Microsaccade detection using pupil and corneal reflection signals

Niehorster, Diederick C; Nyström, Marcus

DOI:
10.16910/jemr.11.5

2018

Document Version:
Publisher's PDF, also known as Version of record

POSTER SESSION: Eye-tracking methodology

Microsaccade detection using pupil and corneal reflection signals

Diederick C. Niehorster[1,2] & Marcus Nyström[1]

[1] *Humanities Lab, Lund University, Sweden*
[2] *Department of Psychology, Lund University, Sweden*

In contemporary research, microsaccade detection is typically performed using the calibrated gaze-velocity signal acquired from a video-based eye tracker. To generate this signal, the pupil and corneal reflection (CR) signals are subtracted from each other, a calibration mapping is applied, and a differentiation filter is applied, each of which may prevent small microsaccades from being detected due to signal distortion and noise amplification introduced by these processing steps. We propose a new algorithm where microsaccades are detected directly from uncalibrated pupil and CR signals. It is based on detrending the pupil and CR signals, followed by windowed crosscorrelation of these detrended signals. When tested on 1000 Hz binocular data acquired with an EyeLink 1000 Plus, the proposed algorithm outperforms the most commonly used algorithm in the field (Engbert & Kliegl, 2003), in particular for small amplitude microsaccades that are difficult to see in the velocity signal even with the naked eye. We argue that it is advantageous to consider the most basic output of the eye tracker (i.e., pupil and CR signals), and introduce as little processing as possible when detecting small microsaccades.

References

- Engbert, R., & Kliegl, R. (2003). Microsaccades uncover the orientation of covert attention. *Vision Research*, 43(9), 1035-1045.