The Sparse Overlapping Sets Lasso for Multitask Learning and fMRI analysis

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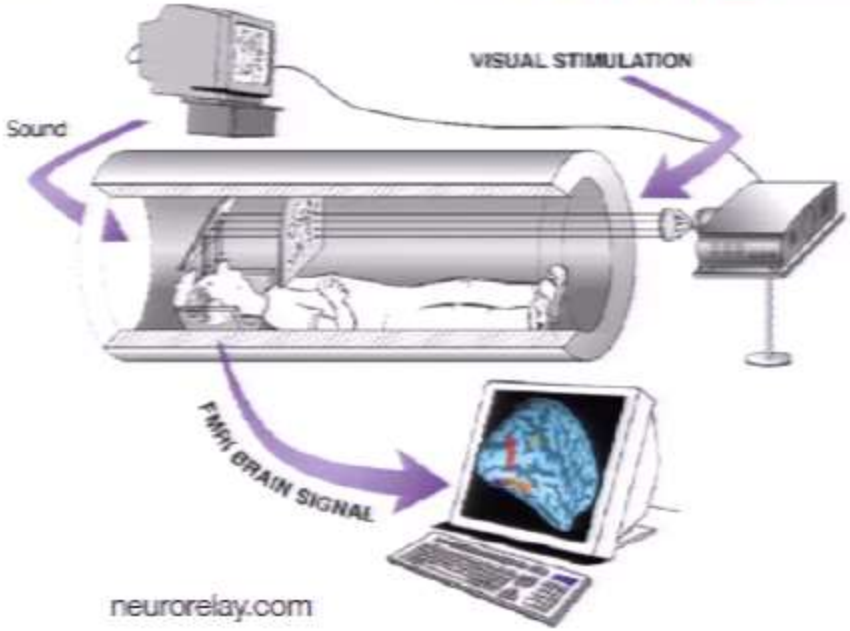
POSTER: SAT46

Can Brains be Crowdsourced?



Q1: What regions of the brain process visual and auditory stimuli ?

Q2: Are these regions distributed?

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.

If multiple people participate, can look to leverage data from all subjects to perform better inference

Typically, data is blurred and mapped to a common brain atlas, losing fine-level information, which may be useful [1]

[1] James V Haxby, M Ida Gobbini, Maura L Furey, Alumit Ishai, Jennifer L Schouten, and Pietro Pietrini. Distributed and overlapping representations of faces and objects in ventral temporal cortex. Science, 293(5539):2425–2430, 2001

The Challenge

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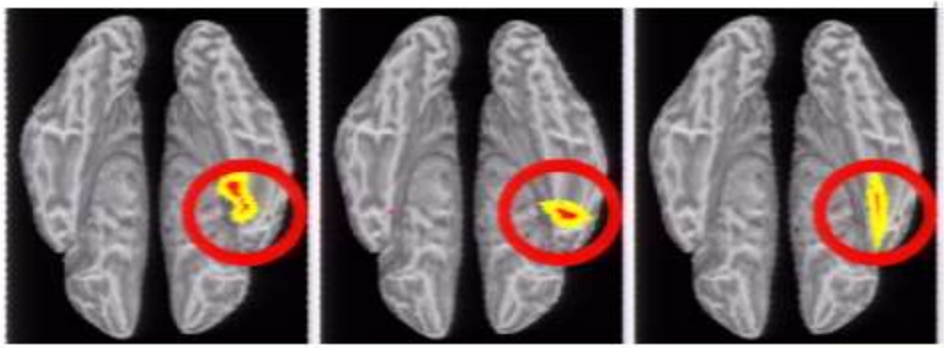
GOAL:

Identify significant voxels in the brain without trying to match brains, while taking advantage of data from multiple subjects



Brains of individuals are similar at a coarse level, and different at fine levels

$X_1, \ X_2, \cdots$ **Data**

$Y_1, \ Y_2, \cdots$ **Responses**

$$\text{minimize}_{\ w_1, w_2, \ldots} \ \{\sum_i f(Y_i, X_i, w_i)\}$$

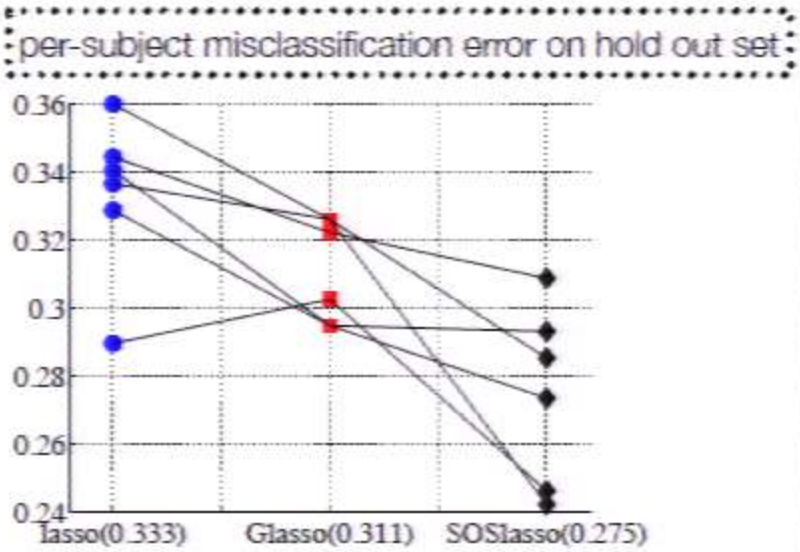
w's account for the structure in the data

Can we model the data in a way that allows us to formulate optimization problems that takes into account both the similarities and differences between subjects?

At a glance: Sparse Overlapping Sets Lasso

We formulate the problem as a regularized multitask learning problem that:

1. Accounts for the coarse level similarities
2. Accounts for the fine level dissimilarities
3. Can be solved efficiently
4. Allows us to derive consistency results



Our results specialize to known cases [2,3,4] under certain parameter settings

We obtain results that are comparable to
other high dimensional inference procedures

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[2] Negahban, S., et al. "A unified framework for high-dimensional analysis of M-estimators with decomposable regularizers." *Statistical Science* 27.4 (2012): 538-557.

[3] Sprechmann, P., et al. "Collaborative hierarchical sparse modeling." *Information Sciences and Systems (CISS), 2010 44th Annual Conference on*. IEEE, 2010.

[4] Jacob, L., et al. "Group lasso with overlap and graph lasso." *Proceedings of the 26th Annual International Conference on Machine Learning*. ACM, 2009.