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## Time-frequency analysis of spontaneous fluctuation of the pupil size of the human eye

*Wioletta Nowak, Andrzej Hachol, Henryk Kasprzak*

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### Keywords

spontaneous pupillary fluctuation, spectral analysis, time-frequency representation, signal nature

### Abstract

The aim of this work has been to develop a new method of variability description for the spontaneous pupillary fluctuation (SPF) signal, based on the time-frequency analysis. In the work we have studied the variability of the SPF signal spectrum. Based on the KPSS (Kwiatkowski, Philips, Schmidt, Shin) test, it has been shown that the SPF signal is non-stationary. A method of SPF signal variability analysis has been proposed using the STFT in the time-frequency domain, and then quantitative variability measures have been introduced to the obtained spectrograms. The application of fast pupillometry for recording the SPF allowed to expand the analyzed frequency band to 20 Hz. The proposed method of analysis and introduced measures of SPF variability enable the detection and quantitative description of short-lasting time-frequency and time-amplitude variations that remain obscured by the overall spectral analysis. SPF signal analysis methods and exemplary results obtained with the methods are presented in the paper.



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