



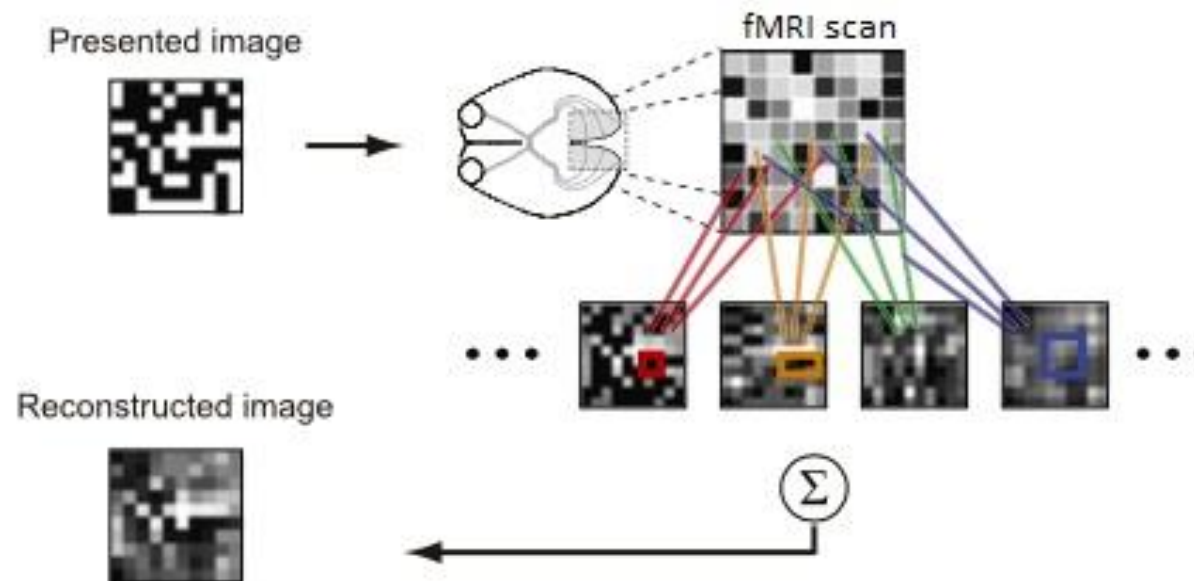
Generalized Reconstruction of Visual Stimuli from fMRI Data

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Project Task

- ▶ Given a 6046-voxel fMRI scan, can we reconstruct 10x10 visual stimulus?
- ▶ Model as classification problem



Methods

- ▶ Least-norm classifier (baseline)
- ▶ SVM with various kernels
- ▶ Neural network with sigmoid activation function
- ▶ Error defined by MSE
 - ▶ Least-norm achieved test MSE of 0.4928

$$MSE = \frac{1}{|I|} \sum_{i \in I} \|\hat{i} - i\|$$

Preliminary Results: SVM

- ▶ For each one of the 100 pixels in the stimulus image, an SVM was trained using all of the fMRI data associated with that image (6046 voxels) to predict whether the voxel would be 0 or 1
- ▶ A variety of kernels were used. Regularization had almost no effect on the training MSE and test MSE

Method	Training MSE	Test MSE
Linear SVM	0	0.4305
Quadratic SVM	0.1906	0.4931
Polynomial SVM	0.4927	0.5273
RBF SVM	0	0.5120
MLP SVM	0.5002	0.2750

Preliminary Results: Neural Network

- ▶ Use of neural network to predict a single pixel in the image, due to time constraints
- ▶ Trained under different conditions, tested using 780 test images/fMRI scans

	Neural Net 1	Neural Net 2	Neural Net 3
Num. hidden layer	1	1	1
Num. hidden nodes	4	4	3
Num. examples trained	5	50	100
Accuracy	34.44%	99.72%	88.89%

Current Work

- ▶ Training a neural network for a single pixel prediction takes at least 1.5 hours, so training all 100 neural networks will take some time
- ▶ Experiment with different neural network hyperparameters for best results
- ▶ Think about refining data with feature extraction techniques
- ▶ We will be able to present reconstructed images in the project paper