Towards a better predictive model from rest fMRI: benchmarks across multiple phenotypes

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Abstract

Psychiatry and psychology are based on assessing individuals traits, characterized through behavioral testing and questionnaires. Imaging of brain activity raises the hope of measuring the physiological differences that underlie these psychological variations [1] [2]. In [4], we have introduced an automated pipeline capable of learning this link across individuals using large cohorts of functional magnetic resonance images acquired during rest (Rest fMRI). We present an openly available implementation of this pipeline and how we used it to draw best practices from its application on various problems. Rest fMRI is a promising universal marker of brain function [3], as it can easily be acquired on many different individuals and is applicable to disease populations. It is used to capture functional-connectivity information, i.e. interaction patterns in brain activity. The challenge is then to relate it to behavior and pathology. Our pipeline successively defines regions from rest fMRI, build connectomes from time series signals extracted upon on these regions of interests, and compares connectomes across subjects using machine learning. We applied it on five datasets to i) determine the steps to obtain the best prediction, and ii) predict phenotypic information with good accuracy. Through systematic comparisons, we outline dominant choices for each pipeline step. Our results show that this analysis pipeline can be adapted to various psychological questions for instance in epidemiological studies [2], moving imaging closer to a diagnosis tools in clinical settings.

References

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