

Machine Learning-based Online System for Diagnosing of Cerebral Ischemia

Bachelor Thesis Proposal; in collaboration with Sahlgrenska University Hospital

Mirosław Staron

the date of receipt and acceptance should be inserted later

Abstract Cerebral ischemia is a condition that is often associated with a stroke. Its diagnosis is often based on symptoms and/or invasive procedures. In our project, we use non-invasive data collection from clinical studies to determine if a patient develops cerebral ischemia. We use machine learning algorithms to recognize clinical events with high accuracy. In this thesis project, the students are expected to design, develop and evaluate software for collecting data from provided sensors and during runtime to recognize whether a patient develops the condition.

Keywords First keyword · Second keyword · More

1 Background

Cerebral ischemia, commonly known as stroke, is a clinical condition where time plays a crucial role – quick diagnoses and clinical treatments can determine the outcome for the patient's life. Therefore, designing and developing a system for detecting the cerebral ischemia can have a large impact on patients and on the clinical procedures.

So far, we have established an off-line data analysis pipeline, which can detect ischemia with very good accuracy (over 90% [2], [3]). However, the system which is in operation today is based on manual extraction and labelling of the data.

Therefore, in this project we provide the possibility for one bachelor student group to contribute to the development and create a system that will connect to the clinical equipment at runtime and make the classification of different conditions while they actually happen.

Mirosław Staron
Software Engineering
E-mail: mirosław.staron@gu.se

2 Project description

The goal of the project is to develop a prototype software tool that:

- connect to the OR equipment, specifically the Moberg Monitor (see [2] and extract the data using the Internet protocol (basically sockets),
- develop a program in C, C++, Rust or Julia to classify each minute of the OR (operating room) procedure based on the extracted data and the models developed previously, and
- create an online component (e.g. using Shiny or just an interactive web app) that can communicate the results to the specialists in the OR.

The general challenges in this project are both technical (e.g., extracting the data at runtime from the Moberg Monitor), scientific (e.g., which ML algorithm to use, given the technical and clinical constraints) and societal (e.g., which kind of decision to communicate and in which way).

This project is done both at the university and at Sahlgrenska university hospital. The proposed process is as follows:

1. Use data generated by the Moberg monitor in a binary format (the description of the format is provided) and extract it to a database (or even just a .csv file). This should be done by creating a new adapted/extractor in C, C++, Rust or Julia.
2. (Re-)train the algorithms used in our previous work on the new data from Step 1. This should be done in one of the languages above.
3. Create an online view component that visualizes the data for the clinicians. This can be done in the language/technology/platform of choice.
4. Evaluated this approach in a real clinical setting.

3 Suggested reading material

- Article about the entire study set-up [1].
- Articles about the predictions [2], [3].
- Film about the results: <https://www.youtube.com/watch?v=edmPy0-mSzw>

4 Target group

This thesis is for students from the D, DV, IT and BE programs, who are eager to program and to contribute to something more than a technology.

5 Special prerequisites

We require knowledge about a fast imperative language, like C, C++, Rust or Julia. Basic skills are enough, they can be developed during the project.

References

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