Digital Twin in Healthcare

This learning line is offered for the last time in 2024-2025. In 2025-2026 an opportunity for re-examination and/or alternative courses/projects will be offered. Re-examination is only available for students that failed the course in the year before.

Digital Twin in Healthcare	
Offered by	Department of Biomedical Engineering
Language	English
Primarily interesting for	All students, but most relevant for students with interest in engineering of health, and an appetite for data science. We build interfaculty teams of students, with different skill sets.
Prerequisites	Required course: USE Basic. Recommended course: Data Analytics.
Contact person	Prof. dr. Jan de Boer (j.d.boer@tue.nl)

Content and composition

Course code	Course name	Level classification	Last year course is offered	Course will be replaced by *
8LEU01	Digital Twins in Healthcare 1	1	2024-2025	NONE
8LAU03	Digital Twins in Healthcare 3	3	2024-2025	NONE
	Choose between (please note assumed previous knowledge):			
8QC00	DBL Computational Biology	3	2024-2025	8BE090
2DBM90	Applied Biostatistical Modeling	3	n/a	

Note: 8LSU02 has been replaced by 8QC00 and/or 2DBM90, check Osiris for more information.

Course description

The learning line Digital Twin in Healthcare (DTiH) introduces the concept of digital twins and how they can be used in the healthcare system. Digital twins in healthcare are digital representations of a clinical problem, based on clinical data gathered from patients using computational models. DTiH is a vibrant and pro-active USE learning line in which you will talk to real patients and doctors, engage in a MedTech hackathon, get feedback from entrepreneurs, and produce your own digital twin model of a clinical problem. The content highlights digital twin as a robust platform to transfer technical and humanistic skills. Throughout the learning line you will receive peer-feedback and expert coaching on team-building and personal growth. For more a glimpse into the course vibe, visit our website www.digitaltwininhealthcare.com .

Intended Learning Objectives of the learning line
1. Design a digital twin solution for a medical problem by applying medical and technological knowledge.
2. Integrate patient data into computational models to generate a digital twin as a minimal viable product for a specific medical problem.
3. Integrate stakeholder requirements into a digital twin model and validate it in a medical setting.
4. Achieve personal and team development growth to become a better engineer.
5. Acquire effective communication skills in order to engage DTiH stakeholders.

Summary of this USE LL as a whole

What is the Learning Line about?
In the USE LL Digital Twin for Health, you will work on real clinical problems as an interdisciplinarity team. You talk to doctors, interview patients, collaborate with medical students and pitch your plan for entrepreneurs. The framework of this learning line is the Digital Twin, a digital representation of a human being that can be used by doctors in the future to make medical decisions. During the learning line you will translate part of clinical reality into a Digital Twin.

Why is it special?
This USE learning line brings what technical innovation needs: tightly organized teams of professionals who contribute their knowledge to find solutions to essential problems. We believe that you learn the fastest by making mistakes and learning from them. In addition, you can only do this project as a team. "Agile" and "interdisciplinary" are key words. Students from all departments are invited to join!

What do I learn?
The answer to the question: What is my role as a biomedical technologist / industrial designer / computer scientist in technical innovation and what is the impact of what I do? You will study one medical problem, gain knowledge about the computational models behind it, but you will also analyze the stakeholders: patients, doctors, insurance agents, companies, government. And above all, you get to know yourself, your role in a team and how to set up a well-organized team.

How is it organized?
During the three blocks you will be part of a team of 5 students working on a clinical challenge.
The challenges are:
1. Anterior cruciate ligament reconstruction
2. Diabetes
3. Atrial fibrillation
4. Catheter guided imaging
5. Scoliosis
6. Hernia mat fibrosis

Each challenge has a USE case team: a challenge owner (a TU/e teacher) who will engage a clinical and a company liaison from her/his network in the course, and who is supported by tutors. We will highlight specific aspects of it in each block. Every quartile your technical solution gets better and your team more effective.

What are we going to do?
You will participate in all kinds of activities to achieve the learning goals. We use outdoor team building activities, a med-tech hackathon event, pitching of your minimal viable product (MVP), and discussions. We use Challenge Based Modules to help you find the information you need. Our starting point is action-based learning, or as Maria Montessori said: *"Teach me how to do it myself."*

8LEU01 Digital Twin in Healthcare 1: Conceiving phase
In this course you will learn about the pathophysiology of a disease and how to effectively frame a research question and hypothesis. It is our educational methodology to introduce stakeholder requirements early in the design and creation of an in-silico solution to the health problem. You will be required to deliver a minimal viable product (MVP) which will represent the digital twin solution. Finally, the MVP will be pitched to an expert panel.

8QC00 DBL Computational Biology research projects related to Computational Biology addressing systems biology and analysis of clinical data.
2DBM90 Applied Biostatistical Modeling course on commonly used methods and their underlying principles for biostatistical analysis of data obtained from experiments and clinical trials.

8LU03 Digital Twins in Healthcare 3: Implementation and operation phase
In this course you will be challenged to apply your digital twin in a controlled clinical case with relevant patient and disease information, and evaluate its performance from the technical, societal, and ethical perspectives. This exploration will involve systematic attention to the attitudes and perspectives of various stakeholders, including alignments and tensions in value judgements within and across different stakeholder groups. With the results of this evaluation, you will develop a roadmap for the clinical implementation of your digital twin solution.

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Please note that this brochure only contains descriptions and transition information about the learning line. In the course catalogue you find information about scheduling and type of education and examination.