

# brainhack

Report from 2015 Brainhack Americas (MX)

## NeuroView: a customizable browser-base utility

Project URL: <https://github.com/lisa-pucrs/neuroview>

Anibal Sólón Heinsfeld\*, Alexandre Rosa Franco, Augusto Buchweitz and Felipe Meneguzzi

### 1 Introduction

The amount of data acquired for an fMRI experiment dimension wise is very large and a challenge for neuroscience studies, in particular for data analysis and visualization. Diverse tools have been developed to confront these challenges, but their analytical results can differ. Addressing those differences is not facilitated by existing tools. The goal of this Brainhack project is to build a flexible utility to analyze fMRI experimental results. This utility is called NeuroView. NeuroView allows researchers to extend the visualizations to their context: every visual behavior or interactions of this tool is customizable. We implemented NeuroView to work in Web-browsers, using JavaScript and the libraries D3.js and jQuery.

### 2 Results

We create three tools using NeuroView to best analyze our research results: CC200 search, SVM coeffs and Connectivity matrix. Each tool is used to aid the analysis of results in Machine Learning tasks. Each of these tools is described below in detail.

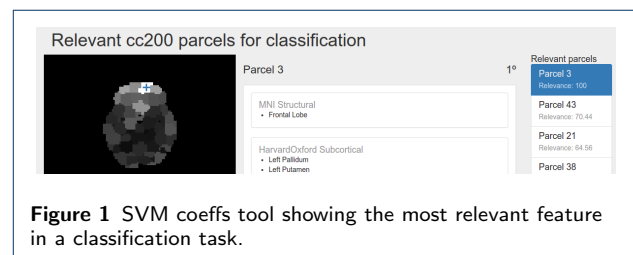
#### 2.1 CC200 search:

In this tool, we allow the user to find atlas regions (e.g. Left Putamen from Harvard-Oxford subcortical structural atlas) mapped to a specific parcellation. As an initial approach, the CC200 [1] parcellation method was used, since our analysis uses data from functional MRI. Since we parcellate our data into CC200's ROIs in most of our studies, the identification of atlas regions became necessary to compare with results found in the literature. The search can be performed in two manners: it is possible to search for an atlas region

(e.g. Putamen) and retrieve which parcels are included in this region, and it is possible to click an ROI in NeuroView to retrieve which atlas regions include the specific parcel.

#### 2.2 SVM coeffs:

For the second tool, we created a user interface to identify the ROIs that contribute to the classification in a Support Vector Machine. The classification method uses task-based fMRI features to identify good and poor readers [2]. Given a list of most relevant features, as shown in Figure 1, we can show the features' parcel in NeuroView and identify to which atlas regions this parcel belongs to.



#### 2.3 Connectivity matrix:

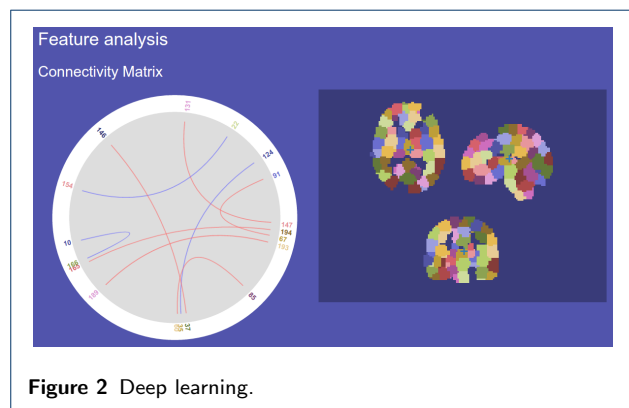
In the third study case, NeuroView was customized to interact with a connectivity chord plot (or connectogram) [3]. This plot contains each CC200 parcel and chords that represent the connectivity between these parcels. Since we use the connectivity matrix as features for our deep learning method, we need to check which feature (i.e. the correlation between two parcels) most contributes to the classification. After thresholding 17995 features, we retrieve ten features that are more relevant in our analysis, as shown in Figure 2. In the chord plot, a red chord indicates that two regions are correlated, and a blue chord indicates that

\*Correspondence: [anibalsolon@gmail.com](mailto:anibalsolon@gmail.com)

PUCRS, Porto Alegre, Av. Ipiranga, 6681, 90619-900, Rio Grande do Sul, Brazil

Full list of author information is available at the end of the article

two regions are anti-correlated. By clicking a chord, NeuroView highlights the regions that are connected by this chord. Thus, highlighted regions are correlated (or anti-correlated) given the chord color.



### 3 Conclusion

This is an initial version of a browser-based neuroimage viewer. The main focus is to develop an embeddable viewer, instead of a standalone desktop software. By doing so, research results can be presented on interactive views, enriching their analysis and interpretation. In our case study, NeuroView facilitates quick evaluation of features for machine learning algorithms, and promotes discussion about them, since the results will inform researchers about their data.

In future work, we aim to directly load Nifti images at client-side and support some AFNI features, such as voxel clustering.

#### Availability of Supporting Data

More information about this project can be found at:

<https://github.com/lisa-pucrs/neuroview>. Further data and files supporting this project are hosted in the *GigaScience* repository REFXXX.

### Competing interests

None

### Author's contributions

ASH wrote the software, and ASH, FM, ARF, and AB wrote the report.

## Acknowledgements

The authors would like to thank the organizers and attendees of Brainhack MX and the developers of AFNI.

## References

1. Craddock, R., James, G.: A whole brain fMRI atlas generated via spatially constrained spectral clustering. *Human brain mapping* **33**(8) (2012). doi:[10.1002/hbm.21333](https://doi.org/10.1002/hbm.21333)
2. Salles, J., Piccolo, L., Zamo, R., Toazza, R.: Normas de desempenho em tarefa de leitura de palavras / pseudopalavras isoladas (LPI) para crianças de 1o ano a 7o ano. *Estud. e Pesqui. em Psicol* **13**, 397–419 (2013)
3. Irimia, A., Chambers, M., Torgerson, C., Van Horn, J.: Circular Representation of Human Cortical Networks for Subject and Population-level Connectomic Visualization. *Neuroimage* **60**(2), 1340–51 (2012)