Standard Cortical Observer

Project description

The broad goal is to develop software and computational methods to predict fMRI responses across visual cortex to arbitrary images. Toward this end, we plan to implement and organize existing core knowledge about functional imaging of human visual cortex, and build on the existing knowledge where applicable. Currently, the project involves combining two types of models: a voxel-wise population receptive field (pRF) model that predicts BOLD responses given an image, and a cortical template that assigns retinotopic coordinates to positions on the cortex based on anatomy. For our Standard Cortical Observer 0.1, we are using an updated version of Noah Benson's V1-V3 anatomical template (Benson et al, 2014), and Kendrick Kay's two-stage cascade pRF model (Kay et al, 2013, PLoS CB). For version 0.1, what he have added is a mapping between visual field coordinates derived from the template and the voxel-wise pRF parameters. Going forward, we will extend the voxel-wise model to be multi-scale rather than limited to a single spatial frequency band, and we will develop software infrastructure to facilitate model development and model comparison, and to house a database of stimuli, fMRI responses, and anatomical MRI.

Flow Charts

**SCO Use case 1**: input images and anatomical data, output predicted fMRI responses

**SCO Use case 2**: same as use case 1, except that functional MRI data also provided in order to quantify model accuracy

Mapping between template parameters and voxel-wise pRF parameters

Template parameters:

- Visual Field Map (categorical variable corresponding to V1, V2, or V3)
- Visual field coordinates (eccentricity, polar angle)

Voxel-wise pRF parameters correspond to selectivity for position (x,y), spatial extent, second-order contrast, and so on