HPI Digital Health Center
Chair Personalized Medicine
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Personalized decision support interventions to promote behavior change for people with low back pain

Background

Millions of people with chronic low back pain, the most common health-related problem world-wide, are prescribed exercise programs and advised to remain physically active in order to reduce pain and increase functioning and quality of life. However, there is a great discrepancy in the type of exercise, e.g. stretching, yoga, or muscle focus, and the mode of delivery, e.g. individual physiotherapy, or group exercises, and treatment outcomes are frequently disappointing. With the rise of Digital Health, a new approach emerged to address physical as well as psycho-social factors contributing to back pain: Digital therapeutic interventions.

In this context, digital therapeutic measures encompass online exercise programs and online educational material. These interventions are provided to the user fully digital, and thus allow for a scalable and cost-effective way for people to self-manage their back pain. However, it remains a great challenge for participants to adhere to the full length of the digital treatment program and consequently change their behavior to sustain a healthy lifestyle.

Nowadays, machine learning based recommender systems are broadly implemented and provide personalized suggestions and decision support in different domains, e.g. recommendation for songs on Spotify or movies on Netflix. In healthcare, these recommender systems are gaining attention to promote healthy behaviors, especially towards enhanced physical activity or cessation of smoking. In this master project, we will explore a new domain: Using recommender systems to support people to adhere to digital therapeutic programs.
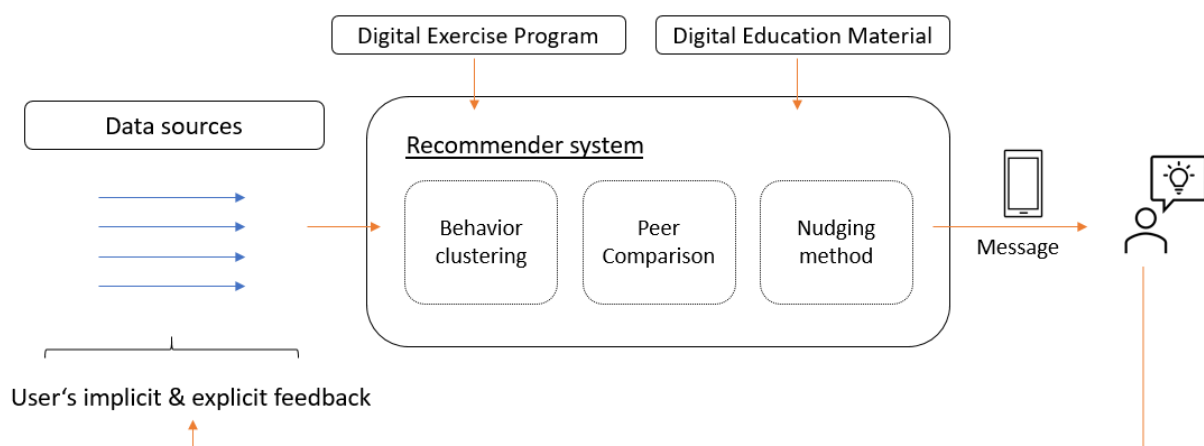

Figure 1: Schematic representation of the master project

Project Goals

In this master project, we will develop a recommender and decision support system, which can be embedded into existing apps and will be tested in a small pilot study. By also drawing insights from behavioral economics theory, we will explore how we can nudge people to change their routine and adhere to guidelines when suffering chronic low back pain.

Moreover, we will address several challenges that arise throughout the development of such recommender system. For instance, as we might not have enough information about the preferences of a person in the beginning, how do we deal with the so-called cold-start problem? Or, as the project proceeds, how do we deal with people who do not react to the intervention messages, so-called non-responders? And how do we address temporal non-responders, who do not adhere to the program because of other environmental factors which again might be a challenge to our learning system? Therefore, the goal of this master project is also to consider already available solutions in scientific literature and find an appropriate way to overcome these problems in this project.

Description

In the main work package, we will develop a tailored recommender system, which considers personalized preferences to promote healthy behavior. In the supporting work package 2, we will build integrations into an existing app. Finally, in the supporting work package 3, we will design, plan, and perform a small pilot-study in which we exploit the recommender system and evaluate performance indicators.

Work packages:

(1) Development of the recommender system
   a) Identify a suitable recommender system methodology and architecture
   b) Elaborate the scope of data (implicit and explicit feedback) to be used, and how new feedback data can be captured, e.g. in-app survey on current pain levels
   c) Integrate digital therapeutic interventions to the recommender system
   d) Develop expedient intervention messages
      i) Explore different behavioral economics principles
      ii) Explore different types of recommender system – user interactions: pop-up text messages, display of information, visualization with figures
   e) Identify evaluation parameters to assess performance. Metrics can be technical (precision, recall, F-score) or non-technical (live pain free)

(2) Integration to an existing app
   a) Conduct user-story mapping for the recommender system
   b) Identify and map interfaces for integration
   c) Develop API endpoints on the recommender module
   d) Run tests and evaluation on the APIs

(3) Use case: Digital therapeutics interventions for people with low back back pain
   a) Design, plan, and perform a pilot-study
   b) Identify a suitable methodology and procedure to test this personalized health intervention.

What you should bring with you

1. App development skills (front end and/or back end)

2. Machine learning skills (preferably knowledge about recommender systems)

3. Interest in learning about study designs and the implementation of such intervention

4. Interest in behavioral economics principles to promote behavior change

Have a look at some references to get more impressions about this master project:

References

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Contact

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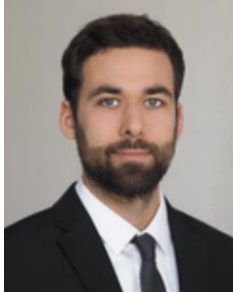
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