

“A nuclear fusion reactor in the Netherlands... Wouldn’t that be Rotterdam damn cool?”
Radio astronomy is the study of celestial objects that give off radio waves. With radio astronomy, we study astronomical phenomena that are often invisible or hidden in other portions of the electromagnetic spectrum. This includes the death and life of stars, exoplanets, black holes and pulsars.

In the Radio Astronomy track of the Honors Academy we are working on both the science and technological aspects of radio astronomy. The track introduces students into fundamental questions about the origins of the Universe, a description of the origin of matter, space and time, stars and galaxies, supernovas and black holes, and the fact that we literally consist of star dust. But we are also looking at, for instance, how radio telescopes work, how the data processing is done and how you can build radio telescopes.

In the first year of this honors track, we worked in four teams. The teams worked on pulsar navigation, building a radio telescope, working on the OLFAR – the Orbiting Low Frequency Antenna Array, and on star-planet interaction. Besides that, we had awesome track events, such as a visit to the radio astronomy institute ASTRON and the movie night discussing and watching the movie Interstellar.

All students worked independently within the teams, took responsibility and above all ensured a positive atmosphere in the track. We are proud of all the students and the work in the track.

**TRACK COORDINATOR**

Mark Bentum

Mark J. Bentum received the MSc degree in Electrical Engineering (with honors) from the University of Twente, Enschede, in August 1991. In December 1995 he received the PhD degree for his thesis “Interactive Visualization of Volume Data” also from the University of Twente. From December 1995 to June 1996 he was a research assistant at the University of Twente in the field of signal processing for mobile telecommunications and medical data processing. In June 1996 he joined the Netherlands Foundation for Research in Astronomy (ASTRON). He was in various positions at ASTRON. In 2005 he was involved in the eSMA project in Hawaii to correlate the Dutch JCMT mm-telescope with the Submillimeter Array (SMA) of Harvard University. From 2005 to 2008 he was responsible for the construction of the first software radio telescope in the world, LOFAR (Low Frequency Array). In 2008 he became an Associate Professor in the Telecommunication Engineering Group at the University of Twente. From December 2013 till September 2017 he was also the program director of Electrical Engineering at the University of Twente. In 2017 he became a Full Professor in Radio Science at Eindhoven University of Technology. His current research interests are radio astronomy, short-range radio communications, novel receiver technologies, channel modeling, interference mitigation, sensor networks and aerospace. In 2020 he became also the head of the Astronomy & Operations department at ASTRON. Since 2023 he is the dean of the Electrical Engineering department of Eindhoven University of Technology.

This was the first year of the radio astronomy track. It was a lot of fun, we learned a lot and we should be proud of the students and the team.
The Astrophysics department on the design and implementation started in 2017. As part of the Radboud RadioLab, he works with RadioLab at the Radboud University in Nijmegen, where he at TU/e, he is currently active as DSP Architect at the Radboud (Ireland). In parallel to his ongoing work as University Lecturer student and has worked as a visiting research scholar at Movidius Engineering department. He has also done projects at Philips as an Assistant Professor in the Electronic Systems group in the Electrical framework with custom exploration strategies.

These estimates, combining the strengths of the LLVM compiler he also explored a VLIW-based processor architecture based on the instruction set of a VLIW processor based on the target application. optimal issue width and ASIPs, trying to find the data-path synthesis for instruction word (VLIW) on automatic very long PhD research, he worked in the same field. For his PhD from TU/e in 2015, 2009. He also obtained his Eindhoven University Engineering from Hamburg University of Technology (TUHH), Germany, in 2009 and his Ph.D. degree from Eindhoven University of Technology (TU/e), the Netherlands, in 2013. From 2013 until 2016 he worked as Senior Systems Engineer at ATLAS ELEKTRONIK GmbH (Bremen, Germany), where his role was system designer and engineering manager for autonomous underwater vehicle (AUV) systems with sonar payloads. Since 2016 he is with the Electromagnetics group at the TU/e department of Electrical Engineering, currently in the role of associate professor. He is the head of the EM Antenna Systems Lab that focuses on innovative concepts and solutions for wireless applications from a system perspective. Since September 2023 he is also serving as director of TU/e’s Centre for Wireless Technology (CWTe) following a two-year part-time employment as junior researcher with the Smart Frontend group at the Netherlands Institute for Radio Astronomy (ASTRON).

Dr. Johannsen is a member of IEEE and EuMA as well as an associate member of INCOSE. He is a past chair of the IEEE Benelux joint AP/MTT chapter. Moreover, he serves on the advisory board of the Chip Integration Technology Centre (CITC, the Netherlands) and is an independent technology advisor to ASTRON’s Smart Frontend group.

Roel Jordans obtained his MSc degree in Electrical and Electronic Engineering from Eindhoven University of Technology (TU/e) in 2009. He also obtained his PhD from TU/e in 2015, in the same field. For his PhD research, he worked on automatic very long instruction word (VLIW) data-path synthesis for ASIPs, trying to find the optimal issue width and instruction set of a VLIW processor based on the target application. He also explored a VLIW-based processor architecture based on these estimates, combining the strengths of the LLVM compiler framework with custom exploration strategies.

He worked as a postdoc at TU/e for 3 years before becoming Assistant Professor in the Electronic Systems group in the Electrical Engineering department. He has also done projects at Philips as a student and has worked as a visiting research scholar at Movidius (Ireland). In parallel to his ongoing work as University Lecturer at TU/e, he is currently active as DSP Architect at the Radboud RadioLab at the Radboud University in Nijmegen, where he started in 2017. As part of the Radboud RadioLab, he works with the Astrophysics department on the design and implementation of instrumentation for radio astronomy and particle physics experiments. These instruments include the digitizer and data processing system of the NCLE project and the Radio Upgrade for the AugerPrime observatory in Argentina.

Dr. Jasmina Lazendic-Galloway completed her PhD in astrophysics in Australia, where she enjoyed climbing on radio telescopes and occasionally playing with kangaroos. She held postdoctoral fellowships at the Harvard-Smithsonian Center for Astrophysics and Massachusetts Institute of Technology in Boston, USA. She moved to Monash University (Melbourne, Australia) in 2008 as a research fellow, and then became a senior lecturer (and is currently an adjunct senior researcher). She taught courses on astrophysics, astrobiology, biophysics, physics for engineers, and history of innovation in science and technology. Through her teaching practice, she became passionate about learner-centred and evidence-based teaching practices, which led her to engage with discipline-based educational research. Always looking for interesting challenges, she moved to Eindhoven to join TU/e innovation Space, where she supports the adoption of challenge-based learning and fostering student entrepreneurship.

Her astronomy research involves supernova remnants, molecular clouds, cosmic ray production, and the effect of stellar ejecta on the habitability of exoplanets. Her expertise stretches from radio to gamma-ray wavelengths, the full electromagnetic spectrum! She lived and worked in many places around the globe, and enjoys the sense of shared knowledge and shared sky that astronomy brings. She has a keen interest in space exploration and likes to teach people how to survive on Mars.

David Prinsloo obtained his Ph.D. from Stellenbosch University in 2015 working on the design and receiver noise characterisation of multi-mode active antennas for a phased antenna array concept envisioned for the Square Kilometre Array telescope. Following a year as postdoctoral fellow at Stellenbosch University, funded by the National Research Foundation (South Africa), he started as an antenna researcher with The Netherlands Institute for Radio Astronomy (ASTRON) in 2016. As antenna researcher he worked on the antenna design and receiver noise characterisation of various radio telescope concepts. Since 2021 he holds the position of Competence Group Lead to ASTRON’s Smart Frontend Group: the group of engineers realising the frontend systems for ASTRON’s telescopes and receivers. In addition to his position at ASTRON, Dr. Prinsloo holds a part-time assistant professor position with the Electromagnetics group at Eindhoven University of Technology where he supervises early-stage researchers working on active antenna concepts for future radio telescopes.
ABOUT THE PROJECT

Star-planetary interactions (SPIs) is a broad term that encompasses a variety of astrophysical phenomena. The rapid advancement of exoplanetary science since the first detection in 1995 created a very promising laboratory to investigate SPIs. Currently, there are over 5 thousands confirmed exoplanets, i.e. planets that orbit stars other than our Sun, thus there exists a variety of environments which allow us to learn about these interactions. A deeper understanding of these phenomena can reveal a lot of interesting physics, and most importantly for this project, allow us to characterize exoplanets. Of particular interest to us is habitability. Whether a planet can sustain life is a very complex subject, that is still poorly understood. However, we have some “ideas” about what might be necessary. For example, presence of liquid water and atmosphere, adequate temperature, and strong planetary magnetic field are all viewed as essential factors. But what makes magnetic fields so important? The answer has to do with radiation from the Sun. Naturally, we can acknowledge our existence to that radiation, since it provides Earth with necessary energy to sustain a habitable environment. However, as most of you know, some radiation can be harmful to life. For example, exposure to high levels of UV radiation can cause skin cancer. Very high level of radiation can even be a direct cause of death. As such when designing an ideal exoplanet for sustaining life, we would minimize how much harmful radiation reaches the surface. We are fortunate that Sun is relatively calm in terms of this harmful output, but it still produces dangerous amounts which can pose a threat to astronauts while in orbit. The reason why we are not overly concerned with it on the surface, is because the atmosphere and magnetic field are “shields” that protect us from harmful radiation. Additionally, atmospheres can also be eroded by stellar radiation, so Earth’s magnetic field does not only protect us directly, but also indirectly by preserving the atmosphere. This level of protection is affected by various planetary and stellar parameters, and studying it is a subset of a field known as star-planetary magnetospheric interactions.

OUTCOMES

At first, we were interested in detection of exoplanetary magnetic fields with focus on rocky planets (e.g. like Earth or Mars) that could be habitable. This required extensive literature review of the theory behind magnetospheric interactions, and what effects we would
be able to observe with modern telescopes. Sadly this direction has proven to be impractical with today’s technology, as habitability conditions often conflict with what maximizes chances of detection of magnetic fields. And even for the promising targets, exoplanets that are the size of Jupiter but orbit much closer to their host star than Mercury (these are known as “Hot Jupiters”), we lack undisputed detection of magnetic fields. We have submitted an observational request to the European Space Agency’s CHEOPS mission, for observations of two hot Jupiters that might have stellar transit asymmetries indicative of magnetic field (currently under review). However, this research will not answer any major habitability questions. As such, the main direction of the project shifted towards quantitative investigation of effects of magnetic field strength, and orbital characteristics on radiation levels on the surface, which would allow us to place further constraints on habitability of exoplanets. We presented the preliminary work at Holland Area Exoplanet Science Meeting (HAESM) organized by ESA. The research is far from done, but we are happy with the development so far, and are cautiously optimistic that we will have some very exciting results within the next year, and hopefully a publication in a scientific journal.

MEMORIES

My best memory was attending, and presenting, at HAESM. I visited the European Space Agency’s campus in Noordwijk, which was an amazing experience in itself, and got to network with experts in the field and listen to some fascinating presentations. It was my first time attending a conference, and it was great! It was particularly satisfying because TUE is not known for astronomy. After saying I’m from TUE, I was asked whether I’m an engineer working on space telescopes to which I could proudly reply that “I am a mathematician and we are doing astronomy in Eindhoven now”. You could really say that we are putting TUE on the “astronomical map”. In general, the first year of Honors has been a wonderful experience, especially working with my supervisors, Jasmina and Willi, to whom I am extremely grateful for the support and opportunities they provided me during this project. I have learned a lot this year, and I couldn’t have done it without them.

LESSONS

I developed, and refined a lot of skills and knowledge during my first year of Honors. In particular, I have learned a lot about theory of electrodynamical phenomena that occur in space physics, and about astronomy in general. Especially valuable for the future are the research skills I acquired, because that’s something I will be able to use to effectively learn other fields of astronomy in the future. Being an applied mathematics major, it was nice to apply the concept I’m learning in the classroom to the field I’ve been fascinated with since childhood. My advice to future Honors students is to always aim for the stars, and don’t fear failure. Especially within the Honors Academy program, don’t be afraid to take on risky projects that some would call infeasible, because even if you don’t fully accomplish the initial goals, you will learn a lot in the process, and by being ambitious you might achieve much more than you would believe you are capable of.

MEET THE TEAM

Simon Petyniak
• 1st year Honors student

Jasmina Lazendic-Galloway
• coach

Willi Exner
• coach

“Somewhere, something incredible is waiting to be known.”
Carl Sagan
ABOUT THE PROJECT

The primary goal of our project is to observe the cosmic dawn, a pivotal period in the early universe. We believe that by exploring the cosmic dawn, we will not only gain better insights into the formation and evolution of the universe but also pave the way for future discoveries. However, the cosmic dawn, occurring in the low-frequency range, presents a unique challenge for observation due to interference and atmospheric disturbances when observed from Earth-based telescopes.

To tackle this challenge, our project team is exploring different innovative methodologies. One approach involves the deployment of a swarm of satellites encircling the Earth, leveraging interferometry techniques to observe radio waves. While this strategy helps to avoid atmospheric disturbances, it is still prone to interference from Earth, such as radio signals emitted from human activities.

Another approach we are investigating is the deployment of antennas on the Moon’s surface. This could entail either one large antenna or multiple small antennas. With this approach, both interference and atmospheric disturbances can be avoided. However, it also raises different problems such as the concerns with the electrostatic sand on the moon and the assembly of the antennas.

One another approach we are considering is Orbiting Low-Frequency Antennas for Radio Astronomy (OLFAR). OLFAR is a project that aims to have a swarm of satellites encircling the Moon instead of the Earth. By making use of methodologies like interferometry, OLFAR intends to use the swarm satellites as one large antenna. However, similar to other approaches, this approach also has multiple challenges – such as communication with Earth and synchronization of satellites – that it needs to address.

Ultimately, our project team aspires to contribute to society by advancing our understanding of the cosmic dawn and the early universe or at least to support the research in this field to make our way to observe the cosmic dawn. With our honors project, we hope to help the research by exploring different approaches and contributing to parts of it.

OUTCOMES

To pursue our goal of delving into the observation of the cosmic dawn, we first needed to learn complex yet fundamental concepts such as interferometry and visibility space. Hence, our journey started by first aiming to understand these fundamental topics theoretically and then developing an even better insight by translating our theoretical knowledge into practical applications.
For this Honor’s year, we had two main goals:  
1) Gain a better comprehension of fundamental concepts  
2) Create a practical resource to aid future students and to translate our theoretical grasp into practical implementations  

For the first goal, we found and studied different materials to create a strong basis for understanding the various concepts. We also had many insightful discussions with our coaches to clarify and strengthen our understanding. For the second goal, we started creating workbooks to cover different parts of the theory we learned such as 2D Fourier transform, and also started making small advancements toward practical implementations such as analyzing data and creating simulations.

Although this process of solidifying our knowledge has required significant time investment, we are optimistic that this investment will help us to consider different approaches for our goal with greater expertise and thus contribute to the parts of future research for the cosmic dawn observations more meaningfully. Furthermore, we hope that the workbooks we are creating will help future students to have a head start so that we all can move on to the next steps in this journey together on a solid foundation.

**MEMORIES**

Reflecting on our Honors year, several favorite memories come to our mind. One unforgettable experience was watching “Interstellar” together as the Radio Astronomy Honors track with students from other tracks. Having an insightful discussion on the science the movie portrayed with Jasmina was an incredible experience as for us it illuminated the beauty of scientific concepts in a cinematic masterpiece.

Another great memory we had was seeing all the effort we put into learning complex topics slowly turning into practical implementations. It was a tough yet rewarding journey to see us being able to build our knowledge base to work on our ideas and even workbooks to help the next generation of Radio Astronomy honors students. Witnessing the satisfaction of our coaches was also a cherry on top for this achievement.

Looking ahead, we are excited about our visit to Astron and we are already confident that this visit will be one of our favorite memories from this Honors year. We believe that seeing incredible technologies in Astron like LOFAR will be insightful and inspirational for our work as well.

**LESSONS**

Throughout our Honors year, we have learned that working together and maintaining clear communication can turn intimidating challenges into achievable accomplishments. From the very start, we have set expectations for communication within our group to ensure everyone would stay informed and engaged even during busy times. This lesson has been invaluable for us as we made our way to understand complex topics.

For future Honors students, we advise sharing their personal goals with their teammates. We believe that sharing these goals creates an environment where everyone can support each other’s personal growth while we all work for the main goal of our project. Additionally, we think that it is important to do fun activities with your teammates outside of university and honors work since building strong bonds with your teammates can enhance collaboration and make the project even more enjoyable.

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**MEET THE TEAM**

Lea Faris  
• 1st year Honors student

Nil Dinc  
• 1st year Honors student

Noah Stevens  
• 1st year Honors student

Roel Jordans  
• coach

Kees van Berkel  
• coach

“Nothing has been changed since yesterday, right?”

Noah Stevens
ABOUT THE PROJECT

Our project is built around developing a better understanding of the working principles of pulsar navigation. The main aim of this project is thus to eventually make a contribution to the development and realization of this technology. We believe that doing so contributes positively to society in a number of ways.

First of all, by developing pulsar navigation, an alternative navigation method to GPS is made available. This would alleviate the reliance of a large amount of modern day technology on this satellite based form of positioning, which might not always be available.

Apart from that, pulsar navigation is a form of navigation which is useful for space exploration. In this application area, navigation can't rely on GPS due to the fact that this requires a full network of satellites to be present, which is not yet feasible in space.

There are thus numerous application areas for pulsar navigation and many ways in which society might benefit from the development of this technology.

OUTCOMES

Our project is highly focused on research, which did not seem like a difficult approach. However, in the beginning of the year, all of us expected a quicker progress than what we actually achieved, which might be the cause of not knowing how to deal with a purely research project.

Thus, the outcomes of our project so far are the vast knowledge all of us gathered in the domain of pulsars and their behavior, as well as in the domain of navigation. Moreover, we managed to develop a simple, but unfinished version of a navigation algorithm using already detected pulsars from the Australia Telescope National Facility (ATNF).

On the other hand, given the big amount of new information that all of us had to deal with, working in a team and dividing the work was slightly difficult, as all of us had to gather some basic knowledge in the topics, from where we could build on. In this process, our interests changed, and we ended up modifying the dynamic of the team and working more individually rather than together. I would say this last achievement is the most important one, as it gave us the possibility to research topics we are actually interested in, allowing us to follow our personal goals, make faster progress, and see how different topics come together naturally and complement each other in pulsar navigation.

We could say that we have not achieved everything that we wanted, however we learnt how to deal with filtering loads of information to obtain the relevant one,
as well as how to work in a team and keep into account everyone’s goals. Some suggestions that we would have for other Honors students would be to never forget that we are doing this for ourselves, and it is not a course that decides the beginning and the end or the possibilities of the project. The sky is the limit.

MEMORIES

Although learning difficult subjects is frustrating to some, the best moments for us are definitely finding out something exciting and then reading for hours about it. Since we are a learning oriented team, these moments, and when we are able to do something practical with the new insights are moments of joy.

An example is when we were able to formulate a method of our own for determining regions where a pulsar is visible, and where we would be able to travel. Although this method needs some variables which are yet unknown.

So, while the stereotype about learning might be true for many of us, let’s not forget about the real gems in life – like the thrill of knocking down pins at the bowling alley or sinking that perfect shot in a game of pool, and finishing with some drinks in Hubble. These are two of the bonding activities we have done so far, with certainly more to follow, distinguishing ourselves as the best honors team in the universe :)

LESSONS

Honors Academy has taught us countless skills - time management, planning our work, researching, working in multidisciplinary teams, and cooperating with professors and specialists in the field— just to name a few. But we believe the most important lesson that we have learned is how capable and skilled we, Honors Academy students, are. Every day we are ready and able to do more than our peers and learn difficult things others will study only next year or even never. We are willing and capable of finding time for our project in our busy schedules and more energy after long lectures. All this shows us how talented we are and how much we can accomplish in the name of our passion. Honors Academy has taught us to believe in ourselves and our future.

The advice we would like to give to other students is to shape your future with help from the Honors Academy. This is not your regular course, so do what will actually help you in your life and career! We would have never learned so much about the things we care about without help from the experts and professors. Without the Honors Academy, we would not have learned how to be leaders, research such complex topics, and navigate our own work and project. Therefore decide what you need and want for your future and take it from the Honors.

Future Honors students have to understand that Honors Academy is a unique possibility to improve themselves, work together with experts in the field, study things they would never learn in lectures or on their own, and most importantly find their passion and believe in themselves.

MEET THE TEAM

Arta Priednice
• 1st year Honors student

Diana Teodora Ionica
• 1st year Honors student

Niels van Kempen
• 1st year Honors student

Thom Theunissen
• 1st year Honors student

Mark Bentum
• coach

Jasmina Lazendic-Galloway
• coach

“I don’t understand shit. Oh, wait, it makes sense! Oh, nevermind…”
ABOUT THE PROJECT

The overarching theme of our project is radio telescopes and building novel antenna designs.

During the first year, we planned to get accustomed to building antenna structures and processing signals, so that we can analyze radio signals from space. It’s really just about getting used to what goes into operating a radio telescope.

In the second year, we’re thinking of delving into what really goes into the assembly and operation of so-called fast antennas, operating at very high frequencies (in the GHz range).

The general goal of this project is to aid current research in analyzing what are called “fast radio bursts” - they’re bright flashes of radio waves emanating from space; and there’s really no consensus on how and why they form. Antennas operating at those frequencies could be the key to unraveling the mysteries surrounding those misunderstood signals.

OUTCOMES

We’re done with the assembly part of the toy-model of a radio telescope, and planning to use it in the coming weeks. An unexpected challenge we faced is finding a suitable location to set the whole thing up. You might ask why - there’s plenty of space on campus, right? Well yes, but it’s not space that’s the real problem - it’s people: radio signals from phones or just radio stations, more precisely. We need to get away from the influence of these unwanted sources, since it’s space signals that we want to look at, and it’s best that we minimize any interference. And finding a radio-silent area, as we like to call it, is easier said than done. We’re now in contact with Astron (Netherlands Institute for Radio Astronomy) to help us secure a site, and we hope to be done in a few days, after which we can hopefully take measurements.
MEMORIES

The best memory of our Honors year was the process of putting together the telescope. Even though it comes with a manual, it was our task to understand and apply the science behind it. We were also challenged with finding the most suitable components in stores all around the Netherlands and assembling them with great care. The whole process brought us much closer as a team and showed how much we can achieve when we venture outside of our comfort zones.

LESSONS

The most valuable lesson that we learnt through our project was that it is important to explore your interest given the opportunity that we have gotten, and make sure that the learning curve increases exponentially.

Our advice in general is to keep learning and doing what you like, whatever attracts you the most. Only then will you be able to grow and be consistent in that subject.

We believe that is crucial to enjoy what you do and make the best out of it!

MEET THE TEAM

Ananya Venkatasubramanian
• 1st year Honors student

Emilis Zilinskas
• 1st year Honors student

Alicja Urbanczyk
• 1st year Honors student

Ian Gherman
• 1st year Honors student

David Prinsloo
• coach

Ulf Johanssen
• coach

“Aim for the stars, you will reach the sky.”
ABOUT THE TRACK

SensUs is the international student competition in the field of Sensors for Health, organized by students for students. Each year, we challenge students from all over the world to develop sensors for a large problem in healthcare. Every year SensUs has a new theme. The theme of SensUs 2024 is Kidney failure also referred to as acute kidney injury (AKI). Kidney failure is characterized by one or both kidneys losing their renal function, namely, the ability to filter waste matter from the blood. This results in an accumulation of waste in the bloodstream, which can be measured by the level of creatinine. In the competition, the Teams develop sensors for the continuous monitoring of creatinine, so that the functioning of the kidneys can be followed and timely action can be taken when needed. Innovative sensors are needed, which are sensitive and that work continuously. That’s the goal of SensUs!

In the SensUs Organization track, the TU/e students organize the global competition. Unique for the SensUs track is that the students design the competition as well as their own learning path, to learn skills that are important for them as a person and as a future professional. They learn about communication and leadership, presentation, design, technology, financials, planning skills, innovation cycles, teamwork, etc. They develop new ideas and solve complex problems by working together. They learn to communicate and negotiate with companies, and with students from all over the world. In SensUs, students work on the future of healthcare and learn what it takes to make international impact.
The SensUs competition was invented at TU/e, initiated by a group of students in the Honors Academy with me as their coach. I am a professor at TU/e in the departments of Biomedical Engineering and Applied Physics. SensUs has grown and has become a vibrant community. Every year I am excited and proud to work with the students and see how their efforts generate new ideas, new activities, and a smashing competition with worldwide impact.

The students define the theme of the SensUs competition, define the rules, coach the Teams, involve companies, work with healthcare professionals, and organize the entire contest week when all participating teams come together in Eindhoven. Teams from all over the world are participating in the competition. The Honors students develop expertise in communication and judgement, in sensors for health, and in management skills. I feel very honored to coach the students!

My mission is to train and inspire young scientists and engineers and to lay the foundations for solutions that will in the future improve the quality of life of patients. SensUs brings talented young people together from different scientific disciplines and from different countries. Every year I am proud of how the students develop new ideas and handle complex problems. It is amazing how the students develop themselves and realize every year a completely fresh competition that is full of innovation!
ABOUT THE PROJECT

The SensUs Student Competition is an annual international student competition that brings together student teams from various universities around the world to develop innovative biosensing solutions for real-world healthcare challenges. The goal of SensUs is to inspire and educate the next generation of scientists, engineers, and entrepreneurs in the field of biosensing and healthcare technology. With the competition, we hope to stimulate the advancement of biosensing technology in the healthcare sector.

OUTCOMES

The theme of SensUs 2024 is Acute Kidney Injury (AKI). The participating, international teams will develop a biosensor that can measure creatinine concentrations, which is a key indicator for the functioning of the kidneys. This year, the SensUs Organization hosted a live kick-off event to start the competition. Throughout the year, we are guiding the participating teams by hosting several feedback moments, entrepreneurship sessions, and partner sessions. These sessions allow the teams to realize their full potential. Furthermore, we are currently occupied with the preparations for two exciting events: the Distributed Testing Event, an engaging interim competition in an online format, and the upcoming SensUs Innovation Days, the week where all teams will show off their finished biosensors, and compete with each other in Eindhoven. The SensUs innovation days are set to take place just before the start of the new academic year. Our team is actively involved in ensuring the organization of both these events, dedicating our time and effort to make them truly remarkable experiences. Additionally, SensUs is constantly evolving and innovating its concept. Throughout the year, every member is trying to challenge the status quo, resulting in many new initiatives, and opportunities for improvement.
MEMORIES

Our fondest memory of SensUs is composed of smaller moments, including delightful dinners, plenaries, an enchanting day trip to Efteling, and numerous other experiences with more to come! We can’t contain our excitement for the upcoming SensUs Innovation Days! Especially since the Kick-Off Event. This event was composed of presentations, a panel talk, and a networking moment. This event was really the first moment of the year in which every member within SensUs could see what was possible when a group of motivated students worked together on a single goal; it really gave us a taste of what is yet to come. We are absolutely thrilled to experience the SensUs Innovation Days; an incredible event that we’ve worked towards for the entire year and will definitely create many fond memories.

LESSONS

We’ve learned a lot in different areas including professional networking with external companies, universities and students from all around the world; technical and interpersonal skills, time & task management, and collaboration.

When working in a team, don’t be afraid to ask for help, as people are always willing to help.

MEET THE TEAM

Vladislav Budiak
• 2nd year Honors student

Lyonne Vlaar
• no Honors student

Jarno Vlaar
• no Honors student

Veronique Bosch
• no Honors student

Louke Vaessen
• no Honors student

Liza van den Heuvel
• no Honors student

Menno Prins
• coach

Liudmila Ayazyan
• 1st year Honors student

Karel Schuller
• 1st year Honors student

Aušra Gronskytė
• 1st year Honors student

Shireen Dan
• 1st year Honors student

Sujitha Navaneetha
• 1st year Honors student

Zofia Rynkiewicz
• 1st year Honors student

Marko Mrvelj
• 1st year Honors student

“Within SensUs, anything is possible!”
ABOUT THE TRACK

Smart Cities addresses various topics from the perspective that smart and innovative solutions are required for the built environment. Implementing these solutions is challenging. The fundamental problem is that needs and preferences of citizens, quantitatively and qualitatively, tend to change faster than an inert physical environment can accommodate. The temporal scales of change considerably differ, creating inefficiencies in the urban system. Optimal interventions can only be instantaneous because, over time, people’s preferences and the properties and performance of the built environment diverge. Over the year, emerging information and communication technologies enable new strategies for urban interventions, thus bridging or narrowing this gap.

We invite all students to join us and work out the most challenging problems in the urban context together. With a compact series of lectures/talks/discussions at the beginning, you as a student will be equipped to define a self-chosen assignment on a specific topic and form groups to conduct the project.
Dr. Faas Moonen is an associate professor of Innovation Structural Design at the Built Environment. He has been the coordinator of the Smart Cities track from the beginning. Next to being the coordinator of the Smart Cities track, he also coaches different groups of students within the track. He also is a teacher of various courses within the Built Environment faculty, and has a great interest in projects which contain the subject of sustainability. One of his projects is the GEM-Stage, a sustainable energy solution for festivals. Another one of his projects is a pavilion that will be shown during the Morgen festival, which is made of a biobased material.

Floor van Schie graduated in September 2017 with a combined master in Architecture and Structural Design at the Eindhoven University of Technology, focusing on the integration of these two disciplines. As of Nov 2020, Floor graduated from her two-year Post-Master of Smart Buildings and Cities as PDEng trainee (Professional Doctorate in Engineering). Together with dr. ir. S.P.G Moonen of the department of Innovative Structural Design, she has been researching the design of the GEM-Stage, a sustainable energy solution for festivals. Floor is focusing on the architecture of the tower, building technology and methodology.

Mark Cox

I have been working for Honors Smart Cities since 2015 as a coach. Like every honors year, this year it has been a pleasure to see students grow in their personal development and see them achieving results and contributing towards new Smart cities solutions. I am especially proud of how honors students realize their dreams despite a lot of scientific and practical challenges by working in mixed teams and with fellow students and external partners. The honors students often contribute to the solutions of societal problems by developing or contributing sustainable technologies and products in the quadruple helix context. With a mix of creativity, energy, collaborative mindset each year the magic happens, and amazing projects are developed or pursued and engineers of the future prepare themselves for their upcoming role in society.
ABOUT THE PROJECT

In the heart of our endeavor lies a bold vision: to pioneer biobased innovation in urban landscapes through the assembly of modular green roofs atop electricity houses. Our project stands as a testament to the fusion of environmental consciousness with technological advancement.

At its core, our mission is twofold: firstly, to enhance the biodiversity and ecological resilience of urban environments, and secondly, to augment the aesthetic appeal of residential areas. With the impending need for the upscale of electricity infrastructure to meet growing demands, our project serves as a timely intervention, transforming these structures into vibrant hubs of life and sustainability.

By meticulously crafting green roofs that serve as habitats for bats, birds, and a plethora of plant species, we strive to foster a harmonious coexistence between nature and urbanity. Through this integration, we envision not only a tangible increase in biodiversity but also a profound enhancement of the overall urban landscape, enriching the lives of residents and wildlife alike.

As we embark on this journey of biobased innovation, our project team is driven by a steadfast commitment to societal progress. By catalyzing a paradigm shift towards sustainable urban development, we aim to leave an indelible mark on the fabric of our cities, ushering in an era where ecological stewardship and human habitation seamlessly intertwine.

OUTCOMES

Our project has achieved significant milestones, notably initiating prototyping and hands-on work, fostering practical skills and team commitment. Unexpectedly, we established connections with major electricity providers in the Netherlands and Belgium, opening avenues for collaboration. Despite initial challenges and missed deadlines, our outlook is optimistic. Moving forward, effective time management, clear communication, and leveraging industry connections are crucial. Flexibility will be key as we navigate towards project realization.
MEMORIES

When we finally decided on what project we want to do.

LESSONS

Most Valuable Lessons Learned: One of the most valuable lessons we’ve learned is the power of perseverance and adaptability in the face of challenges. Our journey has taught us that setbacks are inevitable, but it’s our response to them that defines our success. Embracing flexibility, collaboration, and a proactive mindset has been key in overcoming obstacles and driving our project forward.

Advice for Future Honors Students: For future Honors students embarking on their own projects, our advice is to embrace curiosity and exploration. Be open to new ideas and experiences, as they often lead to unexpected opportunities and insights. Additionally, don’t hesitate to seek support and guidance from mentors, peers, and industry professionals. Collaboration and mentorship can significantly enhance the quality and impact of your project.

Additional Insights for Peers or Future Honors Students: As peers or future Honors students, we encourage you to dream big and pursue projects that ignite your passion and creativity. Remember that every challenge is an opportunity for growth, and setbacks are simply stepping stones towards success. Stay resilient, stay curious, and above all, believe in the transformative power of your ideas. Your journey may be challenging, but the rewards of innovation and discovery are immeasurable.

MEET THE TEAM

Zornitsa Krumova
● 1st year Honors student

Isabella Canavan
● 1st year Honors student

Sydney Everaars
● 1st year Honors student

Agoston Bach
● 1st year Honors student

Faas Moonen
● coach

“Simplicity is the ultimate sophistication.”
Leonardo Da Vinci
ABOUT THE PROJECT

The Netherlands has been facing a huge housing crisis, which has also been affecting the students. There is over 27,000 units shortage for student accommodation in the Netherlands and 57% of foreign students have been confronted by “no internationals” in their search for a place to live. This creates a lot of pressure and stress on students who have moved away from their families and started studying. Therefore, the mission of Team Domus is to ease the stress first-year TU/e bachelor students get from the difficulty of finding accommodation due to the current housing crisis, providing them with accommodation for the first 6 months on the TU/e campus. Domus aims to build modular, sustainable, and temporary accommodations to be transported easily and mounted by students.

OUTCOMES

Team Domus aims to finish this year with a final design showcasing the innovation behind our dome, starting from its folding mechanism to its lightweight quality depicted in the materiality. The dome generates energy through solar panels and has a sufficient thermal/acoustical insulating performance. The aim is to showcase these aspects using models, drawings, and infographics. The models will range from a 1:10 showing folding mechanism, 1:1 showing panel composition, and 1:3 showing dome structure. These models alongside drawings and infographics showcase the innovation behind the dome. In addition, Domus aims to gain a lot of knowledge and participate in the TU/e Contest final summit showcasing our innovative product to potential investors. Finishing this year with these outcomes will pave the path of Domus toward potentially becoming a startup or a student team.

MEMORIES

It is hard for us to pick one specific ‘best memory’ siThe best memories are connected to the moments in which our group bonded and was getting to know each other better. In those instances, we realized that we were working together for a reason, which is similar beliefs, aims, and interests. A specific moment like that was a group dinner after a work session. We talked a lot and had fun after a long working day, which was rewarding. We spent a few hours together that evening and got to know a lot of details about each other.
LES SONS

Domus has taught us many lessons on how to work in a team and enriched our knowledge regarding design, structures, energy efficiency, and thermal performances of buildings. Taking a challenge upon participating in the TU/e contest has enriched our professional communication and presentation skills and opened a window to broaden our network in the professional field. Most importantly, Domus has benefited each one of us on our personal development journey, providing us with the opportunity to develop ourselves in a variety of aspects. Organizing ourselves in a team, working together on one defined goal, and trying to deliver the results within the allocated timeframe requires a lot of discipline and time management, which are two of the most valuable lessons we gained during our time at Domus. Therefore, we advise future honors students to challenge themselves and participate in a project they are passionate about, to dream big, to try and never give up, and most importantly to have fun!

MEET THE TEAM

Agatha Mihalcea-Simoiu
• 2nd year Honors student

Anastasiya Khlieban
• 2nd year Honors student

Bisher Ghadri
• 2nd year Honors student

Inês Sanguessuga Ascensão
• 2nd year Honors student

Maribel Kamal Rizk
• 2nd year Honors student

Vera Jakobs
• 2nd year Honors student

Faas Moonen
• coach

“What, like it’s hard?”
ABOUT THE PROJECT

Our project’s primary aim is to make a renovation plan for the Impuls building located in the heart of the TU/e campus. We strive to preserve its historical significance while also enhancing its functionality and sustainability. We are committed to minimizing waste and energy consumption, transforming Impuls into a net-zero energy building. Our goal is to create a vibrant, inclusive space that contributes to the university experience and to collaboration and innovation within the TU/e community.

OUTCOMES

The outcomes of our project entail the redevelopment plans for Impuls, with the unexpected realization that the building has to be extended to meet the space requirements adequately. This discovery prompted the addition of Impuls Noord, offering an opportunity to expand our project scope and explore innovative design solutions to meet the demands of the campus effectively.

While our team successfully completed a plan for Impuls Zuid and made progress with a model, the work on Impuls Noord remains ongoing. We recognize the need to continue our efforts to finalize the plan for the extension of Impuls, ensuring its alignment with the vision established for the renovation project.

Moving forward, we want to focus on the Impuls Noord project by leveraging the insights gained from our work on Impuls Zuid. Collaborative efforts between team members will be essential to refine the design and address any challenges encountered. By remaining focused on our goals, we are confident that we can achieve our desired outcomes and create a coherent, complete design.

MEMORIES

Attending the creative session for the Impuls building renovation remains one of our best memories. The gathering brought together a diverse group of individuals, each offering unique perspectives and expertise. What made the experience memorable was the opportunity to engage in discussions and exchange ideas with such a diverse group. Each participant brought their own insights and expertise to the table. Moreover, the session allowed us to collectively shape a shared vision for the Impuls building. We discussed
various aspects of the renovation, from the requirements of the student teams and EIRES to the masterplan of the campus.

LESSONS

The most valuable lesson learned from our project is the importance of collaboration and interdisciplinary teamwork. Working alongside students from different backgrounds and different strengths and weaknesses enriched our project outcomes and allowed us to approach challenges from various perspectives. This experience emphasized the significance of open communication, active listening, and respecting diverse viewpoints in achieving shared goals.

For future Honors students, our advice would be to embrace opportunities for collaboration and interdisciplinary learning. Engage actively with your peers, seek out diverse perspectives, and be open to exploring new ideas and approaches. Don't hesitate to step out of your comfort zone and take on challenges that push you to grow personally and professionally. Remember that every experience, whether success or failure, offers valuable lessons for your personal and academic development.

MEET THE TEAM

Eszter Berces
• 1st year Honors student

Ruxandra Florut
• 1st year Honors student

Nora Nemes
• 1st year Honors student

Ignacy Kunowski
• 1st year Honors student

Diana van der Sloot
• coach
ABOUT THE PROJECT

For our project, we both have short term and long term goals. On the short term, we are both participating in the TU/e contest and receiving feedback from companies. With the TU/e contest, we want to improve our personal skills in presenting our ideas to companies, while the company visits are aimed on improving the project content wise and making people more aware of the problem and our solution. For the long term, some students are motivated to keep on solving the housing problem in the Netherlands and want to continue the project to bring our module to the market!

OUTCOMES

The most significant results we booked for the project are both the final design of our module and the network we created with this. The module design has gone through a large amount of development cycles with feedback from both academics as companies. This results in a design that takes the different perspectives from these partners into account. With this procedure, we made a list of new contacts in the industry that can help us develop the project further in the future. We also had the opportunity to compete in both the DTU challenge in Copenhagen and the TU/e contest.

MEMORIES

One of the most spectacular things we did this year was visiting the construction site at the university. Here, we were able to view different stages of installing prefab bathroom modules. This was very spectacular, because every level of the building was one stage earlier in the installation process.

LESSONS

The most important lessons we learned in the past year are about networking and reaching out to companies. For doing this, the most important lesson we learned is to just do it. Companies are often very willing to help you with the project and give feedback. At first, it might feel daunting to send out many emails and not get any responses, but if you persevere, the few companies that get back to you will be worth the hard work.
MEET THE TEAM

Finn Aarntzen
• 2nd year Honors student

Jakub Janas
• 2nd year Honors student

Robin Geraedts
• 2nd year Honors student

Faas Moonen
• coach
ABOUT THE PROJECT

Rijkswaterstaat acquired the parcel of land of a 19th century farm, a monument to this day. It is located close to Oirschot on the side of the A58 highway and will be used for the expansion of the road lanes, but until then the ambition to build a living lab to grow and design with biobased fibre arose from the opportunities of the location. The 12 hectares contain the main farmhouse, and 3 annexes that date to different periods which were used as storage of machinery and produce. One of them is a 19x50m timber portal frame barn. The abandoned structure is enveloped in non-loadbearing concrete panels and a roof layer of asbestos over timber battens. The task of our team was to redesign the barn using biobased materials to incorporate the workshop of the living lab, while sustaining storage possibilities. The challenge is to prove the capabilities of low-tech natural building methods using high-tech performance assessments. High costs associated with the replacement of the whole building envelope redefined the project questions and formulated the brief for a modular construction inside the barn. The module benefits from the stability of the barn and its rain protection barrier, but insufficient light and thermal regulation are assigned to be solved by the inside construction. As a method of proving the capabilities of the fibres grown on the land patches, the team investigated the possibilities of flax, hemp, and elephant grass for the development of dismantlable wall panels that enable the module to move to other locations.

OUTCOMES

The formulation of a design brief and the development of two detailed alternatives for the module are the main outcomes of the project. Starting from brief knowledge on biobased materials, we now familiarized with multiple building techniques and local producers. Being used to individual architectural design decision making, our team struggled with making choices on the project plans. Later improvements determined us to have an individual take on, each offering their capabilities into the realisation of a certain task, which helped in growing the speed of design. At the time, we put the project on the tables of RWS and aim at building the module by the end of the Honors Program.
MEMORIES

Arguably our most favourite memory was a recent event that connected us to other individuals involved in the living lab project. The Zaaien2024 was the first official sowing of an annual cycle of sowing and harvesting of the fibre seeds at the project location. The living lab involves around 50 participants in teams assigned per annex and its repurposing/refurbishment and this event enabled our project to gain context into the processes related to the fabrication of these materials. Professionals in regenerative agriculture, designers of biobased materials and artists that use organic materials presented their work and field of expertise from the 5 disciplines of the Living Lab: Entrepreneurs, Academics and students, Designers, Government professionals and local Experts. It was here where we firstly showcased the sketches for the barn and discussed with people actively involved in the project on the possibilities for improvement and the possible integrations of functions for the independent maker space. More than that, the theoretical knowledge on building materials our team built met with the practical knowledge of MBO students that focus on interior design made from biobased materials, which started a collaboration that now speeds up our progress in the process of making architecture.

LESSONS

On theoretical grounds, we deepened our knowledge of biobased building materials, but also trained our minds into detailing building systems that allow more flexibility in assembly and disassembly of units. We delved into how architectural quality can be synthetised through this still rather limited palette of options, and learned to be critical of aesthetically pleasing but misleading in performance materials as the market tends to promote most new products, and no strict standards have yet been implemented into filtering these on the list. Regarding group work, our team changed methods throughout the whole year, but we found that repetition and consistency help. Meeting often was not enough, but a sense of individual responsibility was, and we learned this by being critical with our own progress. We needed to establish boundaries such as the setup of two plans, the short term for the barn module, and the long term for a conceptual living lab, when the expansion of the road will take place and the parcel lease will end. Because the clients we work with do not have a deadline of their own, we needed to be our own assessors, the fact posing impediments along the way, but by the end of this first year we hope to hand in the clear plans and guidelines for building the case of the module.

MEET THE TEAM

Cristian Codruț Oncioiu
• 1st year Honors student

Hugo Fanjul Mardones
• 1st year Honors student

Maria Dumitrache
• 1st year Honors student

Maria Ștefănuț
• 1st year Honors student

Faas Moonen
• coach

“We borrow from nature the space upon which we build.”
Tadao Ando
ABOUT THE PROJECT

Today, the majority of people in the world live in cities. With rapid urbanization rates, density of urban areas only continues to increase and with that, follows the loss of greenery, biodiversity and endangerment of various animal habitats. While green spaces and vegetation help to combat climate change, they also directly improve psychological and physical well-being of humans and their environments.

Since nature and mankind can benefit from each other, although in cities their required space tends to collide and clash, the project Nature Inclusive Neighbourhood has a goal of finding a solution towards a coherent and a symbiotic environment between the two. While cities are immensely complex the first step towards achieving that goal, is to start with just a neighbourhood in one city.

Breda has a vision towards an improved and greener environment and its municipality is keen on achieving it. In Breda, Doornbos-Linie is the project area, it being selected while searching for a neighbourhood with a possibility for contunuity on a larger scale and which would be able create an inclusive environment for both nature and people.

OUTCOMES

Given that nature brings a benefit to people, a start to the project was finding tangible evidence of it and fostering care about nature and its inclusion within cities. The first goal of the project was to define problems to be solved and the meaning of nature inclusivity within the scope of the project. Settling it down to “a harmonious balance between urban spaces and local flora and fauna achieved, fostering cooperative relationships and shared living spaces,” allow to progress to finding a direction for implementing a nature inclusivity within the project area.

Alongside finding definitions, a basis was needed to start finding a general solution for implementing more flora and fauna within cities. With many similar rowhouses with a need for renovation, similar to many in the Netherlands, Doornbos-Linie was chosen. There, a specific direction of nature inclusive was chosen - finding a solution to sufficient mobility, parking and more functional green spaces in the area. Many of the blocks, in the Doornbos-Linie are similar. In the future we aim use this to define typologies of mass and space for a general plan for bringing nature inclusivity into neighbourhoods and cities.
MEMORIES

So far Honors has been a great adventure. As with every team we had our ups and downs but in the end, it is all about the friends we made along the way and the things we overcame together.

The most important event that took place within the team was our road trip to Breda. One morning we took a car and drove to Breda to analyze and gain insights into the neighbourhood we work with. We grabbed some lunch, walked around the area and chatted which helped us to get to know each other way better. We realized we have a lot more in common than expected and many more plans were made for bonding activities.

LESSONS

Finally, it is worth mentioning that it wasn’t always easy. We had to lead a project with little to no guidelines on our own for the first time. This caused organizational issues combined with times for us that we didn’t know in which direction to go. In addition, as expected, teamwork was lacking at the beginning, which improved as we started interacting with each other more. The most important thing we learned is that organization and team effort is key towards succeeding in a project. We managed to adapt, grow make progress steadily.

Throughout the project we also gained a better insight into the city, its complexity and that of the task of bringing more nature and greenery into a city. The project has revealed integrated and layered problems, which we hope to take on as opportunities and which we hope to overcome in the coming year of Honors.

MEET THE TEAM

Gergana Dimitrova
• 1st year Honors student

Ralfs Ricards Indriksons
• 1st year Honors student

Laura Nascimento
• 1st year Honors student

Andrei Turta
• 1st year Honors student

Faas Moonen
• coach

“All good things are wild and free.”
Henry David Thoreau
ABOUT THE PROJECT

Currently, the water treatment system is largely centralized, handling all types of wastewater together. This method can be inefficient and environmentally unfriendly; it requires treating all water to high standards, even when only some contain hazardous substances. This approach often leads to underutilized or overly strained resources, making the process costly and complex.

In our project, we propose a solution that utilizes decentralized wastewater treatment plants for neighborhoods, industries, and hospitals. Initially, we focused on implementing this system in new neighborhoods to better manage water reuse. This would prevent household water from mixing with industrial waste, improving water conservation. We encourage technologies like vacuum toilets, directly separating black water from easily recyclable grey water, and strive to enhance water purification, making the process more efficient and eco-friendly.

Additionally, we want the water treatment plants to be integrated into the surrounding infrastructure. The plants will have a modern design, adding aesthetic value to the neighborhood. They will also use real plants for water filtering making it full of greenery. The facilities would be used as public spaces where people could spend their free time amongst nature and educate themselves about the water treatment process. To maximize the treatment plant’s potential they would additionally serve as data collection points benefiting, amongst others, the police and virologists.

OUTCOMES

As the project outcome, we developed a proposal for municipalities that outlines the concept of a decentralized water treatment system. This includes guidelines on how the system should be divided between neighborhoods, hospitals, and industrial areas as well as a list of technologies used for the process. Additionally, a proposal for the water system in a newly built house will be included. This ensures that houses in newly built neighborhoods are as compatible with the treatment system as possible and maximize water and energy preservation. All this is combined with informational aid, like conceptual infographics, showing what the benefits of such a system are and how to use it properly.

Ideally, we strive to create a complete guide for the implementation of decentralized water treatment technologies as an integral system. Nevertheless, the
chemical processes within these technologies are too difficult for us to understand on a level so that we might create our own products. Therefore, we decided to focus on the systematic side, and considered the exact technologies to be a “unspecified box” in the system (using only real products). A follow-up suggestion is to look into technologies and find solutions for the decentralization on a micro-scale.

MEMORIES

Throughout the year we have been dealing with name issues. In many meetings, we have tried to come up with a name that would accurately describe our team but is not negatively associated with sewage; we did not want to be known as the “sewage people”. We have had a lot of fun during these meetings coming up ridiculous ideas.

LESSONS

The most valuable lesson we learned is that in real life problems often are not specifically defined and it can take most of the time to figure out how to approach the problem instead of how to solve it.

Our advice for future Honors students is to not get discouraged if the approach to the problem is seemingly unfindable. The answers will come over time, research, and consulting the right people.

MEET THE TEAM

Jagoda Nawrat
• 1st year Honors student

Lukrecija Stanić
• 1st year Honors student

Kai Ceelen
• 1st year Honors student

Albert Mosegaard
• 1st year Honors student

Mark Cox
• coach
ABOUT THE PROJECT

This year, we participated in the humanitarian architectural competition for the design of a new fire station in Dnipro, Ukraine, organized by INSPIREL. The goal was to design a fire station for the municipality of Dnipro to help Ukraine rebuild its war-torn country. Besides fulfilling the design brief, we added low-cost, passive heating and ventilation systems to create a more sustainable design.

OUTCOMES

The design for the fire station has been shaped by three integrated ideas. First is the flow of the fire trucks coming in from the back of the apparatus and being able to leave the fire station easily on the main road. This makes for easy access to and from the apparatus. Second is the separation of the living quarters and the administration wing by taking out an atrium behind the apparatus. This separation allows for privacy for all parties involved. And finally, the signature of the fire station where we reference back to the watch towers from old fire stations, the fire hose drying shaft radiates a similar character. It also creates a point of symmetry in the design as seen by visitors and passers-by from the main road. The tower also gives verticality to the otherwise horizontal design, which is reflected in the facades and highlighted by the vertical windows.

The design of the fire station is represented in drawings, diagrams, and renders, combined in a booklet for the submission of the competition. Furthermore, a physical model will be made to present the design on Demo Day.

MEMORIES

Picking a single memory is difficult given the fun we have had together this year. However, some memories stick out. The first is from one of the design sessions we had for the fire station in which we were working out the design from our concept. Trying different things and in the end, seeing our ideas come to life is always a special memory. Another one is from one of our team outings where the weirdest stories were shared after some homemade cocktails after first having dented out the cocktail shaker. And of course, making new team pictures is always memorable, especially when members climb in the TU/e sign.
The most valuable lesson we learned is that communication is key. As designers, we learn how to communicate our ideas through language and visualizations. As Honor students, we learn that communication is necessary to optimize cooperation, planning, team spirit, and eventually also our design.

Our advice is to have fun! As an Honors student, you get to do projects you could never do within your regular study program. Although this can be challenging at times, the results are going to be worth it in the end. So try to enjoy it while it lasts.

MEET THE TEAM

Nicole Bergendal
• 2nd year Honors student

Mara Gianotten
• 2nd year Honors student

Matúš Kianička
• 2nd year Honors student

Sebastian Spiteri
• 2nd year Honors student

Floor van Schie
• coach

“You have no idea what I’ve been through.”
Nicole
ABOUT THE PROJECT

TreeD’s is to develop a wood-based 3D printing material that offers a sustainable and low-energy alternative to concrete, which is responsible for approximately 7-8% of global carbon emissions. This innovative material matches the flexibility of concrete, allowing it to be used with existing construction tools and slightly modified techniques. Demonstrating its versatility, our initial applications include 3D-printed benches and bus stops. By providing construction companies with a greener option that also offers financial incentives through tax benefits, our project contributes to significant environmental impact reduction. The long-term vision is to scale this technology to construct tiny houses and eventually larger buildings, showcasing the practical and ecological advantages of our material.

OUTCOMES

The outcomes of our project include the development and refinement of various wood-based material prototypes and the successful 3D printing of items on small and medium scale. A significant and strategic development has been our transition from an honors team to an innovation space discovery student team, ensuring the longevity and ongoing evolution of our technology in the challenging construction materials market.

While we have made considerable progress, the complexity of integrating a new material into the construction industry means there is still work to be done.

MEMORIES

One of the best memories from the project was the moment we successfully 3D printed our wood-based material for the first time at a small scale. We had 2 challenges at hand: we had to modify a standard off-the-shelf plastic filament 3D printer to extrude a paste, and we had to develop a wood based paste that could be extruded, all within a tight budget. Once everything was ready, the team gathered with for the final test. On our third try, we watched as the printer began to extrude a perfect cylinder of our material. Seeing our concept materialize successfully, and seeing everything come together was a deeply rewarding and satisfying moment for everyone involved.
LESSONS

The most valuable lesson we learned from this project is the importance of embracing experimentation and the power of rapid iteration. These practices were crucial in driving our progress and overcoming the technical challenges we faced.

For future Honors students, our advice is straightforward: dive into hands-on work early and don’t hesitate to experiment. Engaging directly with your project not only accelerates your learning but also provides immediate feedback and results, which are essential for maintaining motivation. Prior research is important, but it’s the balance between planning and doing that often dictates success. Excessive time spent in preparation without visible outcomes can decrease enthusiasm and stop momentum.

Early visible results build confidence, sustain interest, and provide clear evidence of your efforts, which is incredibly rewarding and motivating.

MEET THE TEAM

Noah Jansema
• 2nd year Honors student

Renzo Jansema
• 2nd year Honors student

Amar Mohindra
• 2nd year Honors student

Maria Malli
• 2nd year Honors student

Laura Trávníková
• 2nd year Honors student

Mauricio Buendía Silva
• 2nd year Honors student

Nicolas Beaus Gratacós
• no Honors student

Pleun Pranger
• no Honors student

Ata Housen
• no Honors student

Mika Yalcinkaya
• no Honors student

Emir Marengo
• no Honors student

Mark Cox
• coach
In the field of Smart Mobility and in particular Cooperative Connected Automated Mobility, we see many opportunities to use technology to solve mobility problems. By adding smartness, we aim to decrease the negative effects of traffic jams, traffic injuries and deaths down to 0% and even lower the overall emissions from traffic and mobility solutions. Mobility impacts us all in our daily lives and the number of people, from industry, academia, and government trying to provide mobility to all of us is therefore immense.

With the trend towards further automation, connectivity, and cooperation of all modalities of transportation, Smart Mobility is further evolving towards Cooperative Connected Automated Mobility. This field focuses on connecting self-driving vehicles, traffic management systems, mapping, efficient powertrains but also vulnerable road users (such as pedestrians and cyclists) and other modes of transport to establish a mobility system for all, and making use of IoT, data science and Artificial Intelligence to achieve this.

In year 2023-2024, the track had 4 projects:

• **Hybrid Maglev Railway:** a continuation of the team that was created last year, based on the passion of one student: trains. The team focuses on bringing maglev technology for trains to market within Europe and ensuring it can be used in a hybrid way (converting regular train to use both traditional as well as maglev powered propulsion systems) way.

• **InCharge:** 3 of our Honors students joined the InCharge team that was initially started at Energy Transition track, but now is a full student team in the next phase of development. The team focused on building a wireless charging prototype and extending the team.

• **RDW Challenge:** this team of 5 students is working on a self-driving challenge, organised by Dutch road authorities RDW. This is the first time that the team is taking part in this new challenge, with a self-driving vehicle from TU/e.

• **Collision Risk Prediction:** 2 students worked together researching a risk prediction algorithm that derives from image data if a vehicle is possible at risk of collision with another traffic participant. They worked on setting up simulation environments and researching how to define what is a safe and unsafe situation.

4 projects
12 students
This year we had teams again with a strong focus on our three pillars: societal challenges in the field of CCAM, being part of one of the Automotive student teams and projects started at Honors. All topics fit very well within the Smart Mobility track, combining both sustainability, cooperative and connected mobility, and autonomous vehicle technology.

Most Smart Mobility track students really choose this track to be able to collaborate within a team. But this year we also had a new team starting. We have seen growth in our students that started last year, with some students now taking a leading role. Being the coach of the collision risk prediction team this year, we focused much more on a research approach, which I prefer myself. I am proud that we still can show what collaboration between tracks can do: this year with a team that originated at Energy Transition (InCharge).

We will surely continue and explore this kind of collaboration further in the future! This year we started off with a nice team activity, which worked out very well and additionally focused on collaborative PDP design within the track as a continuation of last year’s initiative to peer review each other’s PDP.

**COACHES**

**Vadims Kisel**

This was my first year as a coach in the Smart Mobility track. Having successfully completed my own Honors Academy journey, I personally understand the challenges and opportunities that students encounter. In my role as a coach, I supervised two teams: InCharge and Hybrid Maglev Railways, consisting of a total of five students. This diverse mix included both first-year and second-year Honors students, each with unique ambitions and perspectives. For the first-year students, the year kicked off with an emphasis on creating PDPs and ensuring the smooth execution of their projects. We prioritized establishing strong foundations for project management and effective teamwork. While with the second-year students, we focused more on their short-term goals, post-graduation plans and strategies for navigating the transition into a professional career. Reflecting on the year as it comes to an end, I am proud to say that it has been a successful journey filled with important project outcomes and personal growth among the students.

Thank you all for this year!

**Milind Tripathi**

With a host of new projects aimed to shape the future of our mobility and a bucket full of enthusiasm, we kicked off this academic year firing on all cylinders! Having multiple coaches on board this year, we are having multiple coaches on board this year transformed our planning process from reactive to proactive.

**COACHES**

**Jos den Ouden**

This year we had teams again with a strong focus on our three pillars: societal challenges in the field of CCAM, being part of one of the Automotive student teams and projects started at Honors. All topics fit very well within the Smart Mobility track, combining both sustainability, cooperative and connected mobility, and autonomous vehicle technology.

**Mihai-Dragoş Ungureanu**

This year has been my second year being on the other side of the table, from being a student in the Smart Mobility Track to joining as a coach for the track. I have tried my best to help the students achieve their full potential within their own project, the track, and the Honors Academy, guiding them but also sharing a little bit of my experience as an Honors Alumni. I have been working with one team for the past year: the RDW Self-Driving Challenge. The team started this year with a really challenging project: create a self-driving car and participate in the Dutch national self-driving challenge organized in Lelystad on the 14th of June. From the beginning of the project, the timeframe was quite short, and the pressure was quite high, however, the students have worked really hard to achieve their ideas and end goals. There were challenging moments, long hours, drawbacks, and moments when everything seemed to fall apart, but also moments of gain, team collaboration, and excitement when things worked out as initially planned. The team tried to find the best solution to every aspect of their project, keeping track of the limited timeframe they had and I can say that I am so proud of what they achieved by the end of this academic year and the quality of work put into their projects. They listened carefully to the feedback given by their coaches and their track coordinator, and I think I have also learned so much from them. The students showed that no matter how big the challenge is, and how sometimes we might doubt its feasibility, by showing up regularly and motivating each other nothing is impossible. Any project can become a success and a reality. As the team is composed of first and second year Honors Students, I want to wish them all the best in the continuation of their Honors career, their studies and hopefully all the plans I read so much about in their PDPs will one day become a reality in their lives.

Thank you all for this amazing year!
ABOUT THE PROJECT

Road traffic injuries are one of the leading causes of death with several other severe negative impacts (https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries). Reports suggest that every year nearly 1.19 million people lose their lives in road accidents. To reduce the number of collisions that happen due to reckless driving and several other causes, autonomous cars can be used. Autonomous cars work with the help of sensors, cameras, and other automatic features. Also, it is designed for predicting collisions accurately, this brings us to develop an accurate collision risk prediction system.

Adhering to this, TU/e Master’s students created a novel model to predict possible unsafe situations based on video data (Schoonbeek, T. J., Piva, F., Abdolhay, H. R., & Dubbelman, G. (2022). Learning to Predict Collision Risk from Simulated Video Data. In 2022 IEEE Intelligent Vehicles Symposium (IV) (pp. 943-951). Article 9827228 Institute of Electrical and Electronics Engineers. https://doi.org/10.1109/IV51971.2022.9827228). The goal of our project is to implement this model on our laptops and enhance it by addressing its limitations.

The most innovative approach of this model is that because of the lack of real-life training data, it was trained on a synthetic simulated dataset. However, this simulated dataset was quite biased, so we decided to create a new synthetic dataset to enhance the model performance.

Upon successful implementation of the intended model, its application extends to autonomous vehicles. By integrating this model into autonomous vehicles, it can enhance their ability to predict and mitigate collision risks, thus contributing to safer and more reliable autonomous driving systems.

OUTCOMES

First, we are working on creating a new synthetic dataset using the CARLA simulator. On one hand, we need to include many different driving situations, so that the model is trained on all possible scenarios and can generalize well. On the other hand, given that there are multiple aspects on what constitutes a safe driving situation, we need to create a complex labeling protocol and label each moment accordingly. We expect to deliver this dataset by the end of the academic year.
Additionally, we aim to summarize our work in a paper. This would serve two purposes. First, it would offer a clear overview and help comparison with the original model. Second, by summarizing our work, we give the opportunity for future Honors students to join this project and contribute to the development of the model.

A follow-up suggestion would be to improve the F1 score (currently 0.94) of the model by changing the architecture and the learning parameters. The main emphasis should be minimizing the false negatives to enhance the model's precision in predicting collision risks.

**MEMORIES**

The best memory for us was the Interim Presentations. Before the presentations, we finished implementing the model on our laptops, but we could not decide which aspect of the model to focus on. The discussion after the presentation offered us valuable insights. We received great advice on which aspects of the model show the largest limitations, and also on how to organize our work more efficiently. In the end, this input had a large impact on the direction we took.

**LESSONS**

In self-learning, staying organized and managing tasks effectively are essential. Without these, it's tough to move forward in any project. It's crucial to understand each team member's strengths, weaknesses, and personal goals to guide the project in the right direction. By adjusting our end goal based on this understanding, we ensure everyone's contributions are valued. Remember, while reaching the end goal is important, the journey itself—the learning process—is where we truly grow.

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**MEET THE TEAM**

Mahima Varshini Ramanathan
• 1st year Honors student
Andor Károly Bodgál
• 1st year Honors student
Jos den Ouden
• coach

“To err is human, but to really mess things up, you need a laptop, a data scientist, and a deadline!”

---

**Learning to Predict Collision Risk from Simulated Video Data**

Tim J. Schoonbeek, Fabrizio J. Piva, Hamid R. Abdollahi, Gijs Dubbelman

Abstract—We propose an image-based collision risk prediction model and a training strategy that allows training on simulated video data and successfully generalizes to real data. By doing so, we solve the data scarcity problem of collecting and labeling real-world collisions, which are exceptionally rare. Domain generalization from simulated to real data is taken into account by defining the learning process in such a way that we ensure not only that the model performs well on the simulated data but also that it generalizes to the real world. Specifically, we use optical flow and vehicle detection representations. Additionally, we provide the novel dataset—the simulated Prescan dataset—which we intend to make publicly available for training and the YouTube Driving Incident Database (YDID) for real-world testing. The performance of RiskNet, trained only on simulated data and tested on the real-world YDID, is comparable to that of a human driver, both in accuracy (91.8% vs. 93.6%) and F1-score (0.92 vs 0.94).

1. INTRODUCTION

Road accidents are still a major concern of both automotive industry and society as a whole, as globally 1.35 million people lose their lives in traffic every year [1]. Given the number of vehicles is only increasing [2], the need for more competent advanced driver assistance systems and specifically collision avoidance systems grows. The current...
ABOUT THE PROJECT

Hybrid Maglev Railways aims to allow magnetically levitating (MagLev) trains on existing tracks without disrupting the current system. We want to design a train and modular train modules that can be added to existing high-speed railways to improve international connections. MagLev trains can already be found in the Shanghai Transrapid, being able to boast an average speed of 300 km/h over its short track of 30 km. Additionally, Japan is developing its own SCMaglev, which is crushing speed records even before its official commercial use. Our ambition is to eventually be able to break international barriers for rail transport.

So how can a hybrid train break these barriers? Currently, intra-EU travel is mostly done by plane or by car, to either have the comfort of having a short travel time, or have the comfort of individual travel. However, these modes of travel are less sustainable than their rail counterparts. Trains have long been praised as the best way to travel for climate-aware travelers. People who have used them, however, find many flaws in them.

They are often slow, difficult to book and are not reliable enough. Introducing MagLev technology will increase the speed and comfort of the trains while reducing service costs. The major downside of implementing a new large logistical system is of course its immense financial and regulatory burden. Therefore, the Hybrid Maglev Railway is the solution that will have all the benefits of the MagLev technology, while ensuring implementation ease and affordability.

In order to be able to design a hybrid MagLev train we needed to combine magnetic levitation and suspension in a way that would also allow implementation on the current train tracks while still functioning in a safe way. We are redesigning an existing train, currently in operation on high-speed rail lines, and adapting it for modular use (for ease of service and upgradability) as well as designing an electrodynamic suspension and linear synchronous motor implementation of MagLev train technology.
OUTCOMES

After 2 years in the honors academy as a team developing a hybrid maglev solution to intra-EU rail travel, we have finally taken the leap into becoming a student team. Our initial goal this year was to technically develop our project, in particular further building upon the foundation of our previous year; developing the numerical simulation and CAD resulting in a FEM simulation of the entire train. After unexpectedly having the opportunity to collaborate with EuroTeQ on guiding a EuroTeQ Collider team, where we as challenge collaborators saw our project making it into the final Paris EuroTeQaThon, our goals shifted. Seeing the opportunity to expand our project outside of honors and leaving a lasting legacy we focused more on further developing the business case and founding a student team. As a result, we did develop our project in terms of the simulations and CAD, but primarily we have taken large steps in growing the team long-term and building a good PR and ER foundation.

MEMORIES

Our most fun memories this year were the many more group bonding activities we did (as compared to 0 last year). Following our hours-long work sessions we went ice-skating, perfected our Italian culinary skills by baking pizza’s and tried our hand at some old-fashioned gossiping about the “koetjes en kalfjes”.

LESSONS

Don’t be afraid to reach out to people, most will be very happy to help. When gathering information and trying to set up a student team, we expected to have to jump through a lot more hurdles than we did. When reflecting on our year, we might have been able to develop the team even further if we would have begun our PR/ER efforts earlier.

For future honors students, don’t be afraid of reaching out to experts or staff for help. Choose a project that aligns with skills you want to learn, and you can see yourself developing throughout the years by reaching different milestones. (And your PDP will basically write itself!)

MEET THE TEAM

Alexandros Peonidis
• 2nd year Honors student

Annelies van Vastenhoven
• 2nd year Honors student

Lars Hilkens
• Honors graduate

Vadims Kisels
• coach

Jos den Ouden
• coach
ABOUT THE PROJECT

The goal of this project is to showcase the technology of dynamic wireless charging. It targets warehouse operators using Autonomous Guided Vehicles (AGV), that usually require expensive charging infrastructure and experience reduced throughput due to long charging times. The technology developed by InCharge ensures the AGV never stop for recharging and can function with considerably smaller batteries on board, this will greatly improve the cost and efficiency of running an automated warehouse, thus helping the logistics sector. Moreover, the reduction of the battery size needed for an AGV, contributes towards achieving sustainability goals.

OUTCOMES

The outcome of the project is a small scale prototype showcasing the technology. Looking back in time, one of the things we could improve is finding a more flexible way aligning different time-schedules, ensuring good attendance and input during team meetings.

MEMORIES

The in-house sprint in Amsterdam. Seeing Elena cutting a potato with a butter knife.

LESSONS

Searching for electronics is difficult. Go directly to people and talk!
MEET THE TEAM

Ilya Tokareva
• 1st year Honors student
Elena Appendino
• 1st year Honors student
Nikola Petrov
• 2nd year Honors student
Mikey Gustavsson
• no Honors student
Gregory Melville
• no Honors student
Tudor Andrei Pioara
• no Honors student
Eduardo Gomez Hernandez
• no Honors student
Erik Eifel Forcat
• no Honors student

Karim Mahmoud
• no Honors student
Romeu Longo Malinski
• no Honors student
Sofia Soler
• no Honors student
Agueda Marmol de Burgos
• no Honors student
Vadims Kisels
• coach

“Empowering tomorrow, one charge at a time.”
ABOUT THE PROJECT

We aim to participate in the open category of the RDW Self-Driving Challenge in Lelystad on June 14th, completing the challenge course without any hiccups. We wish to address tasks like obeying traffic lights and speed limits, as well as avoiding pedestrians, before progressing to more complex challenges like overtaking and parallel parking. While our ultimate goal is to overcome all obstacles, as newbies learning and developing everything from scratch, achieving autonomous movement and completing initial tasks is a big win for us.

RDW expressed the uncertainty of road authorities in understanding and approving self-driving vehicles. This challenge allows them to learn the development processing of autonomous vehicles and their common weak links. Through ongoing feedback and documentation from teams like ours they can design more robust regulations, ultimately helping save human lives on the road. By the end hopefully, we will be inspired to build more robust and safe self-driving systems, potentially inspiring our peers and play a role in creating a safer mobility landscape.

OUTCOMES

The outcomes of the project are to create the ‘best’ self-driving car that will overcome a certain determined series of challenges in the quickest possible way. The car will be competing with a number of others created by various universities. Therefore, the car has to successfully accomplish the following challenges in the shortest amount of time: stopping at a traffic light, changing speed as indicated by a speed limit sign, and stopping at a pedestrian crossing until it is clear. The car must also be able to overtake a vehicle by changing lanes and finally parallel parking. The most significant results achieved include our team being at a stage where the car is capable of identifying obstacles in real-time, such as pedestrians, traffic lights, speed limit signs, vehicles, and zebra crossings. We have developed the capability to not only identify these obstacles but also calculate their distances and respond to them with appropriate logic. Furthermore, we have successfully implemented the necessary code to control both the speed and steering of the vehicle, enabling us to communicate direct instructions to the car’s system. Regarding unexpected outcomes, we encountered challenges in...
effectively identifying speed limit signs and accurately interpreting the numbers they displayed from a large distance. Additionally, we faced unexpected difficulties in the implementation of the speed control system. If the desired results aren’t achieved, the outlook involves prioritizing functionality over perfection, focusing on making things work rather than striving for perfection.

**MEMORIES**

One of the best memories of the year was when we finally got the Orin, the computer that runs our software, fully ready to use. We assumed this would be something that would be quite easy to do, and we could do it in a single attempt. As there are many different sources giving different techniques to set up the Orin it ended up being quite a difficult process. And let’s just say that it did not take a single attempt to do it. However, when the Orin was finally up and running it felt like a major milestone had been reached.

Another great memory was our first data collection day. Up until that point we had mainly focused on coding the software and hadn’t really touched the car much. It was an extremely nice day, it didn’t rain, and we got everything done that we needed to, surprisingly. With only a few hiccups along the way.

We can’t really say this is a memory because it hasn’t happened yet, but we are sure that the competition day on the 14th of June will also be one of the best memories of the year. As we have worked the whole year to be able to compete against the other universities and universities of applied science.

**LESSONS**

The most valuable lesson we have learned is to always start tasks as early as possible. Creating a clear plan with proper task distributions is essential for effective time management and ensuring quality outcomes. Procrastination often leads to unnecessary stress and compromises the quality of work.

For future Honors students, our advice would be to prioritize organization and time management skills. Develop a habit of breaking down tasks into smaller, manageable chunks and allocate sufficient time for each. Additionally, don’t hesitate to seek help or guidance from professors, peers, coaches or academic support whenever needed throughout the project. Collaboration and learning from others can greatly enhance your academic journey and can make you work more efficiently.

Furthermore, we would like to emphasize the importance of balance. While academic excellence and the Honors project are undoubtedly crucial, don’t forget to take care of your mental and physical well-being. Make time for relaxation, hobbies, and social interactions to maintain a healthy lifestyle. There will be a lot of nice activities and workshops organized by both Honors academy and the Confluente where you can also potentially enrich your life. Remember, your overall well-being contributes significantly to your academic success and personal growth.

**MEET THE TEAM**

Shashank Prabhu
• 2nd year Honors student

Sjaak Eck
• 1st year Honors student

Theophile Guillet
• 1st year Honors student

Vojtech Jandl
• 1st year Honors student

Zhiyang Zhang
• 1st year Honors student

Mihai-Dragoș Ungureanu
• coach

Milind Tripathi
• coach

“I didn’t do much.”
As another Honors year comes to an end, we can look back on months filled with personal development, research, cool projects and new friendships. Confluente, being the Honors Study Association, aims to provide opportunities for all Honors students to come together, have fun and develop themselves.

It was great seeing the Honors Room thrive with this vibrant atmosphere. From engaging discussions to exciting events, which ranged from enjoying breakfast together at the Morning activity and gathering knowledge during lunch lectures to solving a murder at the Mystery dinner and picking movies to watch for Movie nights, it was always a pleasure seeing you around! We’ve gotten to know each other at the Intro weekend, danced at the Gala, took a break during the Wellbeing Week, we broadened our horizons at the Networking Event, and we’ll be able to expand it even further during the upcoming Study Trip to Budapest. Alongside our own events, we also battled our neighboring associations in the Battle of the Rooms (where our team came out victorious!) and eagerly anticipate bonding with Honors associations from all over the country in the upcoming Honours weekend.

Of course, all this wouldn’t have been possible without our lovely committees, so we’d like to make a very honorable mention to the Acquisition, Activity, Bar, Committee Battle, Educational, Gala, Intro, Lustrum, PR, Study Trip and Web Committee, not to forget the Advisory Board and Financial Committee, for all the support and liveliness they brought to the association this year. We hope you had as much fun as we did!

Either way, we look back with pride and gratitude on the time we’ve shared and the memories we created together, though we also feel a hint of sadness that our time as board of this wonderful community is coming to an end. However, the nice thing about years is that the end of this year marks the beginning of the next, during which the association will celebrate her second Lustrum! We wish the best of luck to Board 10, and we are excited to see the experiences that the future will bring.

Love,
Board 9 - Beyond Infinity

Kirsten Heinen
Chair

Evy Zandbelt
Secretary & Commissioner of Internal Affairs

Kati Overbeeke
Treasurer

Maki Vrasdonk
Commissioner of External Affairs
INTRO WEEKEND
During the Intro Weekend, the Intro Committee (and volunteers <3) were able to welcome the new Honors students into the community and the association with games, workshops and great weather!

CREATIVE ACTIVITIES
We brought out our creative side, like Mal is doing over here, while painting, claying, building gingerbread houses or crafting paper shoes to put at our own chimney.

MONTHLY DINNER & DRINK
Once every month, we got together for a nice homecooked meal and a drink. In December, we even had a holiday dinner!

GALA
This year’s Gala Committee brought us to higher realms: we dined and danced as deities at this Olympus-themed celebration!

NETWORKING EVENT
In May, we explored our future by networking with companies and students from Delft & Twente at the Networking Event, planned by the Acquisition Committee.

CASINO NIGHT
Organized by the Bar Committee, we tried our luck at the ConfluCasino for one night while enjoying creative mocktails.

HIGH TEA
Each quartile, we could unwind before exams with a nice cup of tea and some bakeries made by our fellow Conflu-members.

MORNING ACTIVITY
Besides the late hours, we also once spent the early hours together: waking up with breakfast and morning exercise at the Morning activity.

GAME NIGHT
For more games, the Activity Committee set up a game night! Vicktor Jeroen (the lifesize teddy bear residing on our couch) also had a great time.

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GAME NIGHT
For more games, the Activity Committee set up a game night! Vicktor Jeroen (the lifesize teddy bear residing on our couch) also had a great time.
RACHEL VAN DE POL

My name is Rachel van de Pol and you often see me at events or receive e-mails from me. I am mainly responsible for the Bachelor Program and the organizational and administrative tasks around it. It gives me a proud feeling to see your dedication, involvement, and creativity in the Honors projects we have seen this year. Congratulations on what you have accomplished this year and have a great summer!

LENNY APON

My name is Lenny Apon and I am the Education Coordinator of the Honors Academy and innovation Space. My tasks focused mainly on coordination, organization, and communication. I aim to create a crossover between the great activities which takes place at the Honors programs and at innovation Space’s vivid community. I am impressed by the great honors projects at the Demo market, and I am happy to see some of you as a (trial) student team at innovation Space. I am sure we will see many of you with great careers as top-researcher, start-up or CEO of one of the organizations of the future.

MARIJKE VAN DEELEN

My name is Marijke van Deelen and I work as a policy officer for the Honors Academy. Together with my colleagues I develop policy and regulations that guarantee and improve the quality of the Honors program. Therefore, I am also in regular contact with Confluente and track coordinators. I love being surrounded by highly motivated people who want to grow personally and professionally, so working together with Honors students and staff is right up my alley! Congratulations to all graduated Honors students! And to those of you who are continuing your Honors program, enjoy your summer and see you in September!

KATHINKA RIJK

As strategic policy officer (honors) education, I think about what the future of Honors Academy should look like, and what TU/e in general can learn from the Honors Programs. And nothing inspires me more than to see the magic that is happening in the Honors Programs. With a mix of ingredients such as talent, motivation, determination, fun, and teamwork, the achievements you can reach are endless. It is so energizing to hear you talk about your amazing work and to see the way you help each other to take that extra step in your personal development and make miracles happen in your projects. Congratulations on all you have achieved, and best of luck with whatever the future brings!
TIFFANY HE

My name is Tiffany He, and I am the second student assistant in the Honors Academy staff, and I help run events, do design tasks, and take photos—perhaps you’ve seen me pointing a camera at you! Outside of the Honors Academy, I’m finishing my thesis for my master’s in architecture. Congratulations to all the Honors students who are graduating, and have a nice summer!

LISA VAN OS

And another Honors year has passed by, almost then! My name is Lisa van Os and I mainly focus on the Honors Master Program with tasks such as organization, administration, and communication. The most appealing element of the Honors Academy is the focus on personal development, and I hope you really enjoyed and learned a lot last academic year. Congratulations to all graduated Honors students! And to those of you who are continuing your Honors program, see you next year again!