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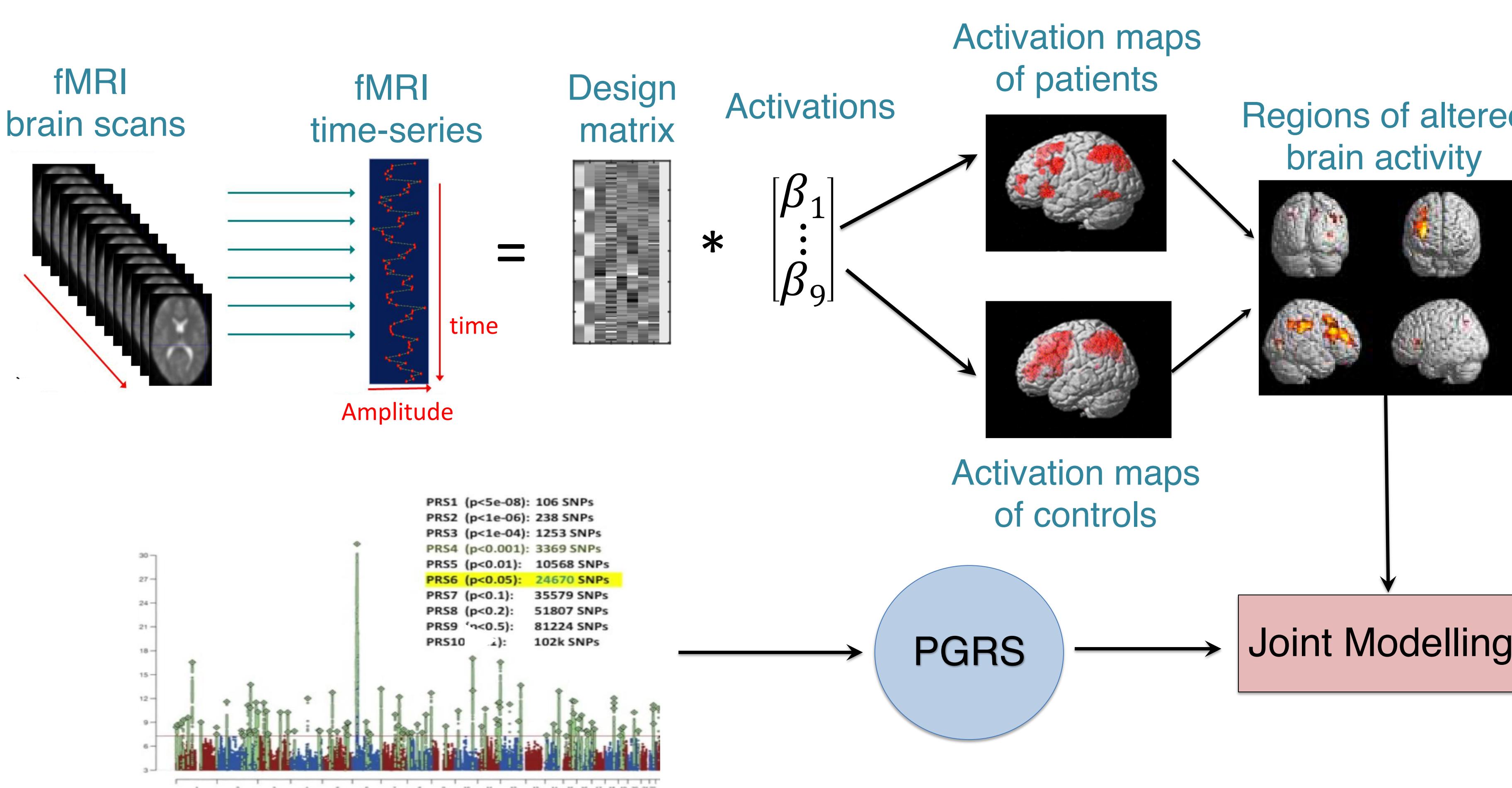
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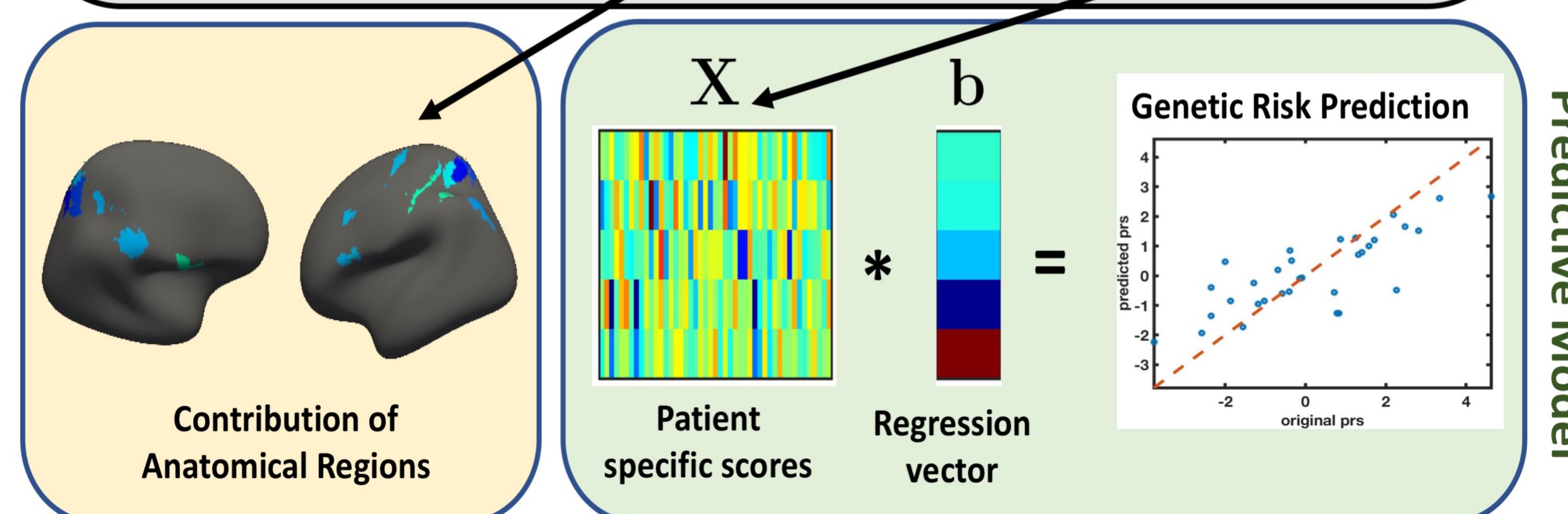
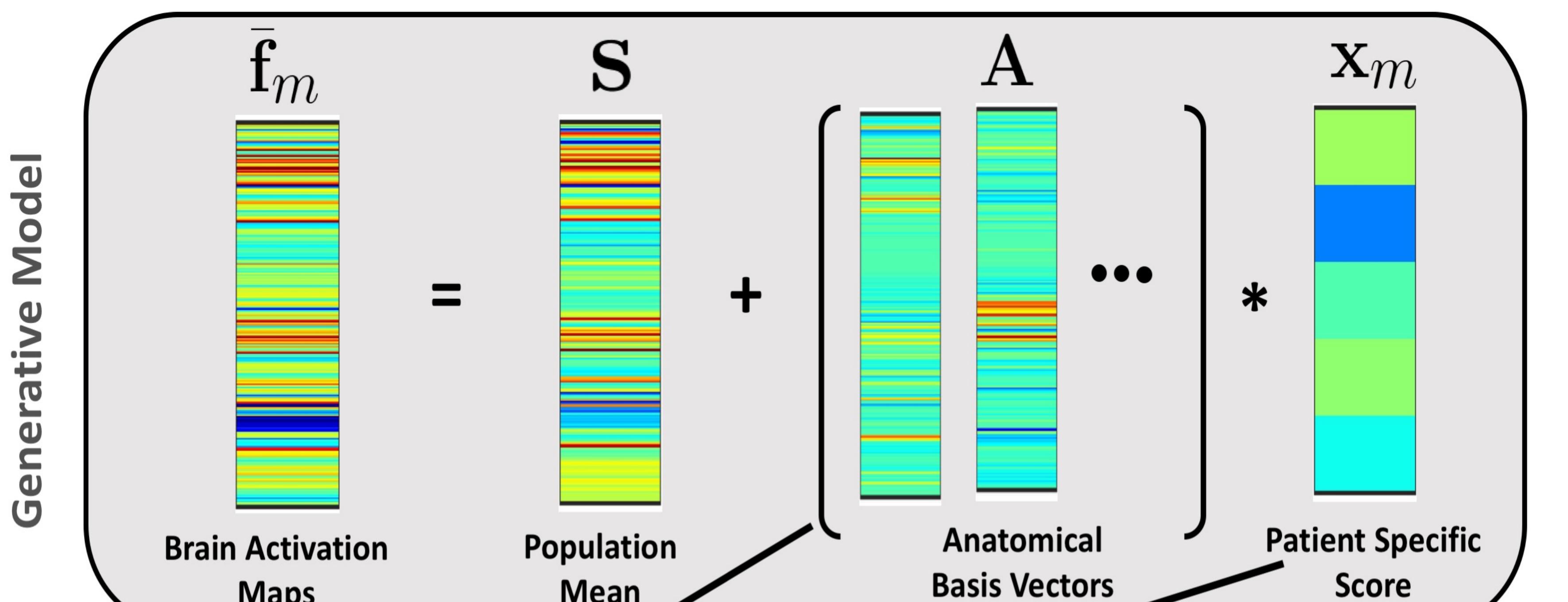
Abstract

We present a generative-predictive framework that captures the differences in regional brain activity between a neurotypical cohort and a clinical population, as guided by patient-specific genetic risk. The generative part assumes that the average functional activity of the clinical group differs from their neurotypical counterparts in certain brain regions and predictive part assumes a linear relationship between the deviation and their corresponding genetic risks scores.

Introduction



Methods

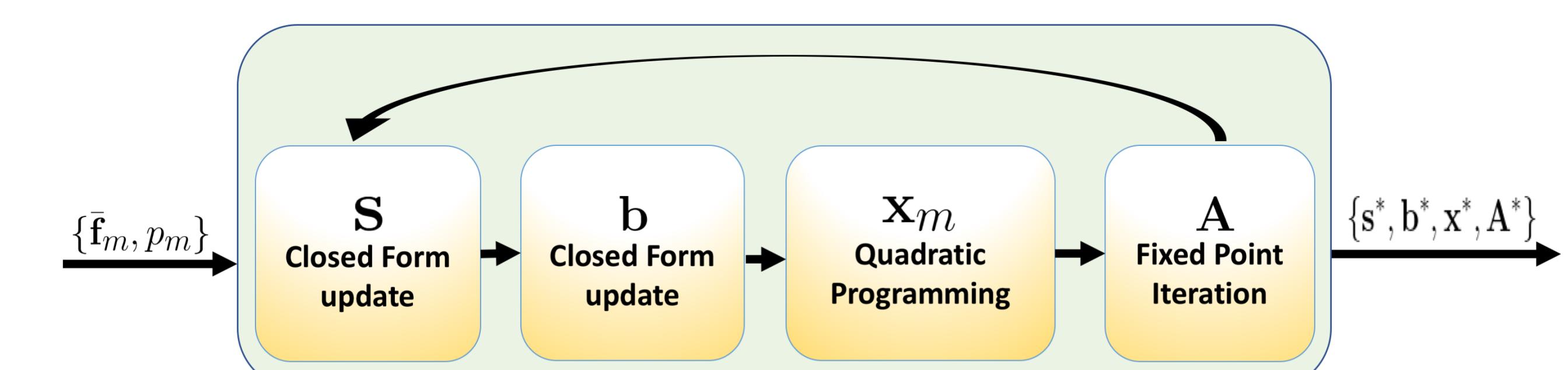


Joint Model

$$\mathcal{J}(\{x_m\}_{m=1}^M, s, b, A) = \sum_{j=1}^J \|f_j - s\|_2^2 + \sum_{m=1}^M \|\bar{f}_m - s - Ax_m\|_2^2 + \lambda_3 \sum_{m=1}^M \|p_m - x_m^T b\|_2^2 + \lambda_0 \|A\|_{2,1}$$

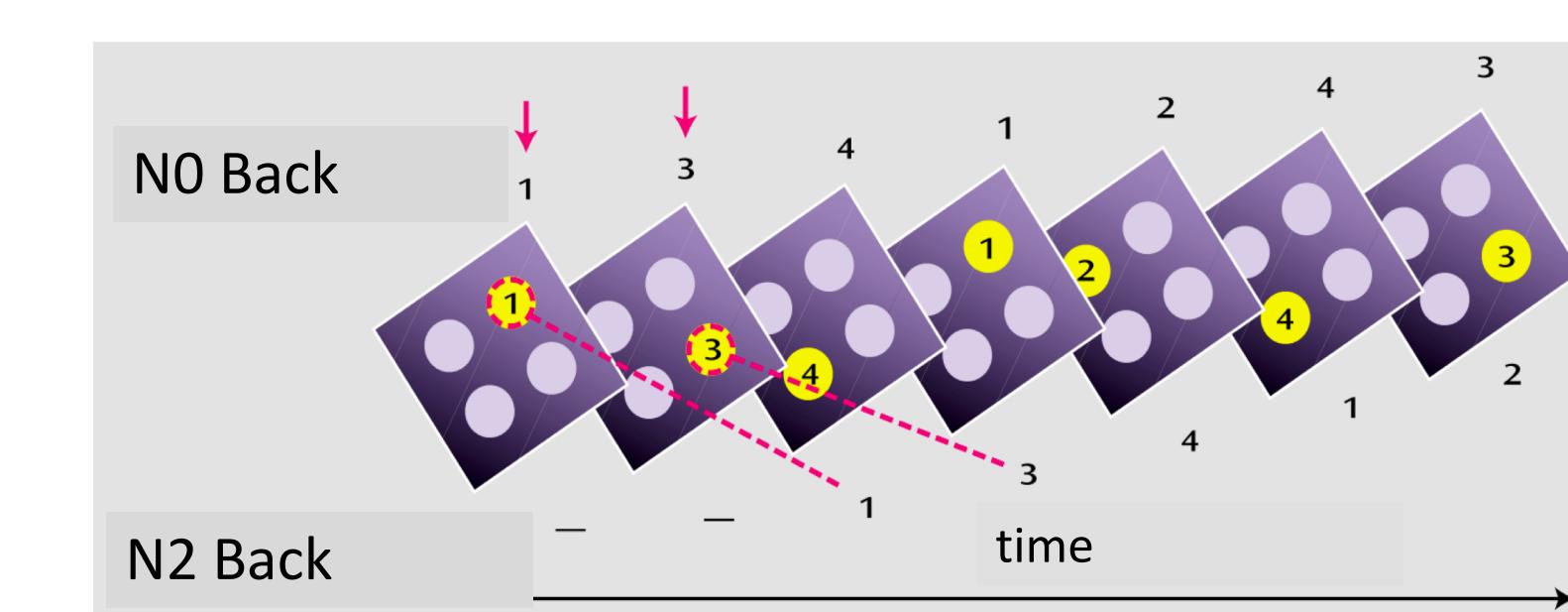
Generative Term Predictive Term Group Sparsity Penalty

Optimization

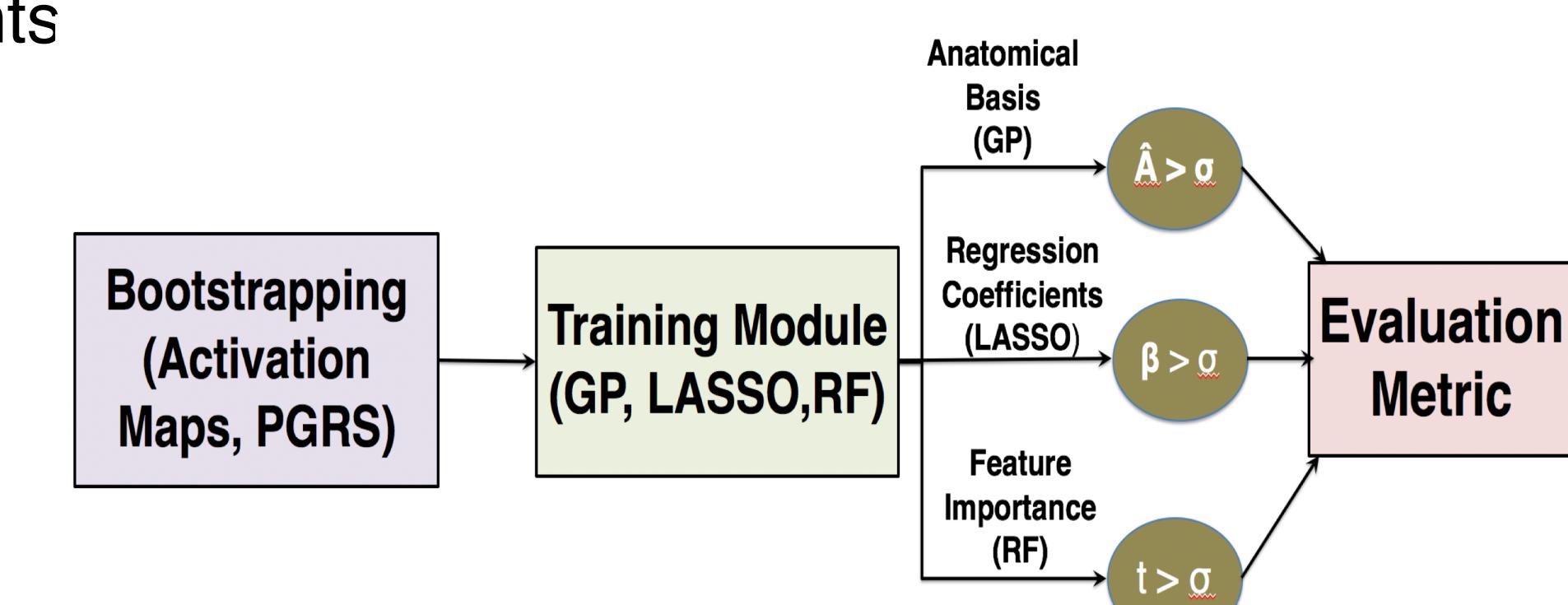


Model Evaluation

Data: N-back Working memory t-fMRI of 53 controls and 53 schizophrenic patients



Evaluation Strategy : Reproducibility

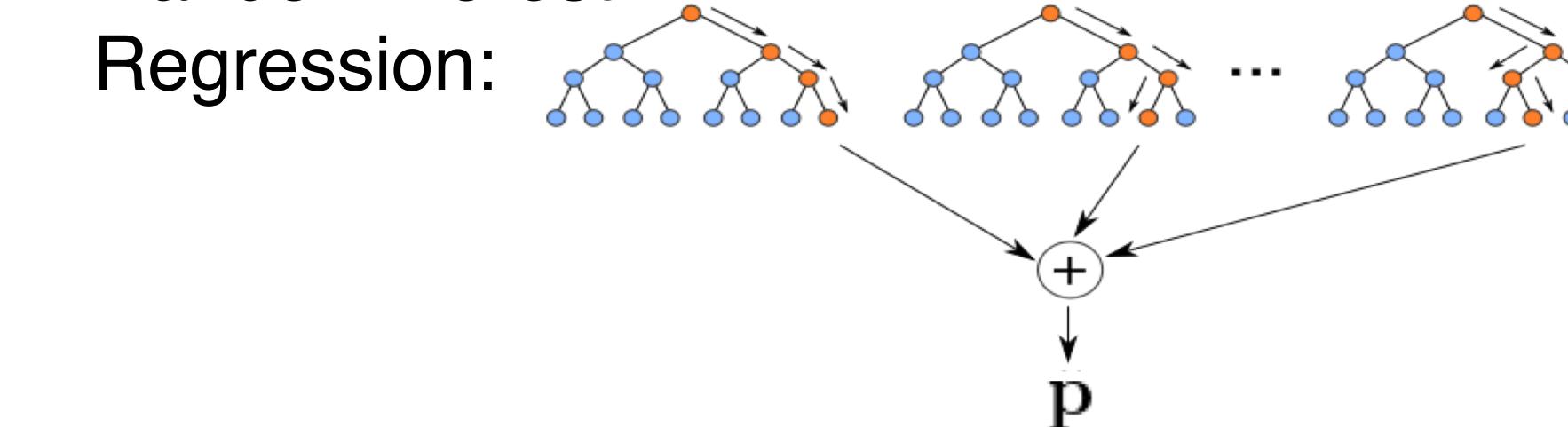


Baseline

Lasso

Regression : $p = \bar{F}^T \beta + \lambda \|\beta\|_1$,

Random Forest

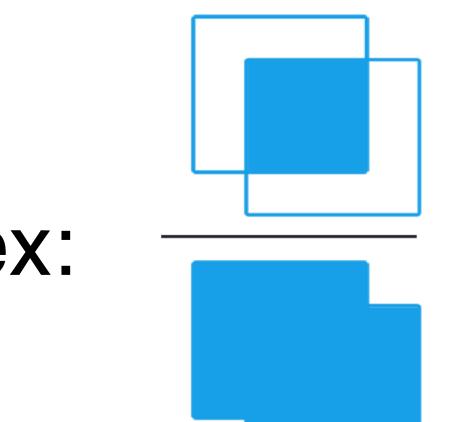


Evaluation Metric

Fractional Occurrence(FO):

$$F_m(i) = \frac{1}{100} \sum_{i=1}^{100} I_m(i)$$

Jaccard Index:



Results

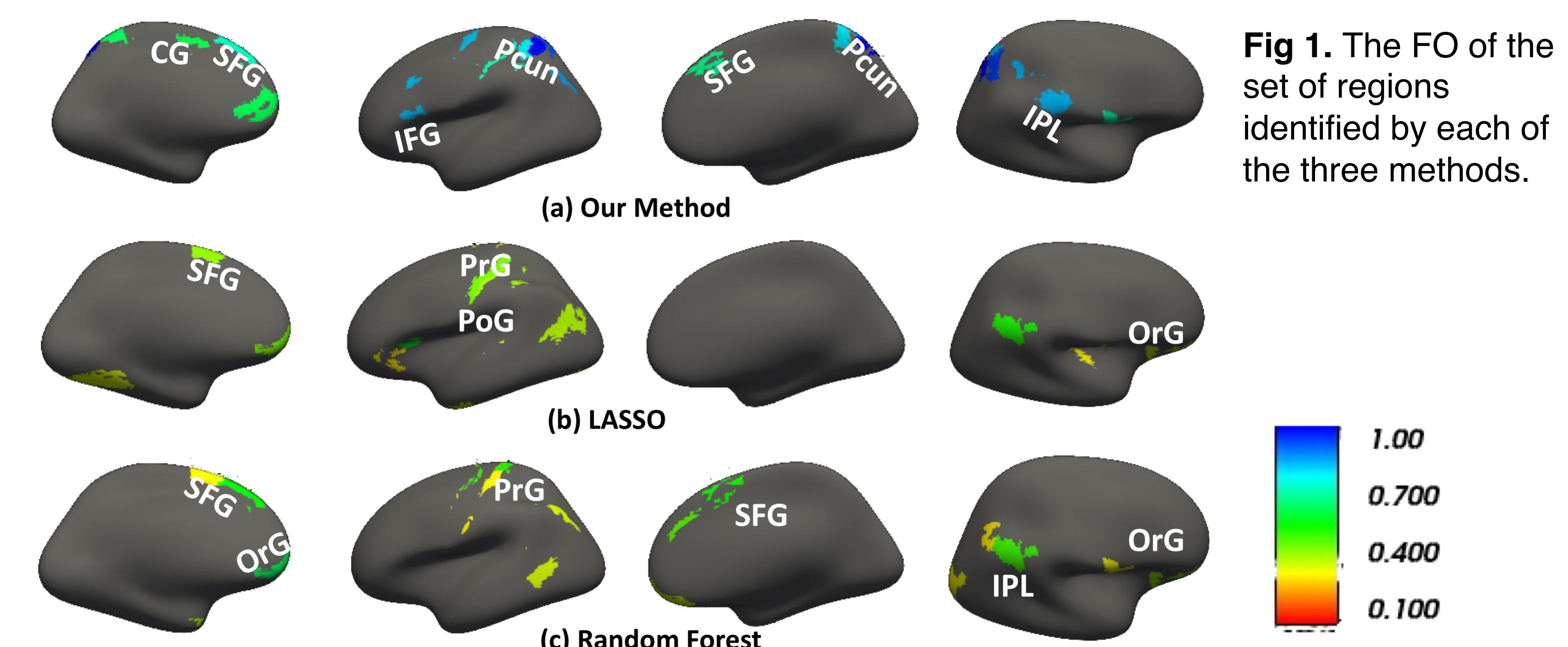


Fig 1. The FO of the set of regions identified by each of the three methods.

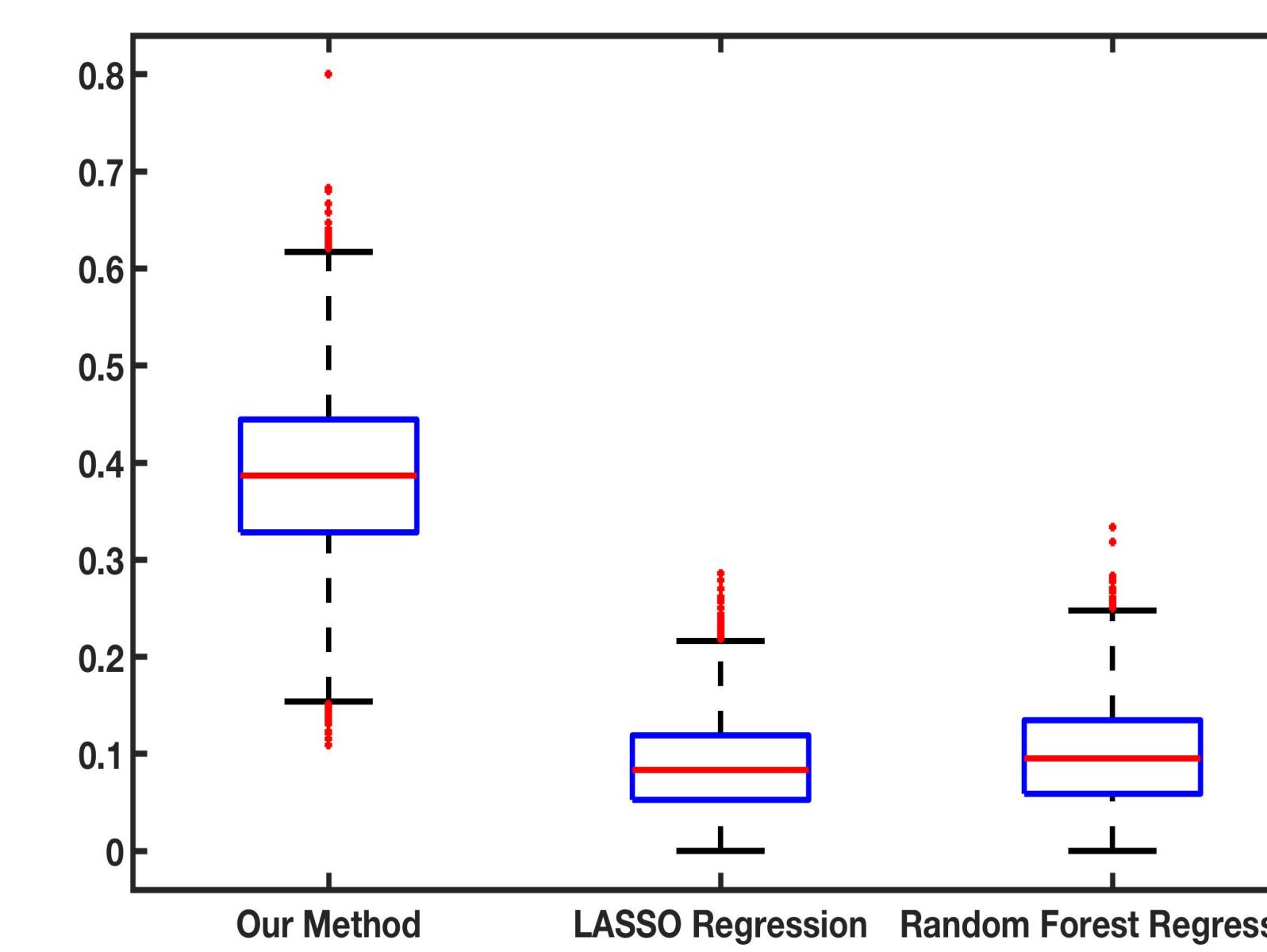


Fig 2. The distribution of the Jaccard similarity index for each of the three methods are shown.

Method	Regions	FO
Generative-Predictive	Precuneus	0.99
	Inferior Frontal Gyrus	0.83
	Superior Frontal Gyrus	0.7
LASSO	Cingulate Gyrus	0.63
	Precentral Gyrus	0.47
	Orbital Gyrus	0.41
RF	Superior Frontal Gyrus	0.38
	Postcentral Gyrus	0.37
	Supramarginal Gyrus	0.53
	Orbital Gyrus	0.49
	Supramarginal Gyrus	0.43
	Precentral Gyrus	0.42

Fig 3. The implicated set of regions identified by each method along with the FO.

Conclusion

- The joint framework models the altered brain activity while tracking genetic risk.
- Group sparsity helps to identify representative set of anatomical basis vectors.