Supernovae

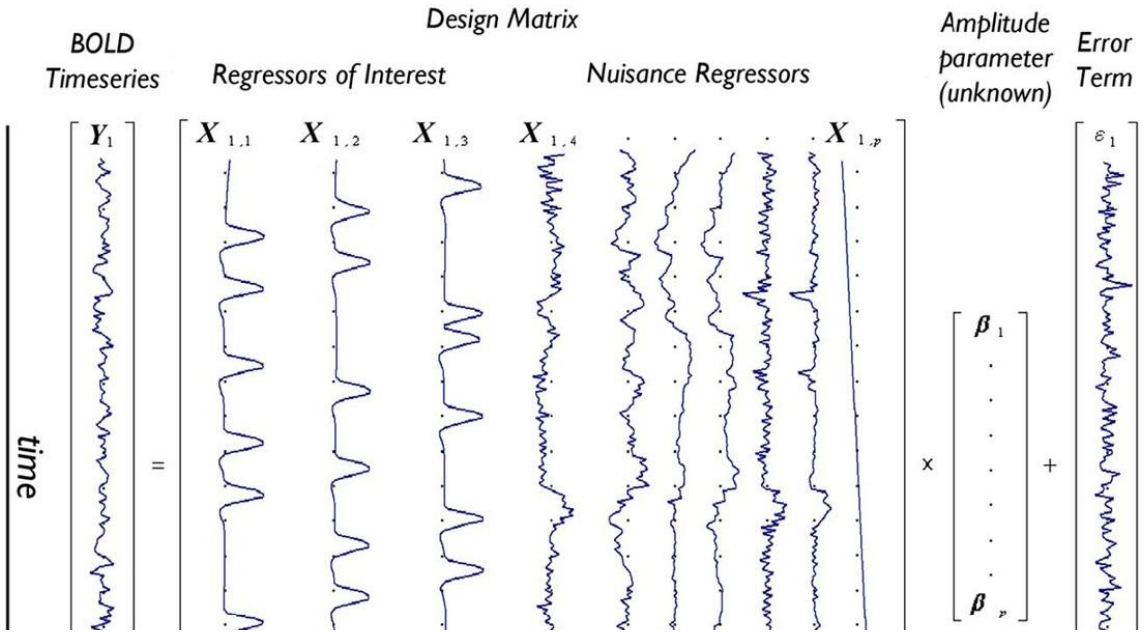
Studying Neurological differences between winning and losing a gamble

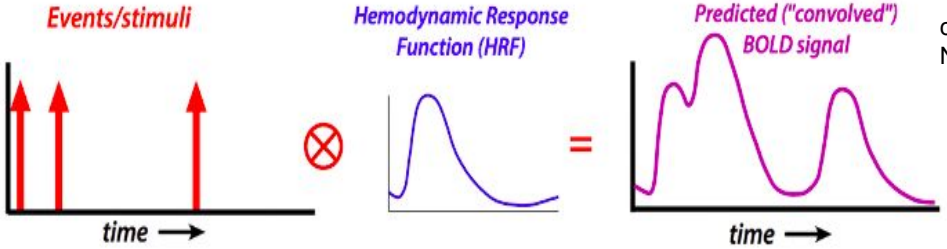
Taha Binhuraib , Sebastiano Vacca, Mohaned Bador

Mentor: Martyna Stachaczyk
Pod TA: Rodolfo Rocco
Project TA: Nicholas Blauch

Data Preparation

- A high beta coefficient would indicate high neural activity in the region
- We have two regressor of interest; winning or losing a bet
- There are two runs for each subject, we average over the beta values of both runs



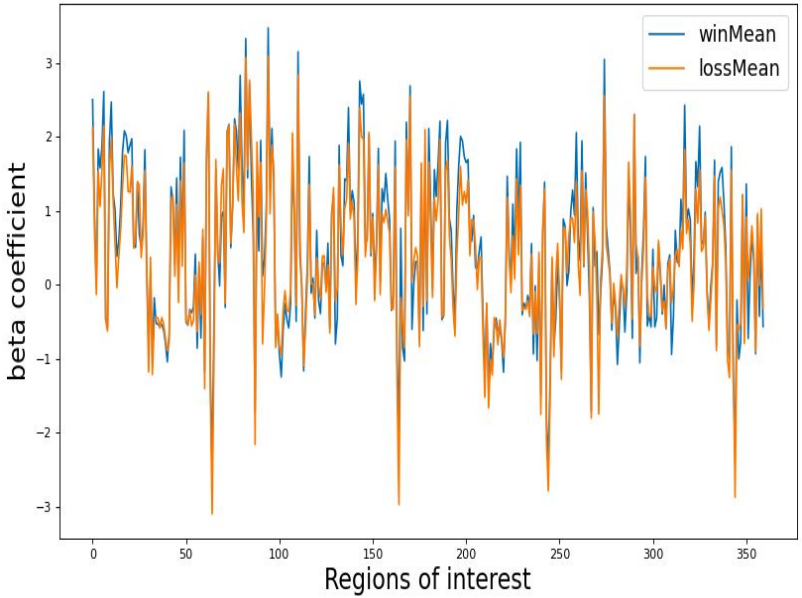


Monti MM. Statistical analysis of fMRI time-series: a critical review of the GLM approach. Front Hum Neurosci 2011

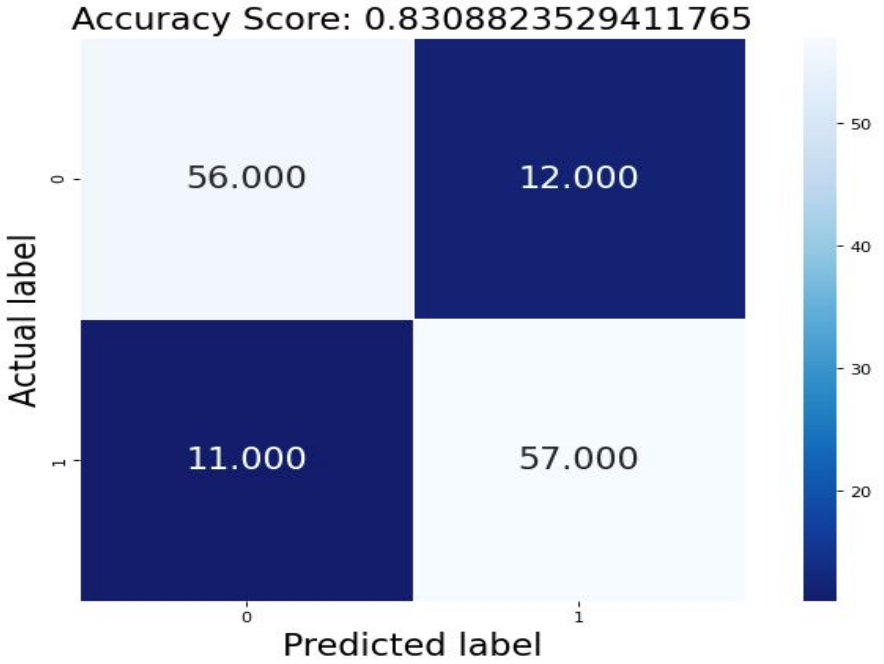
http://mriquestions.com/general-linear-model.html

Data visualisation and accuracy

First 271 subjects as train data, last 68 as test data.

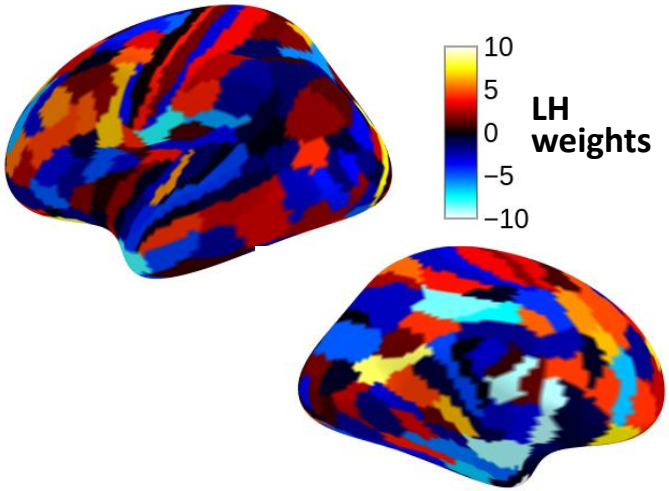


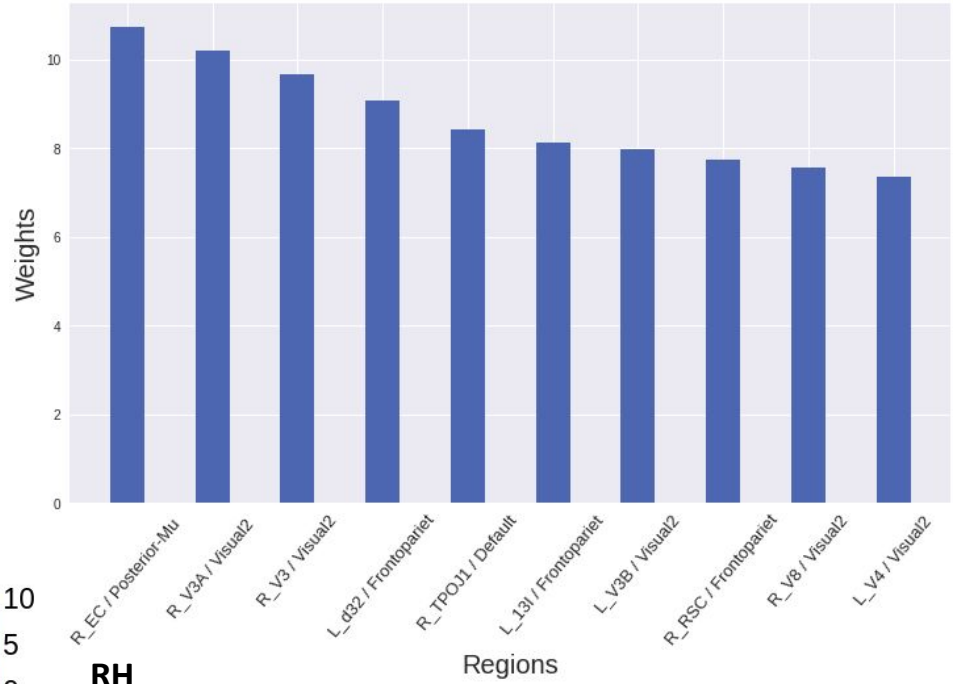
We were able to decode with an accuracy of above random chance.



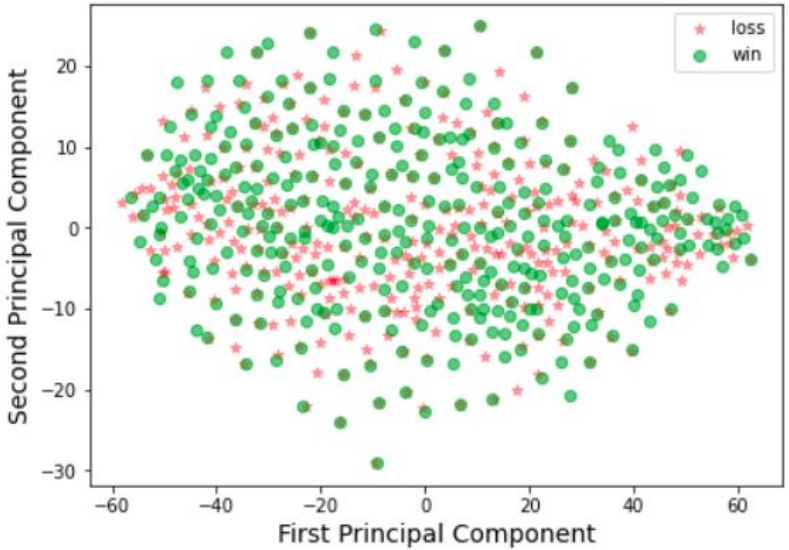
Which brain areas were most responsible for classifying the data?

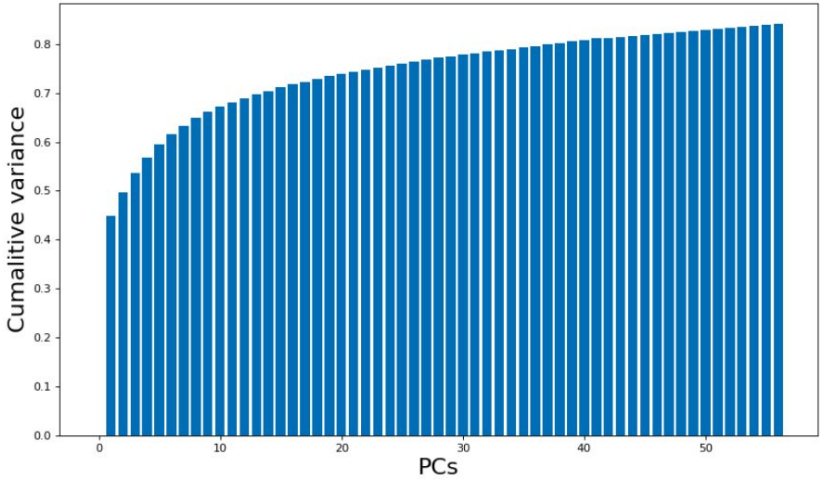
The weights of the Logistic Regression classifier is a good indicator on the regions that were most important in classifying the data



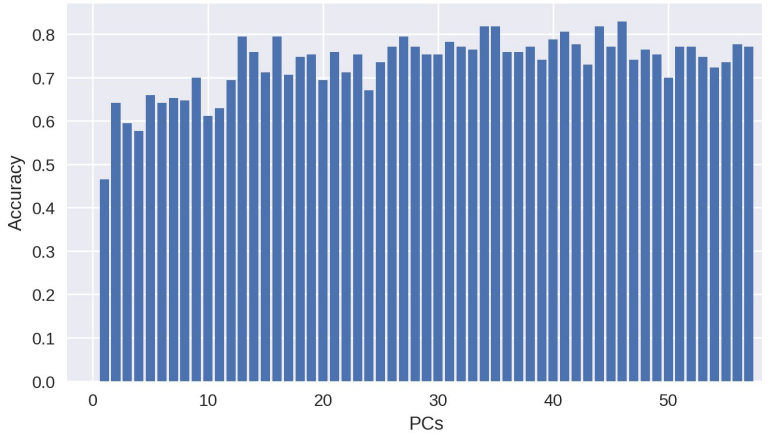


Principal component analysis and classification





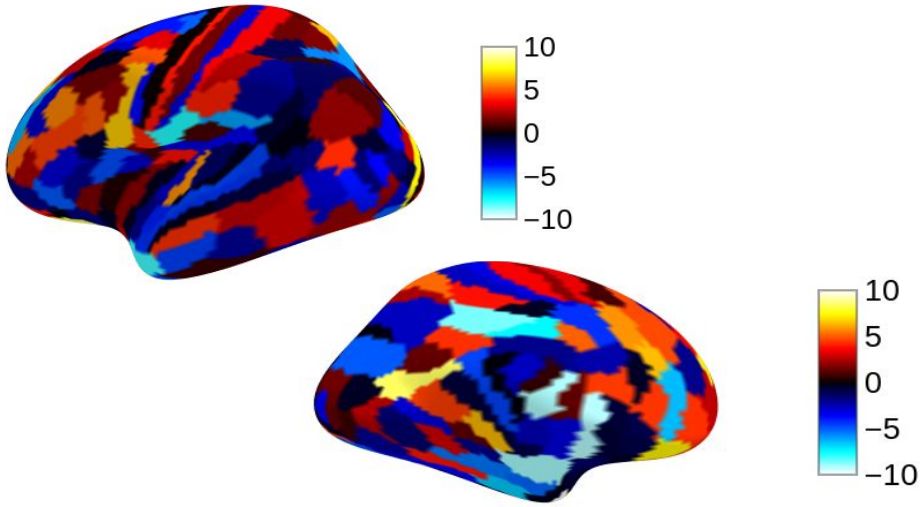
The first 56 components contain 80% of the variance



Conclusions and Future Directions

Surprised by the results?

We were too, as the Entorhinal Cortex is among the most active regions.



Potential link with addictions?

Dorsal Anterior Cingulate Cortex: error detection

Occipital Cortex: relevance to negative event [1]

Insula: decision making

Is it a dead-end?

1. In depth analysis of dataset and its limitations
2. Predicting pathological gamblers with a few runs

[1] Frederik Van de Steen, Ruth M. Krebs, Nigel Colenbier, Hannes Almgren, Daniele Marinazzo, Effective connectivity modulations related to win and loss outcomes. *NeuroImage*,

Thank you!

A special thanks to our Mentor Martyna Stachaczyk, to our TAs, Rodolfo Rocco and Nicholas Blauch, and to the other members of our pod “frigid dodos”!

References

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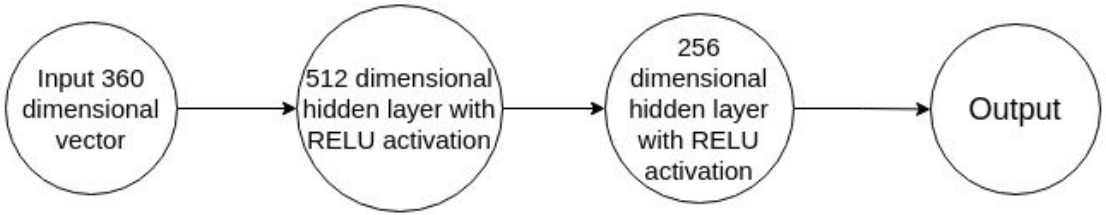
- Limbrick-Oldfield EH, Mick I, Cocks RE, et al. Neural substrates of cue reactivity and craving in gambling disorder. *Transl Psychiatry*. 2017;7(1):e992. Published 2017 Jan 3. doi:10.1038/tp.2016.256
- Amy E. Bouchard, Maya Dickler, Emmanuelle Renauld, Christophe Lenglos, Francine Ferland, Claude Rouillard, Jean Leblond, Shirley Fecteau, Brain morphometry in adults with gambling disorder, *Journal of Psychiatric Research.* Volume 141, 2021, Pages 66-73, ISSN 0022-3956, https://doi.org/10.1016/j.jpsychires.2021.06.032.
- Lorenzo Moccia, Mauro Pettorruso, Franco De Crescenzo, Luisa De Risio, Luigi di Nuzzo, Giovanni Martinotti, Angelo Bifone, Luigi Janiri, Marco Di Nicola, Neural correlates of cognitive control in gambling disorder: a systematic review of fMRI studies. *Neuroscience & Biobehavioral Reviews*, Volume 78, 2017, Pages 104-116, ISSN 0149-7634, https://doi.org/10.1016/j.neubiorev.2017.04.025.

Comparing the results with a Neural Net

Architecture of the neural network



Accuracy	82%

A neural net without sufficient training data will not perform as well as intended.