



Report from 2015 Brainhack Americas (MX)

Detecting task-based fMRI pursuance using plan abandonment approaches

Project URL: <https://github.com/brainhack-poa/fmri-plan-recongnition>

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1 Introduction

Task-based fMRI is an interesting approach for understand brain processes for a given task. However, fMRI images are usually preprocessed hours, or even days, after the scan. During preprocessing stage, defects in images are detected and, in some cases, can not be corrected. For example, technical problems or lack of collaboration from the subject to realize the given tasks. For this cases, it is necessary to realize a new scan.

2 Approach

In this BrainHack project, we aim to detect if the subject is following the given task and give an almost real-time feedback to the researchers make decisions (e.g. restart the task), in order to avoid images discard or rescans. To do so, we use Automated Planning techniques [1], an sub-area of Artificial Intelligence. For a given fMRI paradigm, a plan should be created and compared with the subject's brain activations during scan using recognition methods. In order to use plan recognition methods, we need to discretize and formalize the fMRI, and construct a expected plan based on the hypothesis paradigm using this formalization. To evaluate the pursuance of a specific paradigm, we aim to use real-time fMRI method to retrieve BOLD signals of brain regions that are supposed to be active in a particular time range. By doing so, it is possible to detect if a subject is following the paradigm given a specific stimulus type, such as visual or auditory stimulus. The brain state of each stimulus type

will be mapped based on atlas literature. For example, Brodmann areas 17, 18 and 19 will be mapped to cover visual stimulus with a state *visual_actv*. So, for a paradigm that works with visual stimuli, the plan must contain *visual_actv* for the given time that the stimulus occurs.

3 Discussion

The formalization of brain states highly depends on the discretization of specific region states, that might vary for each subject. In order to normalize the signals, a previous tuning phase is required with simple paradigms, depending of which paradigm will be executed. The usage of real-time fMRI methods aggregates to our approach, since the tuning and pursuance recognition can be made during the exam. In case of fMRI paradigm abandonment, the paradigm can be adapted to induce or interest the subject in a way that the subject proceed with its tasks, using methods such as demonstred by [2].

4 Conclusions

This project is in its initial phase. Real-time fMRI methods are being tested, using AFNI's provided tools. The next step is to formalize basic stimuli types based on mapped regions. Using these formalizations, paradigms can be converted to plans and it become possible to evaluate the participation of a subject during the scan.

Availability of Supporting Data

More information about this project can be found at: <https://github.com/brainhack-poa/fmri-plan-recongnition>. Further data and files supporting this project are hosted in the *GigaScience* repository REFXXX.

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Competing interests

None

Author's contributions

RFP and FM develop the project, and RFP, ASH and FM wrote the report.

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References

1. Sukthankar, G., Goldman, R.P., Geib, C., Pynadath, D.V., Bui, H.: Plan, Activity, and Intent Recognition: Theory And Practice, pp. 82–88. Morgan Kaufmann, Burlington, Massachusetts (2014)
2. Lee, D., Park, B., Jang, C., Park, H.-J.: Decoding brain states using functional magnetic resonance imaging. *Biomedical Engineering Letters* 1(2), 82–88 (2011). doi:[10.1007/s13534-011-0021-z](https://doi.org/10.1007/s13534-011-0021-z)