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Mapping sensory, cross-modal, and cognitive representations in the human brain

Our daily experiences are realized by sensory signal processing followed by diverse cognitive functions in the brain. Mapping these perceptual and cognitive functions in the cortex has been one of the important topics in functional neuroimaging studies. However, relatively little has been known about how these diverse functions might be combined or co-represented. Given that many of our natural experiences (e.g., talking, commuting, and studying) involve complex orchestrations of multiple sensory and cognitive processes (e.g., vision, language, memory, and decisions), it is essential to comprehensively understand how such functions are mapped and how some of them might be jointly represented. Toward such a goal, we have built quantitative voxel-wise encoding and decoding models of brain activity evoked by diverse perceptual and cognitive experiences. Such studies have revealed latent representational spaces of cognitive functions and their fine-scale cortical mapping. In this talk, I will introduce some of our recent modeling studies, including the convergence of cross-modal linguistic functions, multidimensional mappings of diverse emotions, and a comprehensive representation of more than 100 cognitive functions in the human brain. I will also discuss how such studies will further be applied and generalized toward understanding more naturalistic experiences.