

Functional Characterization of Brain Areas Using Functional Magnetic Resonance Imaging

DANIELA SOFIA PEDROZO ROCA (dpedrozo@inbio.unsj.edu.ar) * 1 Argentina

JUAN PABLO GRAFFIGNA (jgraffig@inbio.unsj.edu.ar) 1 Argentina

VIRGINIA BALLARIN (vballari@fi.mdp.edu.ar) 2 Argentina

1 INBIO, UNSJ, San Juan, Argentina: Libertador Gral. San Martín (West) 1109, San Juan, Argentina (ZC: J5400ARL)

2 FI, UNMDP, Mar del Plata, Argentina: Juan B. Justo 4302, Mar del Plata, Buenos Aires, Argentina (ZC: B7608FDQ)

INTRODUCTION & AIM

Functional magnetic resonance imaging (fMRI) is a non-invasive neuroimaging modality that is continuously growing, both in the clinical and scientific fields. The analysis of these images requires a very complex and varied post-processing of the obtained images. This causes the results of different studies to be non-comparable or difficult to characterize. In order to simplify the processing and obtain objective results with analyzable metrics, **this work proposes the development of an analysis methodology to obtain statistical values on brain activation areas segmented by region.**

METHOD

The methodology employed for the statistical analysis is illustrated in Figure 1. The open-source image processing tools **FreeSurfer** [1], **FSL** [2] and **3D Slicer** [3] were employed. This method was applied to the database proposed by **Masterson TD et al., 2016** [4], where studies of neuronal response to visual food stimuli were conducted in 15 individuals at two different times of the day.

RESULTS

The **fMRI processing methodology was designed and implemented** with the database [4]. The segmented brain areas, the activation areas and thus the **descriptive values were obtained** (such as volume of activations per area), Figure 2. A statistical analysis could be performed on the obtained values. In the case study presented in Figure 3, the Wilcoxon method was applied, resulting in a p-value of 0.57. This indicates that there was no significant difference between the various schedules. This result is in alignment with that reported by [4].



Figure 2: Results of processing fMRI with the define methodology.

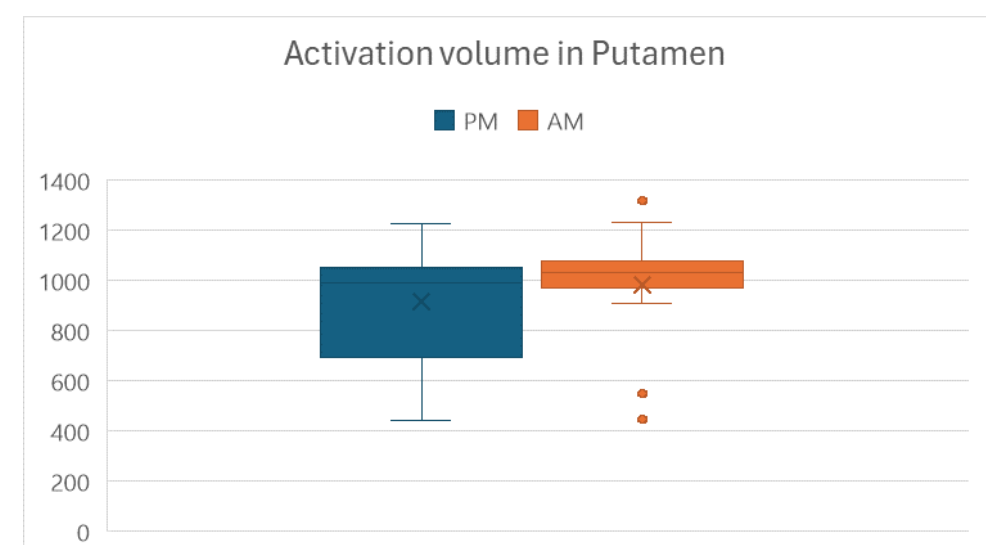


Figure 3: Statistical analysis of activation volume in Putamen.

CONCLUSION AND FUTURE WORK

This work applied a methodology for automatic fMRI image processing to obtain metrics and perform the most convenient statistical analyses. This method can be extended to different intra- and inter-patient comparisons. The next step is to automate the process by developing a script. Once this has been achieved, the automated process could be validated with different sets of fMRI images.

REFERENCE

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- [4] Masterson TD, Kirwan CB, Davidson LE, LeCheminant JD. Neural reactivity to visual food stimuli is reduced in some areas of the brain during evening hours compared to morning hours: an fMRI study in women. Brain Imaging Behav. 2016 Mar;10(1):68-78. doi: 10.1007/s11682-015-9366-8. PMID: 25753781.

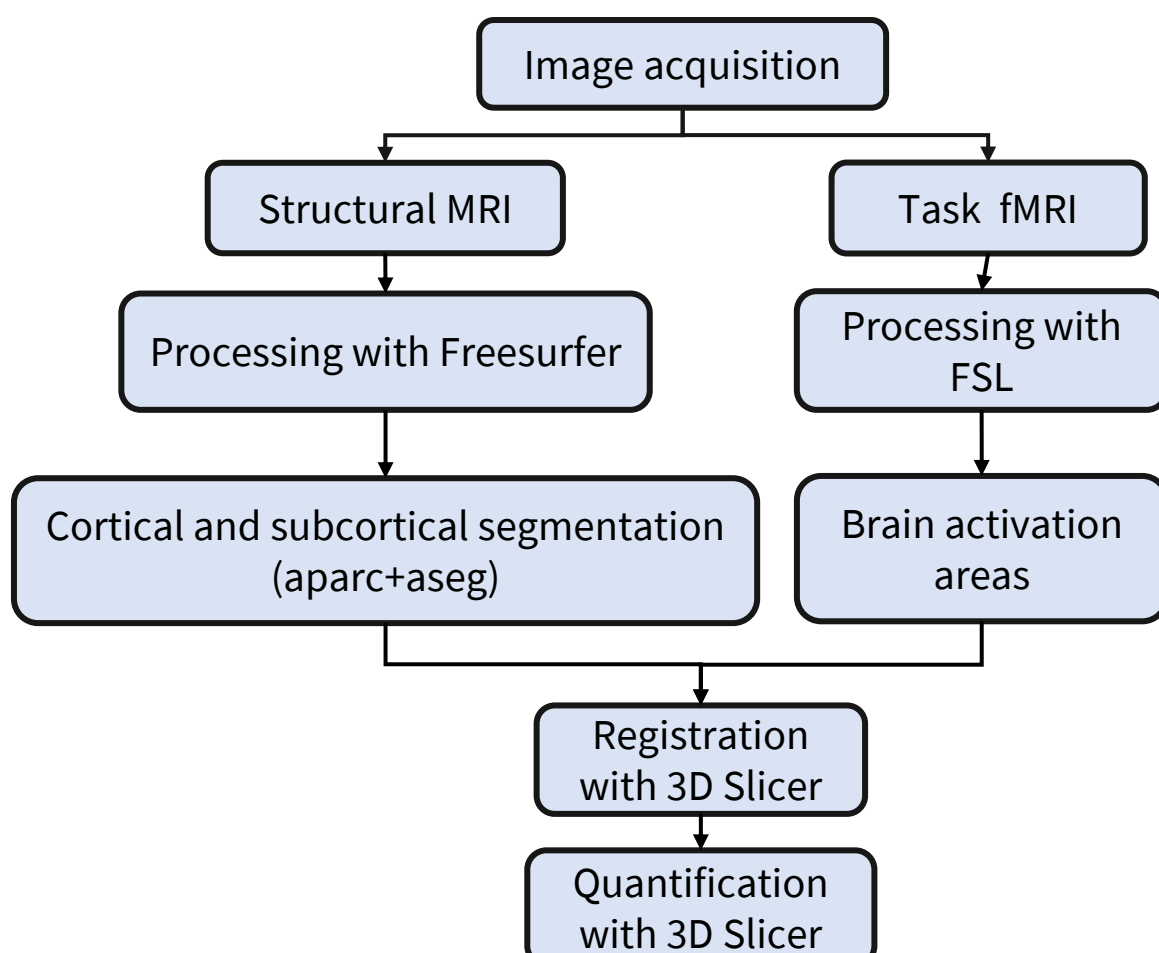


Figure 1: Methodology for processing fMRI data.