Inferring Human Attention from Physiological Signals

Project description

Modern user interfaces or applications could benefit from knowing the users’ state of attention in different kind of situations. This would, for instance, enable the implementation of an intelligent interface, which by continuously monitoring users, could determine favorable moments for message deliverance or phone call acceptance. Research found out that heart rate variability is a solid predictor for human attention. In this project, we hope to build a fine-grained model of human attention by using the heart rate sensor and possibly other sensors of smartwatches. The general idea is to build a machine learning pipeline that is able to discriminate users’ states of attention. One challenging aspect of this project is that machine learning algorithms may require large number of labelled samples. In the context of models targeting end-users and their subjective perception (the state of attention), labelling enough samples for all possible scenarios can be annoying and tedious for users. Hence, we would like to employ the active learning concept, which based on the uncertainty of a model polls the user for unknown states. The goal is to build a system that requires only few probes in order to learn a personalized model of user attention. In this thesis, students should implement a smartwatch app, which is capable of recording relevant sensor data and ask users for their state of attention (for labeling). The student should investigate the performance of different ML / Active Learning algorithms and implement the best working model as a software development kit (SDK) for smartwatches.

Keywords

Active Learning, Experience Sampling, smartwatches, Android

Context

The goal of this project is to implement an Active Learning solution, which is able to predict users’ state of attention based on smartwatch sensor data.

Work packages

- Literature survey on existing State-of-Art Active Learning algorithms
- Implement an Android App which collects physiological data from a smartwatch and polls user’s attention level
- Explore the collected data, build models
- Implement smartwatch application with best performing model
- Analyze results and write up the thesis

Required skills

- Solid knowledge of Machine Learning
- Highly motivated and independent

Type

SA/MA

Time period

Autumn 2016

Internal supervisors

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Figure 1: Gaussian Processes for Active Learning [LINK], Moto360 smartwatch