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Topology for gaze analyses

Oliver Hein
Universität Hamburg, Germany
oliver.hein.home@web.de

The talk sets out how the application of topological arguments can improve the evaluation of eye-tracking data. The task of separating raw, noisy eye tracking data into distinct events (i.e., fixations, saccades, smooth pursuits, and post-saccadic oscillations) on the basis of a single, simple as well as intuitive argument, described as coherence of spacetime, is discussed, and the hierarchical ordering of the data shown. The method, namely identification by topological characteristics (ITop), is parameter-free and requires no pre-processing and post-processing of the raw data whatsoever. The general and robust topological argument is easy to implement and to expand into complex settings of higher visual tasks, making it a powerful tool by which to identify visual strategies.

End-to-end eye-movement event detection using deep neural networks

Raimondas Zemblys[1], Diederick C Niehorster[2], Kenneth Holmqvist[3]
Research Institute, Siauliai University, Lithuania;
Humanities Lab & Department of Psychology Lund University, Lund, Sweden;
UPSET, North-West University (Vaal Triangle Campus), South Africa
r.zemblys@tf.su.lt

Existing event detection algorithms for eye-movement data almost exclusively rely on thresholding one or more hand-crafted signal features, each computed from the stream of raw gaze data. Moreover, this thresholding is usually left for the end user. Zemblys et al (2017) present an event detector based on Random Forests, where they show how to train a computationally inexpensive classifier to produce oculomotor events, without the need for a user to set any parameters. This approach outperformed conventional event detection algorithms, approaching the accuracy of expert human coders. However, Random Forests and other traditional machine learning algorithms still need a collection of hand-crafted data descriptors and signal processing features. In this paper, we take one step further and use an end-to-end deep learning approach to classify raw gaze data into fixations, saccades and PSOs. Our method challenges an established tacit assumption that hand-crafted features are necessary in the design of event detection algorithms. Using manually or algorithmically coded examples, we train a LSTM neural network that produces meaningful eye-movement event classification from raw eye-movement data without any need for pre- and post-processing steps. Its accuracy is also at the level of expert human coders.