INDIVIDUALIZED DIAGNOSIS OF PSYCHOSIS BASED ON MACHINE LEARNING FROM FUNCTIONAL MAGNETIC RESONANCE DATA USING AN EMOTIONAL AUDITORY PARADIGM

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Background:
Recently there has been an increasing interest in the use of machine learning techniques to neuroimaging data, in order to discriminate patients with schizophrenia from healthy control. However, until now, these tools have not been useful enough to be integrated into the clinical practice (Arbabshirani MR et al 2016). In the last 10 years we have been using an fMRI auditory emotional paradigm specifically designed for psychosis (Sanjuan et al 2007). This paradigm showed sensitivity to detect changes in brain activation after CBT treatment in patients with persistent auditory hallucinations (Aguilar et al 2018).

Objective: Discriminate patients with Non-affective Psychosis from healthy controls employing Machine Learning in a fMRI database (with the Emotional Auditory Paradigm).

Methods:
Sample: 122 patients with the diagnosis of Non-affective psychosis according to DSM-IV criteria, and 49 healthy controls, from two different samples of Valencia Clinic Hospital (Spain) and Barcelona San Pau Hospital (Spain). 37 patients and 21 healthy controls come from Valencia, and 85 patients and 28 healthy controls come from Barcelona.

fMRI Paradigm: Four blocks of stimuli, 20 s each, interleaved with another four blocks of rest of 20 s each, were presented to patients and controls. Each block had 13 words, 2 with emotional content and 2 with 13 emotional neutral words (Sanjuan 2007).

Machine Learning Method: Several measures were extracted from the fMR images for a total of 312 characteristics. These characteristics are statistical parameters extracted from the percentage of brain activation change for all anatomical areas: amygdala, lower front, medium frontal, superior front, insula, lower temporary, temporary average, superior temporary, cingular, hippocampus. The following statistical descriptors were collected for each area and zone: mean, median, standard deviation, asymmetry, kurtosis and others related to these ones. Machine learning techniques were applied, in particular, Support Vector Machines (SVM) (Schölkopf and Smola, 2018), to this data. An exhaustive scanning of the parameters C and Gamma of the Radial Basis Function kernel SVM was performed.

Results:
The obtained accuracy for an experiment using all data with a cross validation with 25 splits was 77%. If we separate samples from each hospital, we obtained an accuracy of 84% for Barcelona and 71% for Valencia.

Discussion:

These preliminary results with a very passive, simple, short paradigm in different samples suggested, this method combining the emotional auditory paradigm with machine learning technique may be useful as clinical state biomarker in daily diagnosis practice. Although other Machine Learning Machine Techniques and replications in different larger samples are needed before filling the gap between research and clinical practice. Furthermore, these results indicate that this methodology may help elucidate pathophysiological mechanisms in psychoses.

References:

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