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# TITLE: A comparison of the epileptic discharges driven BOLD response functions in EEG-fMRI data

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## ABSTRACT (upto 300 words)

Introduction: Using the EEG-fMRI (electroencephalography-functional magnetic resonance imaging) method one can conclude about the hemodynamics of the brain during epileptic discharges. Methods: Patient with generalized epilepsy underwent an EEG-fMRI scanning session. EEG-fMRI data was processed and Matlab scripts were prepared, which enabled the preparation of GLM model regressors based on the recorded EEG signal. They were derived from the Global Mean Field Amplitude (GMF) signal and the Peak and Root Mean Square (EnvPeak, EnvRMS) envelopes. Additionally, a hemodynamic response model was selected when creating the regressor: canonical and Balloon model describing the dynamics of CBV and deoxy-hemoglobin. Eight General Linear Model (GLM) regressors were prepared including 2 based on manually selected events (SPMReg) with each possible regressor / response model combination. Then, a statistical analysis was performed in SPM12 and statistical values were determined, such as number of activation clusters, maximum cluster size, maximum value of the T statistic and the maximum value of the T statistic in the selected region of interest (ROI) - thalamus.
Results: Using the SPMReg regressor resulted in receiving large activation clusters. Comparing the hemodynamic model of the canonical and the balloon, one can notice a greater number of obtained activation clusters for the latter. The maximum whole brain T value was noted at chosen ROI (thalamus) for the GMF, EnvPeak, EnvRMS regressors for the canonical hemodynamic response and the GMF for the balloon response. The highest value of the T statistic was found for SPMReg (Balloon).
Conclusions: The analysis of the EEG-fMRI data shows that the use of different regressors and hemodynamic models may bring differing results. This indicates that the type of regressor and hemodynamic response model used can significantly affect the results of the analysis.

## BIOGRAPHY (upto 200 words)

Nikodem Hryniewicz (MScEng.) is a PhD student at Nalecz Institute of Biocybernetics and Biomedical Engineering PAS. In his research work, he focuses mainly on simultaneous EEG-fMRI measurements, functional connectivity analysis and hemodynamic response modelling.
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