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NEWS

Early ASD Assessment Using DTI Analysis with Machine Learning

PURPOSE

Autism Spectrum Disorder (ASD) impacts social skills, repetitive behaviors, speech, and nonverbal communication. Diffusion Tensor-MRI (DT-MRI) can aid in accurate diagnosis, and this study aims to create an artificial diagnostic system that extracts connectivity markers from DT-MRI to improve early-stage precision in diagnosing autism.

METHODS AND MATERIALS

We developed a three-stage system to analyze DT-MRI. Firstly, FSL corrected eddy current distortions and isolated brain tissues from scans. Secondly, connectivity markers (e.g., Fractional Anisotropy, Mean diffusivity) were extracted from different brain regions using the John Hopkins White Matter Atlas. Significant markers were identified through MinMaxScalar and REC-CV feature reduction algorithms. Finally, the extracted features were fed to a Linear Support Vector Machine (LSVM)-classifier to diagnose subjects as ASD or control. Our system was validated through a five-fold cross-validation test on the Autism Brain Imaging Data Exchange-II (ABIDE-II) dataset, consisting of 126 autistic and 100 control subjects.

RESULTS

The proposed ML-Based system achieved an overall accuracy of 98.5% with a sensitivity of 97% and specificity of 98% on the ABIDE-II database.

CONCLUSIONS

In conclusion, this study demonstrates the potential of DT-MRI in the diagnosis of ASD, and the use of connectivity markers can aid in understanding the development and progression of the disorder.

CLINICAL RELEVANCE/APPLICATIONS

Early and accurate diagnosis of ASD is crucial for improving the quality of life for individuals with the disorder. We believe that early intervention can lead to better outcomes, including the potential for individuals with ASD to achieve greater independence and higher IQs.