

Clinical decision tool for proctology: A data science/AI project

Background

Proctos Kliniek is a medical center that specializes in disorders of the anus and rectum (proctology) in both men and women. Surgeons, nurses, physiotherapists, dermatologists, gastroenterologists and psychologists work together here to help patients.

To make the first consultation with surgeons more targeted, all patients complete a questionnaire (up to 200 questions) about their symptoms before the consultation. After the consultation, the surgeon structurally scores the diagnosis. Data from several thousands of patients have now been collected in this way.

Due to the measures related to the coronavirus, it was difficult for patients to go to the general practitioner or hospital with anal complaints. As a result, they continued untreated, while complaints could possibly be solved in a simple manner. To help these people, a self-diagnosis tool was developed and made available on analeklachten.online. The simple tool is based on a decision tree and asks a maximum of 6 questions. The decision rules behind this tool are expert-based and were developed by surgeons of Proctos Kliniek. About 2000 patients per month now use this tool. All questions in the tool also appear in the much more extensive questionnaire for the first consultation with a surgeon.

The accuracy of the online tool is unknown. The availability of the extensive questionnaire and associated diagnoses (provided by the surgeon) gives us the opportunity to test the tool and, hopefully, improve it using AI approaches.

Project overview/possible endpoints

Development of a tool that can be used by (potential) patients on the website to self-diagnose. This may include providing predictions for certain diseases, including the (un)certainities in the predictions.

Development of a tool that can be used by doctors to obtain data-driven predictions as an aid for their diagnostic process; developing methods to present these prediction model outputs in a way that is optimal for the doctors' use (e.g., how to visualize the outputs).

The research involves the following parts:

- getting familiar with the topic and the project (including the current online decision tool)
- obtaining an overview of the available data; formulating objectives and research questions (for instance: are certain prediction errors more problematic than others? Can we define a loss function for this?)
- preprocessing the data (defining target outputs; dealing with missing values; standardization)
- validating the current decision tool by making an offline implementation of the decision tree in R or python and running it on the dataset. Comparing the predictions with the gold standard (true output labels) and calculating relevant performance measures
- investigating erroneous predictions:
Identification: who are the patients that get wrong predictions (and why?)
Improvement possibilities (better models, better or more data)

Depending on the background of the student and the available time, advanced AI models can be developed to improve accuracy, reliability, and/or explainability. Other options include the investigation of how predictions and how they are made can be best presented to doctor (and patient).

Good understanding of the Dutch language is recommended.

The project will be supervised by H. Schnack, assistant professor Artificial Intelligence University of Utrecht and Thony Ruys, surgeon Proctos Kliniek.