Health analytics is transforming health services owing to the advent of digitization and new information collection systems (e.g. patient portals, IoT, cloud computing, big data, and wearables), so that health innovation is driven by analyzing, processing and acting on health data.
Health Analytics
DSCE RESEARCH PROGRAM

SCOPE

Information technology, IoT, cloud computing, big data and data analytics have a large impact on the health services. While advances in medical knowledge result in better diagnosis and more and better treatment solutions, patient-centricity, self-care, integrated care delivery and shared decision making are appearing as new trends. The way health services are delivered is being revolutionized by sharing and integrating large volumes of health data. Health analytics is the key element of this revolution, allowing to merge, analyze and process all health related data to gain more actionable insight, understanding and knowledge at individual and population level. This provides the basis for modern innovation and value addition in evidence-based medicine.

We have 3 main focus themes:

- **Decision support for better health**
  Data analysis, computerized modeling, clinical decision support, personalized models

- **Visual health analytics**
  Visualization, visual analytics, medical image analysis, decision support based on image analysis

- **Healthcare process and environment innovation**
  Process mining, environmental factors, organizational aspects, privacy

VISION

In the future, the availability of large volumes of health data is an important asset for health organizations. Data, controlled by the citizens, are collected ubiquitously throughout the care continuum, connected seamlessly and interpreted within the right context. Data are used to improve health solutions and to advance medical knowledge, leading to better outcomes while increasing efficiency. For instance, data are continuously used to analyze and improve workflows and medical guidelines, thereby providing stronger evidence for best practice solutions. For this purpose, health analytics enables personalized care delivery throughout the care continuum. Using personalized health records citizens are empowered to control their own health better, such that the collected data is of service to the individuals and to the society at large.

RESEARCH CHALLENGES

**Data handling**

a) **Collect and integrate health data (at the broad scale)**
   How can we collect, integrate and harmonize data to create consistent models across organizations, regions and nations, taking into account semantic interoperability aspects?

b) **Collect and examine health data to examine the interaction between the environment and persons**
   Environment has a large influence on peoples’ health. How can we use environment data (e.g. indoor and outdoor climate data) to improve health solutions?

c) **Techniques and algorithms for federated or distributed data analysis**
   Can we run all data analysis methods fast and accurate in a federate way, when data can not be pooled in one location?

**Personal healthcare**

d) **Develop data-driven decision-support models**
   How can data-driven and consistent multi-scale decision-support models be developed to support both individuals and health professionals in the whole care continuum?

e) **Develop data analytics solutions to optimize and personalize care workflows**
   Can we analyze the effectiveness of clinical protocols and clinical pathways to suggest individualized treatment paths?

f) **Personalized decision support models**
   How can we create data driven models that allow personalization of recommendations and treatments?

**Models**

g) **Developing and improving techniques for process analytics in healthcare**
   How can we improve process modeling under different sources of personalized heterogeneity and how do we estimate the influences of the risk factors?

h) **Integrate data analytics into continuous medical improvements for value based healthcare**
   How to facilitate the deployment of the models in practice? Can those models continuously learn and adapt to increase their prediction quality?
PROJECT EXAMPLES

BrainBridge program
Philips, TU/e and Zhejiang University
Clinical Pathway Analysis - Develop tools to analyze and study the performance of clinical pathways and clinical workflows.
Cardiovascular Risk Assessment - Develop an intelligent system for long-term cardiovascular risk assessment and prediction.

Creating healthy environments in hospitals
Meander Medical Centre Amersfoort and Jeroen Bosch Hospital
Collecting and analyzing indoor climate data to understand the interaction between the environment and staff’s performance and patients’ safety.

Philips Data Science for health flagship
Philips, Catharina hospital, TU/e
Continuous personal health - Develop data-driven, predictive solutions for the whole care continuum.
Optimizing Healthcare Workflows stream - develop process analytics techniques and interactive visualizations to analyze and improve process performance.

Creating healthy lighting environments in offices
Signify, Deloitte
Collecting and analyzing light data to understand the interaction between light and staff performance while taken in consideration energy savings

Clinical workflow
NWO
Diffusion MRI tractography with uncertainty propagation for the neurosurgical workflow

Gamebus
EIT Digital, MMC and MUMC+
Secure yet engaging platform to stimulate physical, cognitive and social healthy behavior across communities and generations of people.

GOAL
ZonMW, Selfcare, UU, Municipalities Utrecht & Eindhoven
The project "Gamification for overweight prevention and Active Lifestyle" will deliver guidelines to design health campaigns based on empirical research. The focus is on the promotion of an active lifestyle for vulnerable groups.

DiaGame
NWO Data2Person
The DiaGame project applies the sciences of data learning and biomedical simulations to an existing serious diabetes gaming platform (SugarVita). We aim to make the current SugarVita a data-driven, personalized serious game (SugarVita-P4) that empowers individuals with diabetes to manage the disease they are facing.

DMCoach+
EIT Digital, Engineering, IMEC
The novel mHealth App, DMCoach+ will provide tailored management and coaching on Type Two Diabetes Mellitus (T2DM) for sedentary workers who are at high risk or already diagnosed. The App will provide ad-hoc monitoring facilities and gamified social interactions which guide users to healthier lifestyles in an effective and enjoyable way. The project will also improve the privacy and security aspects of the underlying GameBus platform.
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

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

QUANTIFIED SELF - Prof. Aarnout Brombacher
Human Vitality & Technology

RESPONSIBLE DATA SCIENCE - Prof. Mykola Pechenizkiy & Dr. Philip Nickel
Ensuring fairness, accuracy, confidentiality & transparency by design

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

For more information contact us at:
www.tue.nl/ds or dsce@tue.nl

MetaForum 5.096
Groene Loper 5
5612 AZ Eindhoven
+31 (0)40 247 4233