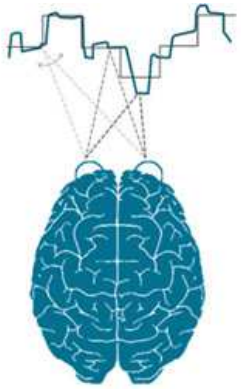
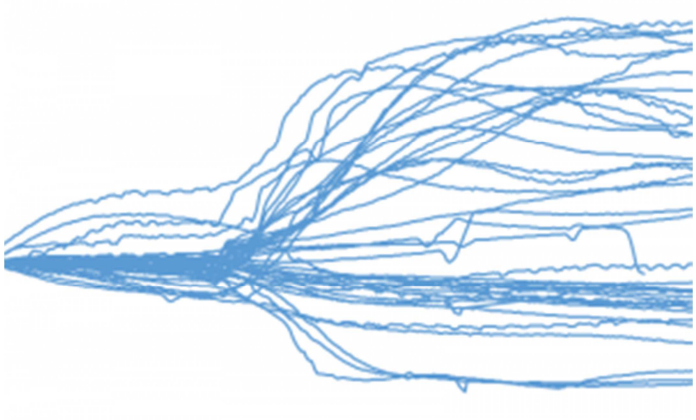
Time Series Analysis of Human Eye Movement Data

Advisor: Prof. Themis Palpanas (Paris Descartes University), Dr. Zoi Kapoula (Paris Descartes University)
themis@mi.parisdescartes.fr ***zoi.kapoula@egp.aphp.fr***

We will use time series management and analysis techniques in order to study a series of eye movement data recorded with an eye tracker (Eye See Cam) from healthy humans, and humans with various visual motor dysfunctions. A first set of data is available, and concerns data from 30 subjects, among whom 10 experience visual stress and weakness of some of their eye movements (vergence insufficiency syndrom). These subjects are rehabilitated with a novel technology invented by Z. Kapoula (see http://fondation.parisdescartes.fr/regard-et-motricite-binoculaire/).





The advantage of the time series analysis techniques [1,2,3] is that they can efficiently operate on the original, fully detailed data, taking into account the trends that these data exhibit. Therefore, we can use similarity search to identify data that follow similar trends over time and subsequently group those together in clusters, or detect abnormal behaviors.

The time series analysis will be applied to assess the differences between healthy subjects and subjects with dysfunctions, and also study the changes due to rehabilitation. The student will have the opportunity to familiarize herself/himself with eye tracking devices and physiologic aspects of eye movement control in addition to time series analysis.

Accepting this project will make you part of a stimulating, multi-disciplinary, and enthusiastic team working on real, challenging problems!

Prerequisites: computer science background, and a very good knowledge of a programming language.

References

[1] Alessandro Camerra, Jin Shieh, Themis Palpanas, Thanawin Rakthanmanon, Eamonn Keogh. Beyond One Billion Time Series: Indexing and Mining Very Large Time Series Collections with iSAX2+. KAIS 39(1), 2014.
[2] Kostas Zoumpatianos, Stratos Idreos, Themis Palpanas. Indexing for Interactive Exploration of Big Data Series. SIGMOD 2014.
[3] Kostas Zoumpatianos, Stratos Idreos, Themis Palpanas. RINSE: Interactive Data Series Exploration with ADS+. VLDB 2015. http://daslab.seas.harvard.edu/rinse/