Responsible Data Science

Ensuring fairness, accuracy, confidentiality & transparency by design

Your company, hospital, or public agency wants to harness the power of big data to make your operations more efficient. You want deeper insights into what makes your clients tick, or you need a dashboard for real time decision making. This may have societal impacts because of sensitive data, fairness issues, and the need for transparency and trustworthiness. Responsible Data Science anticipates these ethical values as part of the innovation process, creating a sustainable model for data science applications and developing novel techniques that are compliant with fairness, accountability, transparency and confidentiality requirements by design.

Responsible Data Science
DSCE RESEARCH PROGRAM

SCOPE

In responsible innovation, deeply-held ethical values and goals are anticipated, reflected upon, and responded to in an ongoing learning process. Responsible data science incorporates ethical values and goals in order to innovate in ways that are fair, accurate, sustainable, and respectful of individual rights.

OUR DRIVERS

We believe **societal values are an intrinsic part of the value of big data**. Building values into data science "by design" is a challenging and fascinating interdisciplinary field of research with many practical applications.

Creating societal value through data science requires an understanding of context and effective governance of data!
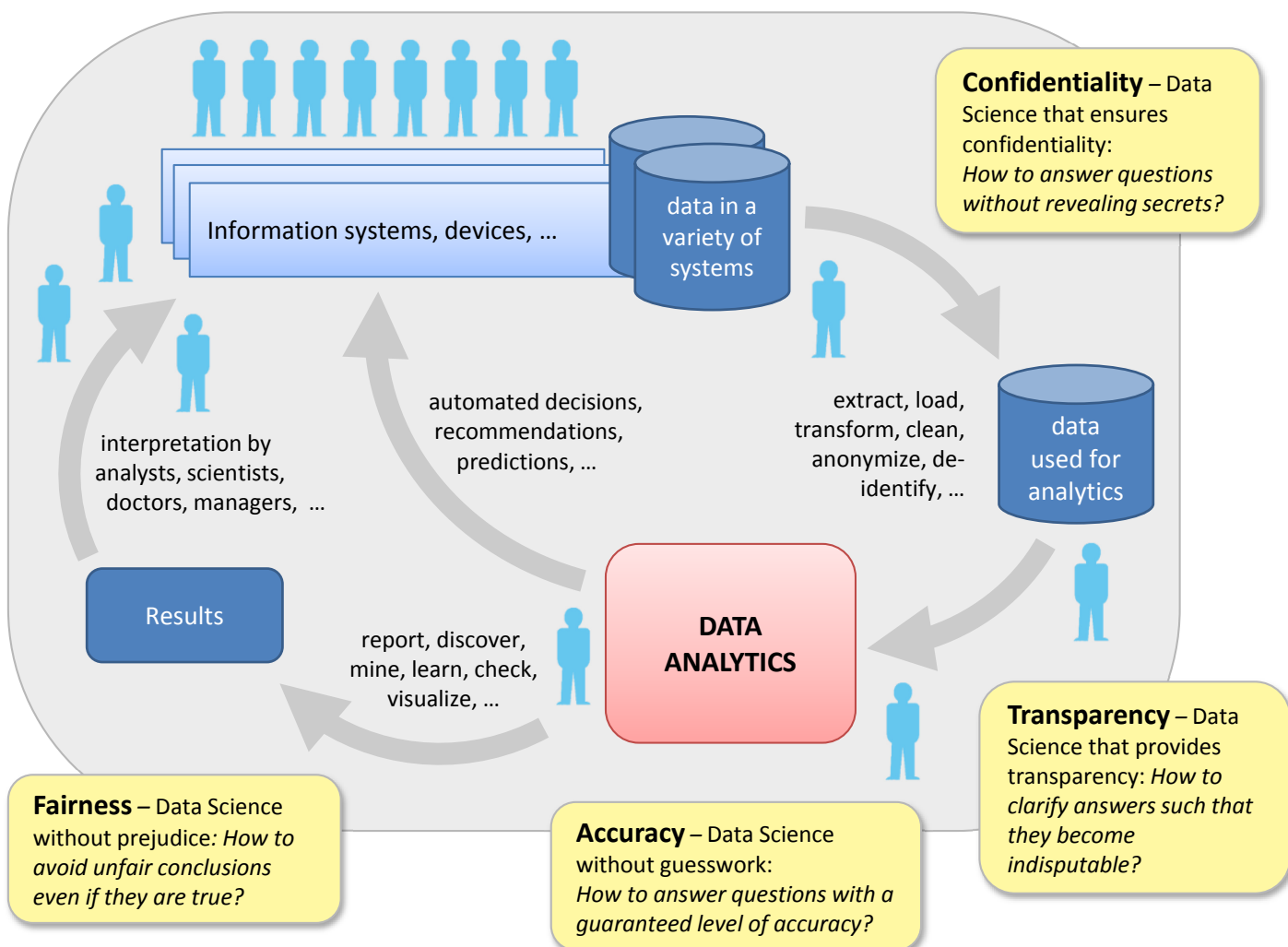
GOVERNANCE

Develop effective governance mechanisms for responsible data science, including appropriate risk assessment in different data contexts. Develop new ethical concepts and approaches for the practice of responsible data science.

Personalized medicine as an example application area

Construct data narratives and visualizations that facilitate communication between machine learning models and medical experts, between patients and healthcare professionals. Translate clinical values such as consent and trust into the context of mobile, data-enabled health care. Develop tools for people to manage their own medical data and gain insight from it while ensuring confidentiality.

RESEARCH CHALLENGES IN A NUTSHELL

Confidentiality – Data Science that ensures confidentiality: *How to answer questions without revealing secrets?*

Information systems, devices, …

data in a variety of systems

automated decisions, recommendations, predictions, …

extract, load, transform, clean, anonymize, de-identify, …

data used for analytics

interpretation by analysts, scientists, doctors, managers, …

Results

report, discover, mine, learn, check, visualize, …

DATA ANALYTICS

Transparency – Data Science that provides transparency: *How to clarify answers such that they become indisputable?*

Fairness – Data Science without prejudice*: How to avoid unfair conclusions even if they are true?*

Accuracy – Data Science without guesswork: *How to answer questions with a guaranteed level of accuracy?*

PROJECT EXAMPLES

Transparent Explanations for Predictive Analytics using Interactive Visualization - TEPAIV (*NWO TOP, 2018-2022*):

TEPAIV aims to contribute to a better understanding and judgment of predictive analytics results for a broad audience.

Bringing together expertise in interactive visualization, machine learning, statistics, and cognitive psychology we study how to simplify complex predictive models for presentation purposes, how to present and interact with all relevant information, and how to evaluate the effectiveness of new methods.

Mobile Support Systems for Behaviour Change

(NWO-MVI, 2017-2021, with Philips Research).
Persuasive health technologies offer significant opportunities for addressing the challenges of chronic illness and an aging society. At the same time, there are fundamental ethical and psychological questions about using data-driven technology to influence behavior. This project develops frameworks for consent, trust, and intrinsic motivation that can be used in mobile support systems for health.

Distributed consent for mobile health
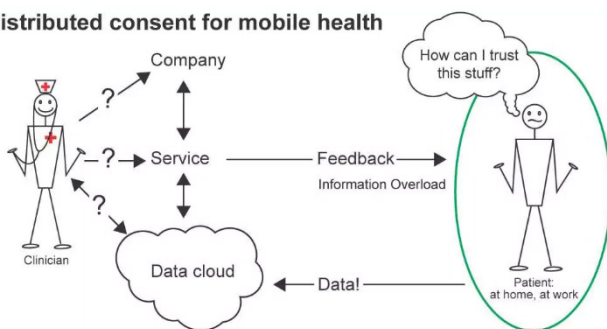
Scalable Oblivious Data Analytics – SODA

(*H2020 Big Data PPP, 2017-2019*). The problem of privacy is prevalent in all sectors world-wide that deal with personal information. SODA brings together theoretical and practical expertise in MPC and data analytics to develop techniques for analyzing encrypted data.


Know Your Customer Predictive Analytics (*with Rabobank, 2017-2020*).

In this project we study how to achieve transparency and compliance of advanced predictive analytics in fraud detection and customer due diligence analysis.

The Artificial Ethicists (*NWO Veni*).

AI of the future could potentially surpass humans in some forms of ethical reasoning. If an AI advised you to modify your most fundamental moral beliefs, is there any context in which you should follow its advice? This project examines the practical and philosophical implications of AI that can reason about ethics.
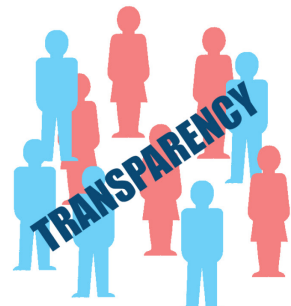
SCIENTIFIC STAFF INVOLVED

Prof. Mykola Pechenizkiy (Scientific leader)
Predictive analytics

Dr. Philip Nickel (Scientific leader)
Trust and trustworthiness, electronic coaching, biomedical ethics

Dr. Wouter Duivesteijn (Program manager)
Data mining, exceptional model mining

Ir. Joost Gabriels (core team)
Project development officer

Prof. Regina Bernhaupt
Human interaction in system design

Dr. Rui Castro
Adaptive sensing and sequential experimentation, high-dimensional statistics, sparse data models

Prof. Boudewijn van Dongen
Process analytics and conformance checking

Dr. Mathias Funk
Adaptive data design in a systems context

Prof. Wijnand IJsselsteijn
E-coaching, digital tools to enhance psychology research, value-sensitive design, UX design

Prof. Jean Bernard Martens
Signal and image processing, psychophysics, visual interaction with complex data

Dr. Sven Nyholm
Ethics of robotics, gamification, moral responsibility, self-tracking

Dr. Elizabeth O'Neill
Moral epistemology, moral psychology, applied ethics, moral enhancement, ethical AI

Dr. Berry Schoenmakers
Secure multiparty computation (MPC), cryptographic protocols, homomorphic encryption

Prof. Jack van Wijk
Information visualization, visual analytics

Dr. Nicola Zannone
Computer security, data protection, access control and auditing

OTHER DSCE RESEARCH PROGRAMS

The research programs provide a meeting place for researchers to get together and have discussions, workshops or research meetings. The goal is to let novel ideas emerge and collaborations between researchers and external parties to be started or strengthened. Existing contacts can easily be shared to further increase collaboration.

CUSTOMER JOURNEY - Prof. Mykola Pechenizkiy
Informed and responsible analytics to understand and improve the customer journey

HEALTH ANALYTICS - Prof. Uzay Kaymak
Improving your health through data analytics

INTERNET OF DATA - Dr. George Exarchakos
Computational intelligence and network science for the Internet of Things

QUANTIFIED SELF - Prof. Aarnout Brombacher
Human Vitality & Technology

SMART MANUFACTURING & MAINTENANCE - Prof. Geert-Jan van Houtum
Exploit the full potential of your data to boost manufacturing and maintenance!

DSCE

**DATA SCIENCE
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