# Reconstructing single finger trajectories from intracranial brain activity

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In Brain-Computer Interfacing (BCI), brain activity is recorded and translated into actions intended by the user. Recent developments capitalize on the relation between motor actions and localized activity of motor- and somatosensory regions of the brain. The ability to control a robotic hand or regain control over a paralyzed hand with a motor-BCI has promoted the latter as a solution for patients devoid of voluntary hand control. Electrocorticography (ECoG), an intracranial recording technique, offers new perspectives for such challenging applications as it avoids scarring or other histological processes and combines high spatio-temporal resolution and broad bandwidth with long-term recording stability. What is still lacking is the accurate control of individual fingers, crucial to provide the targeted patient group with a true sense of dexterity. To address this issue, we propose a multiway regression model, called Block-Term Tensor Regression (BTTR), to better account for the multilinear structure of ECoG signals than conventional vector- or matrix-based techniques. BTTR adopts a deflation-based approach sequentially decomposing data into a series of blocks. As the parameters are determined in a fully automatic manner, the model offers increased flexibility and interpretability. We used BTTR to predict thumb, index and little finger movements (flexions/extensions) from ECoG activity recorded over a subject's sensorimotor cortex. BTTR was trained on joint ECoG/finger movement recordings, the latter obtained with a data glove. BTTR was shown to predict the trajectories of the 3 mentioned fingers with an accuracy of 0.37, 0.87, and 0.78 (Pearson correlation), respectively.

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