Mapping the spatio-temporal dynamics of vision in the human brain

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Recognition of objects and scenes is a fundamental function of the human brain, necessitating a complex neural machinery that transforms low level visual information into semantic content. Despite significant advances in characterizing the locus and function of key visual areas, integrating the temporal and spatial dynamics of this processing stream has posed a decades-long challenge to human neuroscience. In this talk I will describe a brain mapping approach to combine magnetoencephalography (MEG), functional MRI (fMRI) measurements, and convolutional neural networks (CNN) by representational similarity analysis to yield a spatially and temporally integrated characterization of neuronal representations when observers perceive visual events. The approach is well suited to characterize the duration and sequencing of perceptual and cognitive tasks, and to place new constraints on the computational architecture of cognition. In collaboration with: D. Pantazis, R.M Cichy, A. Torralba, S.M. Khaligh-Razavi, C. Mullin, Y. Mohsenzadeh, B.Zhou, A. Khosla

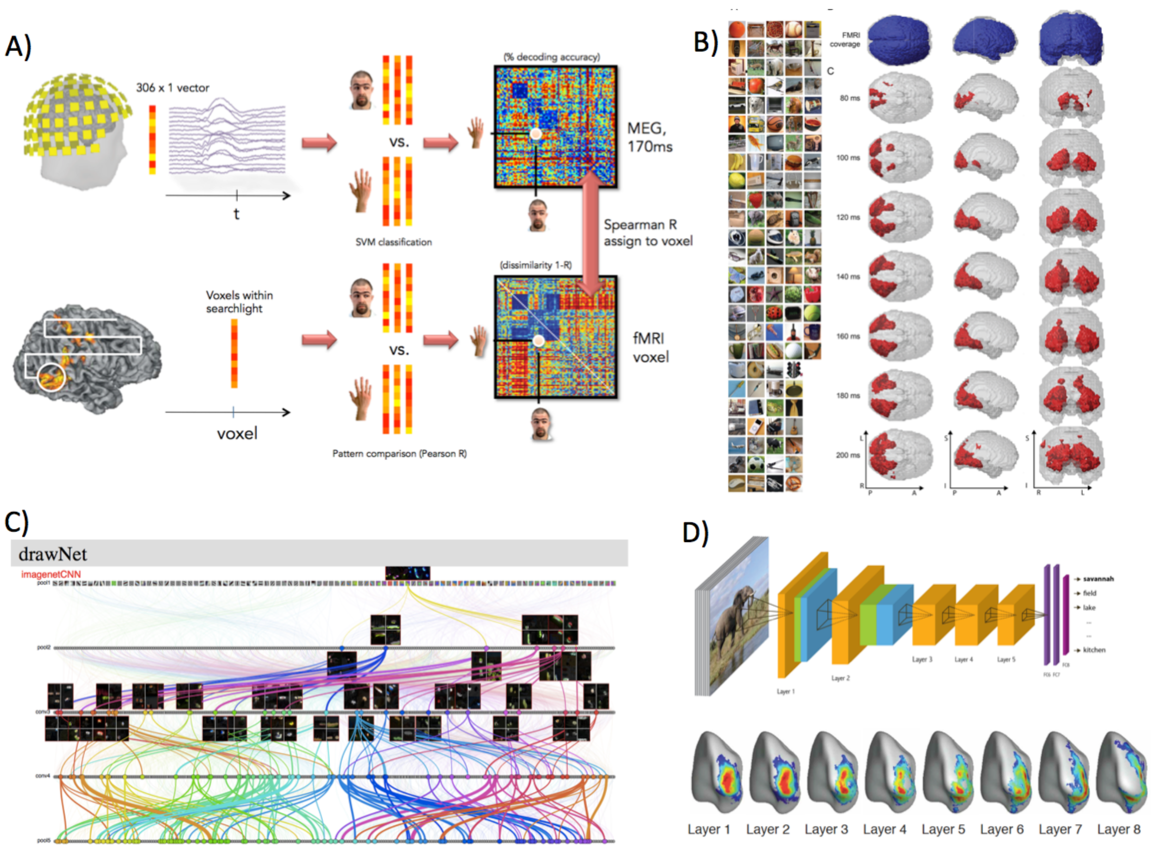

Figure 1: A) Illustration of the similarity-based fusion method of MEG and fMRI data; B) Spatio-temporal maps of visual image representation generated from A); C) Illustration of the types of features learned from Convolutional Neural Networks (CNN) trained to recognize objects and scenes; D) Maps of correlation between human cortical regions and CNN model representations. Adapted from Cichy, Pantazis, Oliva (2016, Cerebral Cortex) and Cichy, Khosla, Pantazis, Torralba, Oliva (2016 Scientific Reports).