Abstract

This lecture focuses on customizable software for gaze analytics, starting with digital filters for velocity-based event detection. Calibration error computation will be reviewed along with correction via minimization of least-squares. Time permitting, advanced metrics will be covered, including basic approaches to scanpath comparison, including sequence-based and heatmap-based statistics, followed by advanced metrics such as transition matrix entropy and ambient-focal fixation dynamics via computation of the K-coefficient. Metrics will be showcased in the context of various eye-tracking applications, e.g., panoramic scene viewing, packaging evaluation, reception of subtitles, and viewing of text and pictures. Data produced by the custom software will then be available for further evaluation via inferential statistics, including ANOVA, Linear Mixed Models, etc.

Attendees will download and use a suite of Python scripts to process raw gaze point data to yield fixations, as filtered by a combination of the Butterworth and Savitzky-Golay filters. Python code will be dissected to highlight filter settings that attendees will iteratively change to examine their effects on visualizations produced by the Python code.

Attendees require no specific background other than a general knowledge of programming principles, basic code constructs, e.g., if-then-else, looping, etc. Knowledge of Python is NOT required although some experience would be preferred.

The lecture will introduce the following topics:

- Data pre-processing (Python scripting).
- File parsing with Python (e.g., .csv files, XML, etc.).
- Basic filtering (convolution) with the Butterworth and Savitzky-Golay filters.
- Filter fine-tuning (setting sampling rates, thresholds, etc.).
- Ambient/focal K coefficient computation.
- Basic visualizations (scanpaths, heatmaps) with Python's `matplotlib`.
- Brief introduction to R and Transition Matrix construction (time permitting).

The lecture ties in to the remaining Winter School lectures by focusing on processing raw eye movement data from a hands-on eye tracking session producing performance and process metrics suitable for subsequent statistical analysis.

Hands-on Session

In the hands-on session, students will work with PsychoPy software that implements the ISO9241-9 testing protocol for non-keyboard input devices. An eye tracker is used as the testing apparatus. The software implements a typical Fitts' law target selection task, modified to receive input from the eye tracker. This lecture focuses on data collection, organization, and preliminary analysis, prior to subsequent statistical analysis.