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Poster title: Convolutional neural network feature extraction dramatically improves brain-machine interface control for tetraplegic participants

Abstract: To infer user intent, clinical neural prosthetic systems must extract features that accurately estimate neural activity. However, the degradation of signal quality over time impedes the ability of modern feature engineering techniques to recover real-time functional information for high-performance decoding. Here, we present FENet (Feature Extraction Network), a convolutional neural network mapping electrical signals to neural features. FENet jointly optimizes feature extraction and decoding under the constraint that each electrode must use the same parameters during training and validation. We validate FENet using neural data recorded from electrode arrays implanted in the cortices of three human participants. We compare decoding performance using features extracted by FENet against two current gold standards: 1) the rate of threshold crossings and 2) wavelet decomposition of the broadband neural data. FENet dramatically improved closed-loop cursor control on all metrics, including a threefold improvement in bitrate. Further, FENet improved offline performance in all three patients by at least 50% in all tested metrics. We also demonstrate that the trained FENet can be used for new datasets, brain areas, and participants without modification.