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ARTIFICIAL INTELLIGENCE APPROACHES IN PSYCHIATRIC DISORDERS

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To editor;

The contribution of artificial intelligence (AI) methods to various fields of study such as medicine, manufacturing, finance engineering, art and social sciences has broadened the scope of AI. Nowadays, classification of psychiatric disorders by combining neuroimaging methods and artificial intelligence approaches is becoming one of major focus of research. The combination of feature selection (FS) and classification methods appreciate the value of biological biomarkers and contribute to the treatment process of psychiatric and neurological diseases.

The value of clinical factors in various psychiatric diseases is extremely limited and a shift towards biomarkers is evident. With the Personalized Medicine approach to psychiatric diseases, genetic and neuroimaging biomarkers have been explored and generated promising outcomes in aiding treatment process using pre-treatment and post-treatment measures. The methods used to classify diseases, to predict treatment outcomes of diseases and FS techniques to underline informative features are valuable approaches in medicine contributing to early diagnosis, treatment planning and monitoring of disease progression processes. This has revealed structural and functional alterations in several disorders including, amongst others, mild cognitive impairment, probable dementia of Alzheimer type, major depression, bipolar disorder, schizophrenia and generalized anxiety disorder (Arnone et al., 2011; Davatzikos & Resnick, 2002; Ellison-Wright & Bullmore, 2010; Etkin & Wager, 2007; Smieskova et al., 2010; Zakzanis et al., 2003).

Despite much interest in the use of neuroimaging studies for diagnostic and prognostic purposes, neurologists and psychiatrists are still forced to rely on traditional and often ineffective diagnostic and prognostic tools. One of the reasons for the limited impact of the findings on clinical practice is that neuroimaging studies have typically reported differences between patients and controls at group level. Thus over the past few years, there has been growing interest to machine learning (ML) techniques in order to address the considerations of neuroimaging community (Hastie et al., 2001).

ML algorithms include two main phases; in the first phase they try to find a model for the class attribute as a function of other variables of the datasets, and in the second phase, they apply previously designed model on the new and unseen datasets for determining the related class of each record. There are different methods for data classification such as Decision Trees (DT), Rule Based Methods, Logistic Regression (LogR), Linear Regression (LR), Naïve Bayes (NB), Support Vector Machine (SVM), k-Nearest Neighbor (k-NN), Artificial Neural Networks (ANN), Linear Classifier (LC) and so forth (Tan et al., 2006; Kantardzic, 2003; Witten & Frank, 2005). Compared to traditional methods of analysis based on the general linear model, the advantages of applying ML methods to neuroimaging data could be expressed with two steps. Firstly, ML methods allow characterization at the level of the individual therefore yielding results with a potentially high level of clinical translation. Secondly, as inherently multivariate approaches, ML methods are sensitive to spatially distributed and subtle effects in the brain that would be otherwise undetectable using traditional univariate methods which focus on gross differences at group level.

Besides classification accuracy of proposed ML approaches, FS process is a sustaining step improving classification accuracy eliminating less informative features. Several techniques are developed to address the problem of reducing irrelevant and redundant variables which are a burden on challenging tasks. Those algorithms that differ in their optimality and computational cost have been developed to search the solution space which are namely, Tabu Search (TS), Simulated Annealing (SA) and Genetic Algorithm (GA). Another trend of search procedures is based on swarm intelligence, which adopts the social insect metaphor that emphasizes distributedness and direct or indirect interactions among relatively simple agents. Swarm intelligence methods, particularly the Ant Colony Optimization (ACO) and Particle Swarm Optimization (PSO) were also utilized as search procedures in FS problems. Nature inspired algorithms such as Artificial Bee Colony, Firefly Algorithm and Bee Colony Optimization are being used to appreciate the value of FS process as well.

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For future perspective, prevailing application of AI methods in the diagnosis and treatment process of psychiatric disease will be valuable and highly applicable to clinical studies requiring diagnostic results.

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