MIDAS Tutorial at the Symbiotic 2015 Workshop

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http://www.ttl.fi/bwrc
https://github.com/bwrc/midas

Abstract

The goal of the MIDAS tutorial is to provide a hands-on session in which participants are introduced to online analysis of psychophysiological signals. The tutorial is primarily focused on practical exercises in which the participants create online signal analysis systems and connect these to example applications. The tutorial chairs will guide the participants in the process. After this tutorial the participant has a good working knowledge of how to start implementing online analysis systems of psychophysiological signals using the open source MIDAS framework.

Background

In recent years, it has become both simple and affordable to record psychophysiological signals using wearable devices. Psychophysiological sensors can also often be found embedded in mobile consumer devices. Psychophysiology has also become a commonplace phenomenon through the Quantified Self movement in which people make recordings of, e.g., different physiological parameters in order to discover trends and for instance make positive lifestyle improvements.

In addition to allowing self-monitoring, psychophysiological signals have a huge potential of being used to augment human-computer interaction (HCI). For instance, it could be beneficial to automatically determine the level of mental workload of an operator in a safety-critical profession and adjust the amount of information in a control room to suit the operator's current physiological state. Recognition of states of information overload can be useful also in ordinary HCI.

Although the recording of psychophysiological signals is easy, it is still not a straightforward process to extract features online from the biosignals and utilise these features to augment, e.g., a user interface. Challenges include interfacing with devices, varying data formats and making results accessible to end-user applications.

Goals of the Tutorial

In this tutorial we present how the open source MIDAS framework developed at the Finnish Institute of Occupational Health can be used to analyse psychophysiological signals online and easily integrate derived features into various applications.

The goal of this tutorial is to provide a hands-on session in which participants are introduced to online analysis of psychophysiology. The tutorial is primarily focused on practical work in which the participants will create online signal analysis systems and tie these to example applications. The workshop chairs guide the participants in the process.

After this workshop the participant has a good working knowledge of how to start implementing online analysis systems of psychophysiological signals using the MIDAS framework.

The MIDAS framework is available from https://github.com/bwrc/midas

Prerequisites and Required Materials

1. The programming tasks in the workshop will be in Python, so a good working knowledge of Python is recommended.
2. An understanding of signal processing basics is helpful.
3. Each participant must bring their own computer. We provide a bootable live Linux USB drive with all required software. The live Linux image is based on Debian (https://www.debian.org/). The participant should make sure that their computer is capable of booting and running a 64-bit x86 operating system from a USB drive.

Programme

The tutorial last about 2.5 hours and consists of two parts.

1. The tutorial starts with an overview (1 hour) in which the participants are introduced to the architecture of the MIDAS framework and how it can be used for online signal analysis

2. In the second part of the tutorial (1.5 hours) the participants are free to engage in prepared exercises or explore MIDAS on their own. We will provide ready exercises that implement complete MIDAS systems, such as, e.g., calculation of average heart rate from ECG, etc. We will also have some devices for real-time measuring and streaming of biosignals (e.g., ECG, EOG, EEG). In addition to real physiological signals we will also provide simulated signals for experimenting and testing.