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A movement and tremor identification algorithm for evaluations during deep brain stimulation

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Abstract: Deep brain stimulation is widely used to alleviate symptoms of movement disorders. During intraoperative stimulation the influence of active or passive movements on the neuronal activity is often evaluated but the evaluation remains mostly subjective. The objective of this paper is to investigate the potential of a previously developed Weighted-frequency Fourier Linear combiner and Kalman filter-based algorithm to identify tremor types and to isolate the tremorous part. The method is applied to ten intraoperatively acquired accelerometer recordings from eight patients from which 186 phases were manually annotated into: rest, postural and kinetic phase without tremor, and rest, postural and kinetic phase with tremor. The overall accuracy for tremorous phases only is 89.1% and 76.3% when also non-tremorous phases are considered. Two main misclassification cases are identified and further discussed. The results demonstrate the potential of the developed algorithm for the use as an online tremorous movement classifier based on the acquired digital biomarkers.

Keywords: Tremor estimation, Deep Brain Stimulation, Microelectrode Recording, Weighted-frequency Fourier Linear combiner, digital biomarker.

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