

Project Zeta Progress Report

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Background

The Paper

- ▶ 'Distributed and Overlapping Representations of Faces and Objects in VEntral Temporal Cortex'
- ▶ from OpenFMRI.org
- ▶ ds105

The Data

- ▶ 6 subjects
- ▶ 12 runs per subject
- ▶ 8 conditions per run: faces, houses, cats, scissors, bottles, chairs, scrambledpix, shoes

The Method

- ▶ Linear regression (Lasso/Ridge/Elastic Net)
- ▶ T-tests
- ▶ Convolution
- ▶ Smoothing

Initial work

Our Hypothesis

- ▶ The differences of BOLD signals between different conditions are significant

Exploratory Data Analysis

- ▶ Downloaded data
- ▶ Initial analysis: Sub001 Run001
- ▶ Identified and removed outliers (with functions from HW2)
- ▶ Attempted to test our hypothesis
- ▶ Convolution and prediction of BOLD signals
- ▶ Created design matrix for linear regression

Identify outliers

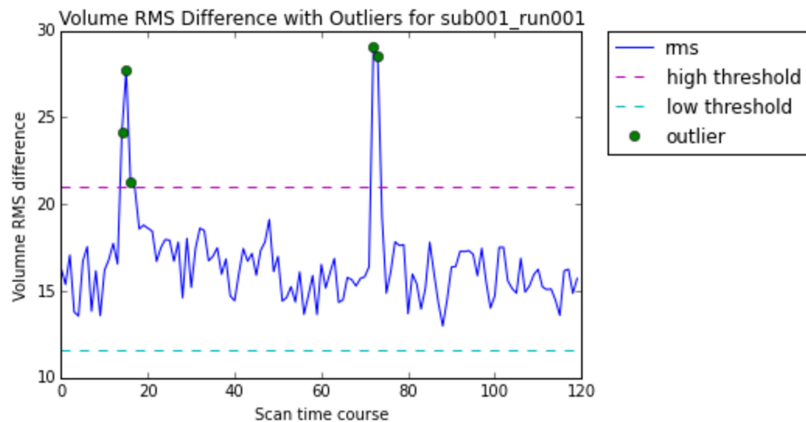


Figure 1: Outliers in sub001 run001

Task time course - Event related design

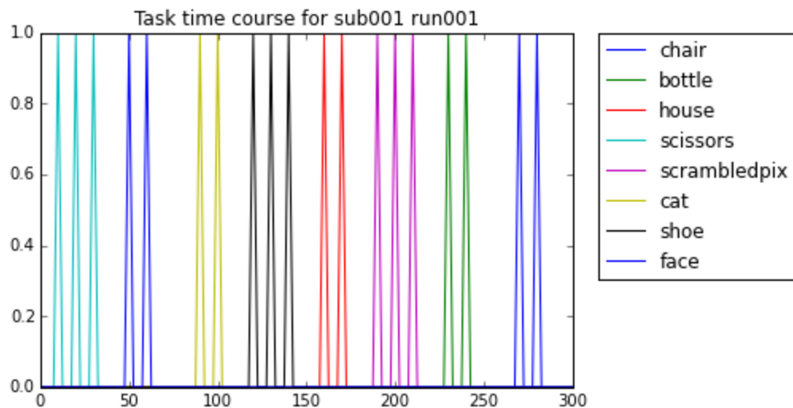


Figure 2: Task time course

Convolution Graphs

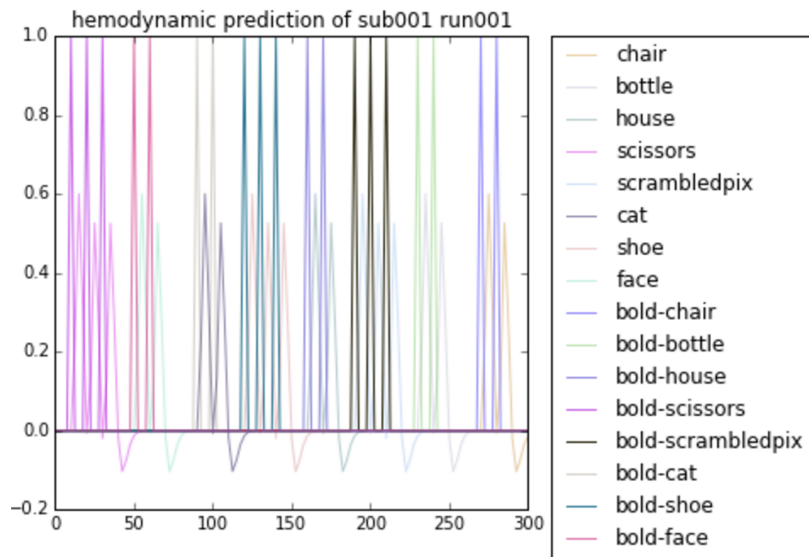
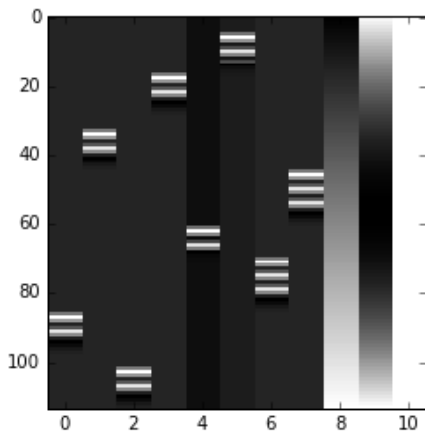


Figure 3: Predicted BOLD

Design Matrix

- ▶ bottle, cat, chair, face, house, scissors, scrambledpix, shoe, drift1, drift2, ones

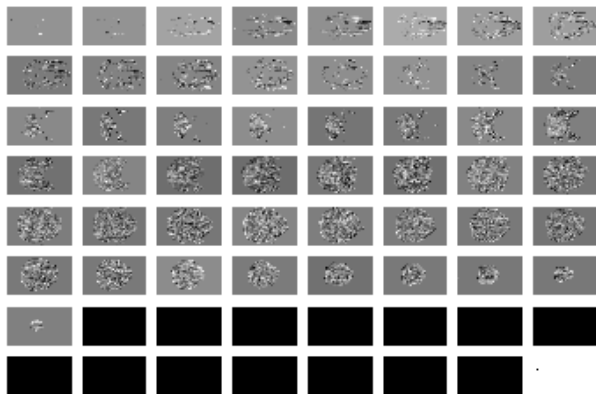


Problems Faced

- ▶ Noise within original dataset, causing low-resolution brain images
- ▶ Drifting of BOLD signals
- ▶ Standardization of BOLD signals across different subjects for comparison
- ▶ Difficulty understanding the study and the dataset itself
- ▶ Hence only did analysis on one subject and one run so far

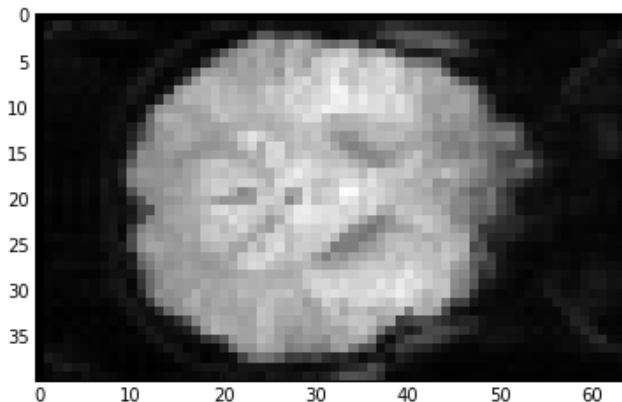
Before And After Smoothing

- Background noise is high:



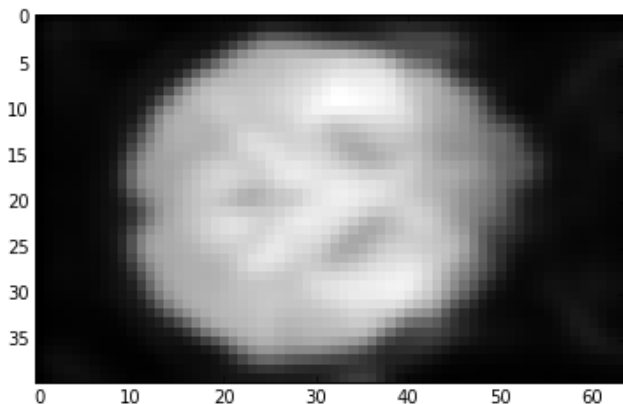
Before And After Smoothing

- Before Smoothing:



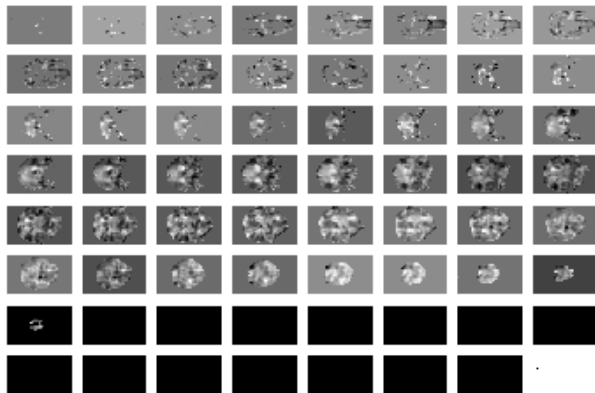
Before And After Smoothing

- Used smoothing techniques to create clearer and more meaningful images



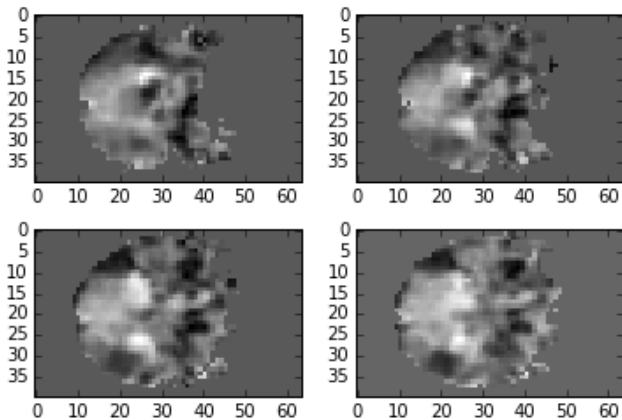
Before And After Smoothing

- We can identify brain region specific for stimulation



Before And After Smoothing

► Detail:



Next steps

Preprocessing On The Rest of The Data/ Validation

- ▶ Removing outliers
- ▶ Smoothing on remaining subjects
- ▶ PCA
- ▶ Cross Validation on MSE/Classification Rate

Statistical Analysis

- ▶ Linear model
- ▶ ANOVA/Kruskal-Wallis Test
- ▶ Time series analysis of BOLD signals
- ▶ Investigating the normality assumption of BOLD signals

Potential Analysis

- ▶ Random Forests
- ▶ Boosting