Abstract

Objective: The objective of the study is to use the different machine learning classifiers to classify the children with ASD problem at early stage with high accuracy by combining the rs-fMRI and the s-MRI data.**Methodology:** The dataset consists of 53 individuals with ASD and 53 control subjects sourced from ABIDE. The brain volume of each participant comprises a total of 180 scans.The pre-processing of scans is conducted utilising the CONN toolbox in MATLAB version21. The preparatory stage of the data entails a series of procedures, including but not limited to realignment, slice time correction, normalisation, segmentation, outlier detection, and smoothing. The regions of interest (ROIs) utilised in this study were derived from the FSL Harvard-Oxford atlas, which encompasses both cortical and subcortical areas, as well as resting-state networks, Brodmann areas, and cerebellar areas from the Automated Anatomical Labelling (AAL) atlas. The application of graph theory is utilised in the analysis of pre-processed scans, wherein seven distinct graph parameters are computed and categorised into three groups for both ASD patients and control subjects. The set of seven parameters comprises betweenness centrality, degree, average path length, local efficiency, cost, global efficiency, and clustering coefficient. The SFSS (Sequential Forward Selection Scheme) algorithm is utilised to select the most noteworthy features within each parameter derived from graph theory. The best selected features are given to 8 classifiers with all possible combinations of parameters. The 10-fold gird search cross-validation is used to find the optimal value of the parameters of the 8 classifiers.

Results: The classifier known as Adaptive Boosting, when used in conjunction with the degree parameter, was able to attain a classification accuracy of 100%, indicating its high level of effectiveness. The Local Centrality Parameters were evaluated and it was found that the Adaptive Boosting classifier yielded the most optimal results with an accuracy of 62.96% specifically for the Betweenness Centrality parameter. The results indicate that the Adaptive Boosting classifier outperformed other classifiers with an accuracy of 96.29% for the Clustering Coefficient parameter in the Functional Segregation Parameters. Conversely, the Linear Discriminant classifier achieved the highest accuracy of 59.25% for the Local Efficiency parameter. The Adaptive Boosting classifier was found to have the highest accuracy of 55.56% among the Functional Integration Parameters, specifically for the Global Efficiency parameter. It is noteworthy that the Random Forest classifier also achieved the same accuracy for this parameter. The selection of a classifier is imperative in attaining the highest possible accuracy in classification tasks that are based on graphs.