

Designing and Building a Citizen-Centered Digital Health Platform

In this Masters project, we will be exploring mechanisms for data acquisition, analysis, visualization and feedback for human-centered digital health interventions. Through the application of machine learning and human-centered design we will create frameworks, processes around a digital health platform and explore two use-case scenarios in population-based health research.

Chronic Non Communicable Diseases (NCDs), such as cardiovascular disease, obesity and diabetes present a significant and growing health risk world-wide across social, cultural and political boundaries. In this course, we will be examining data from two diverse demographic domains and cultural backgrounds: Northern Europe and Rural South Africa. Each demographic has unique conditions and challenges for digital health. Utilizing health data from over 500,000 participants from the UK Bio Bank data base, we will perform statistical modeling, visualization, and user interactions for participant empowerment and engagement to improve health care outcomes.

We will work with a diverse data set which includes health histories, and genotyping, as well as brain, heart, abdomen and bone scans. In the UK, health related issues due to an aging population, NCDs present the health system with unique challenges. In rural KwaZulu-Natal, South Africa, a region that besides rapidly increasing numbers of incidences of NCDs, suffers from a high burden of HIV and Tuberculosis. We believe that in this region, with an expanding young population and limited access to local clinics and doctors, digital technologies have a great potential to improve health.

We will use machine learning to identify health risk factors, to cluster individuals into risk subgroups, and to model health risk trajectories over time. We aim at visualizing the results and trajectories in a way that an individual can identify and understand their own data and health risks. A mobile app will be designed to enable interactions between health workers and study participants and give customized advice to individuals on how they can improve their health and reduce health risks.

The benefits of this study for digital health will include:

- creating digital solutions and appropriate visualizations to report analysis results back to study participants, to raise awareness of their health risks and to empower individuals to improve their own health.
- design mechanisms and technical solutions to interact with study participants and collect information in subsequent interventional digital health studies conducted by researchers across the globe.
- creating digital tools to set up and manage large-scale digital health studies
- contributing to improving health care in the 21st Century

In this project-based course, students will get a hands-on introduction to digital health design. Students will gain fundamental knowledge of and applied experience

with machine learning, data science, software engineering and human centered design in the context of digital engineering. While this course focuses on the foundations of digital health, students will develop tools and expertise that can be applied to all aspects of data science and digital engineering.

Designing and Building a Citizen-Centered Digital Health Platform will be taught by Professor Christoph Lippert, Chair of Machine Learning at the Digital Health Center, and Dr Jonathan Edelman, Visiting Professor of the School of Design Thinking.

Christoph Lippert and his team are working on Machine Learning and Artificial Intelligence algorithms and novel applications in medicine. The group is developing models to detect disease patterns in images and molecular data and statistical models for the quantitative analysis of large Digital Health studies. Jana Fehr who is a PhD student in this group will assist supervising this student-project.

Jonathan Edelman leads the Research to Impact (R2I) research group at the Hasso Plattner Institute. Focusing on enabling innovation in product-service-system design, R2I's mission is to translate cutting edge theory and research in human-centered design and design engineering and make it accessible and actionable for digital engineers and designers.