Source documentation

PythonFilterSpike

In this Python project we started to develop our initial ideas for the EEG project. We explored the possibilities of python, the MNE library and communication protocols. This section will give a brief overview of the test applications that were made, the findings we did and references to the corresponding python files. The heading names in this document correspond to the package and filenames in the project repository.

The project was developed in Eclipse using the PyDev plugin. As interpreter, we used the Python27 folder that can be found in the tools directory on the project repository. Libraries include:

- NumPy
- SciPy
- matplotlib
- MNE
- h5py
- python-osc
- pyOSC

OSCData (in spikes)

Three files correspond to one user story of performing simulated playback of two recorded EEG files.

OSCDataSimulator reads two hdf5 EEG files and sends this data over UDP to a port on the local host. An important aspect of this script was the timing accuracy of the simulated playback. Timing accuracy is realised by storing the start time of playback and sending data samples by refering back to this starting time. In the case that data playback starts lagging for a short period of time, the lag will be compensated by sending more data in the short period after that, such that the total number of processed data samples since the start of playback will be correct. Data of four EEG channels for two headsets is send through OSC to the local host on port 8000.

OSCDataProcessor reads the data from the serial port and plots a part of this data to using MatPlotLib. Two data channels (channel 0 and 2) are taken from the two EEG headset's data streams.

OSCDataMain runs these two files on separate processes. OSC stands for Open Sound Control, which is a data protocol for sending data over UDP.

These classes have been made for two distinct libraries: PyOSC and python-OSC. Their functionality is basically the same, but the underlying python classes are different for Python 2 and Python 3. PyOSC works under Python 2.7 and python-OSC worls under Python 3.4.

Data

This package only holds the EEG data provided by Baltan Labs. It also creates a list of paired HDF5 data filenames. The member ‘filenames’ is a 13x2 list containing all the filenames, converted to full filepaths.

Input

This package includes all the modules that can be used as input for the data for the signal processing framework. Up until now this only includes an hdfreader. This hdfreader can read an HDF5 EEG file, parse it and return it as a list that can be used by the MNE signal processing functions.

The method returns six types of data that are recorded by the EEG headset. Additionally to this data, the method returns the sample frequency for each of these data types, such that the data can be played back at the correct speed.

Output

The spikes package includes all the programs, bits and pieces of code that were used to investigate certain functionalities, libraries, methods, algorithms, GUI's and other things that had to be investigated. Some of these will be useful as examples in the future, some of these are messy and useless.

Spikes

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Bandpassfilterspike

This script is an investigation in how EEG data can be filtered using the MNE library and plotted using matplotlib. It is also an early investigation in how valence and arousal can be extracted from this data using methods from the papers mentioned below.

The bandpassfilter method from MNE seems to work fine and is good for visualization. However, the method for calculating tha band activation is not correct! It should be done using some form of Fourier Transform and averaging the activation of multiple bands. Also, the smoothing filter is horrible. Do not even think of reusing it.

http://www.nime.org/proceedings/2014/nime2014_418.pdf

http://www.sahajayogaportal.org/papers/NEUROSCI.PDF

http://cmr.soc.plymouth.ac.uk/publications/184-Kirke.pdf

http://psycserv.mcmaster.ca/ljt/schmidt_trainor_2001.pdf