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Maximum-likelihood Inference of Multi-Finger Movements Using Neural Activities

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Abstract : It remains unknown whether M1 neurons encode multi-finger movements independently or as a certain neural network of single finger movements although multi-finger movements are physically a combination of single finger movements. We present an evidence of correlation between single and multi-finger movements and also attempt a challenging task of semi-blind decoding of neural data with minimum training of the neural decoder. Data were collected from 115 task-related neurons in M1 of a trained rhesus monkey performing flexion and extension of each finger and the wrist (12 single and 6 two-finger-movements). By exploiting correlation of temporal firing pattern between movements, we found that correlation coefficient for physically related movements pairs is greater than others; neurons tuned to single finger movements increased their firing rate when multi-finger commands were instructed. According to this knowledge, neural semi-blind decoding is done by choosing the greatest and the second greatest likelihood for canonical candidates. We achieved a decoding accuracy about 60% for multiple finger movement without corresponding training data set. this results suggest that only with the neural activities on single finger movements can be exploited to control dexterous multi-fingered neuroprosthetics.

Keywords : finger movement, neural activity, blind decoding, M1
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