

AUTISM DISEASE PREDICTION

Jeya Mary S

Jayaraj Annapackiam CSI College
Of Engineering, Nazareth

Sjeyamary4@gmail.com

S. Jeyakumar

Principal

Jayaraj Annapackiam CSI College
Of Engineering, Nazareth

C. Prema

Professor

Jayaraj Annapackiam CSI College
Of Engineering, Nazareth

Abstract - Autism Spectrum Disorder (ASD) is a complex neurodevelopmental condition characterized by challenges in social interaction, communication, and repetitive behaviours. Early detection and intervention are crucial for improving outcomes and quality of life for individuals with ASD. In recent years, deep learning techniques have shown promising results in various medical applications, including disease prediction. Here we have proposed a deep learning approach using ResNet50 architecture for effective detection of ASD from MRI images.

The model is trained using MRI datasets collected from Kaggle. Image preprocessing, segmentation, and feature extraction techniques are used to improve model performance.

The proposed ResNet50-based system achieves improved accuracy, sensitivity, and specificity, making it a reliable tool for early ASD detection.

I. INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects individuals across their lifespan. It is characterized by difficulties in social communication, repetitive behaviours, and restricted interests or activities. Although there is no known cure for autism, various treatments and therapies can help individuals with ASD manage their symptoms and improve their quality of life.

Deep learning, a subset of machine learning, has emerged as a promising tool for autism prediction due to its ability to analyze large datasets and extract meaningful patterns from diverse sources of information. Deep learning models such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and their variants have shown significant success in various healthcare applications, including medical image analysis, genomics, and clinical decision support. Feature extraction is a critical step in deep learning-based autism prediction, where the model automatically learns relevant features from the input data. For instance, CNNs can capture spatial patterns in neuroimaging data, while RNNs can model temporal dependencies in sequential behavioural data. Feature selection methods may also be employed to enhance model interpretability and generalization. The performance of deep learning models for autism prediction is evaluated using metrics such as accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve (AUC-ROC). Clinical validation studies are essential to assess the model's reliability, clinical utility, and potential impact on early diagnosis and intervention strategies for individuals with ASD. Overall, deep learning holds promise for

advancing our understanding of ASD risk factors and improving personalized care for affected individuals.

II. LITERATURE REVIEW

[1] The goal of the present study was to apply deep learning algorithms to identify autism spectrum disorder (ASD) patients from large brain imaging dataset, based solely on the patients brain activation patterns. ASD is a brain-based disorder characterized by social deficits and repetitive behaviors. One of the challenges to brain imaging studies of brain disorders is to replicate findings across larger, more demographically heterogeneous datasets that reflect the heterogeneity of clinical populations.

The results improved the state-of-the-art by achieving 70% accuracy in identification of ASD versus control patients in the dataset.

[2] Autism Spectrum Disorder (ASD) is defined by a heterogeneous constellation. As research on ASD continues at rapid pace, the etiology and developmental course appear to be increasingly diverse, resulting in a view of ASD with diverse cognitive, behavioural and neural trajectories and subtypes of behavioural symptoms that emerge over the first years of life. An emerging view is that the behavioural symptoms that define ASD may be the end result of early brain adaptation, rather than the direct consequence of ongoing neural pathology.

The result improved the achieving 95% accuracy at some ages.

III. METHODOLOGY

Prediction: The processed images are fed into the ResNet50 model, which classifies them into ASD or non-ASD categories with improved accuracy due to residual learning.

A. Data Collection and Preprocessing:

Gather a diverse dataset containing behavioural, genetic, and demographic information of individuals, including those diagnosed with autism and neurotypical individuals.

Preprocess the data by handling missing values, normalizing numerical features, encoding categorical variables, and ensuring data quality.

B. Feature Extraction:

ResNet50 automatically extracts deep hierarchical features from MRI images, capturing complex spatial

patterns and reducing reliance on manual feature extraction techniques.

Extract relevant features from the preprocessed data, such as social interaction patterns, communication skills, repetitive behaviors, sensory sensitivities, and genetic markers associated with autism.

Use techniques like dimensionality reduction (e.g., PCA) and feature selection to reduce the complexity and focus on informative features.

C. Deep Learning Model Selection:

Prediction: The processed images are fed into the ResNet50 model, which classifies them into ASD or non-ASD categories with improved accuracy due to residual learning.

Consider pre-trained models like ResNet50, ResNet, or custom architectures tailored to the dataset characteristics.

D. Model Training and Validation:

Split the dataset into training, validation, and testing sets for model development and evaluation.

Train the deep learning model using the training data, optimizing hyperparameters, and monitoring performance on the validation set to prevent overfitting.

Evaluate the trained model's performance on the testing set using metrics such as accuracy, precision, recall, F1 score, and area under the ROC curve (AUC-ROC).

E. Interpretability and Explainability:

Prediction: The processed images are fed into the ResNet50 model, which classifies them into ASD or non-ASD categories with improved accuracy due to residual learning.

F. Deployment and User Interface:

Prediction: The processed images are fed into the ResNet50 model, which classifies them into ASD or non-ASD categories with improved accuracy due to residual learning.

Ensure the system's scalability, security, and compliance with data privacy regulations (e.g., GDPR, HIPAA) when handling sensitive information.

G. Validation and Clinical Integration:

Validate the predictive model with independent datasets or collaborate with healthcare professionals and researchers for validation studies.

Explore integration opportunities with clinical workflows and electronic health records (EHRs) to support healthcare providers in early screening and intervention for autism spectrum disorder.

Prediction: The processed images are fed into the ResNet50 model, which classifies them into ASD or non-

ASD categories with improved accuracy due to residual learning.

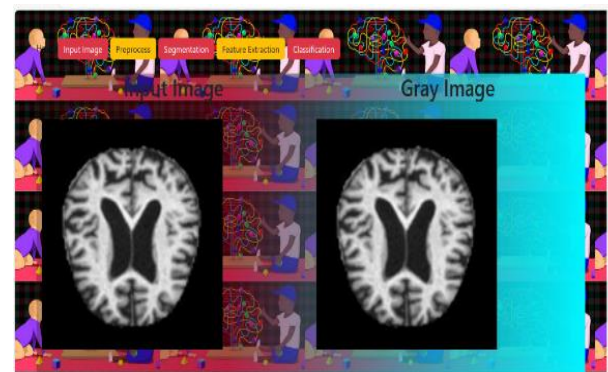
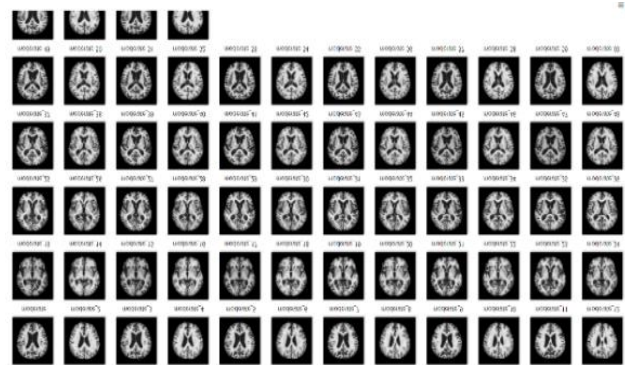
In the proposed system of autism detection using MLP (Multilayer Perceptron) algorithm, an automated and data-driven approach is introduced to enhance the efficiency and accuracy of the diagnostic process. The system leverages machine learning techniques, specifically MLP, to analyze relevant data and assist in the identification of autism spectrum disorder (ASD).

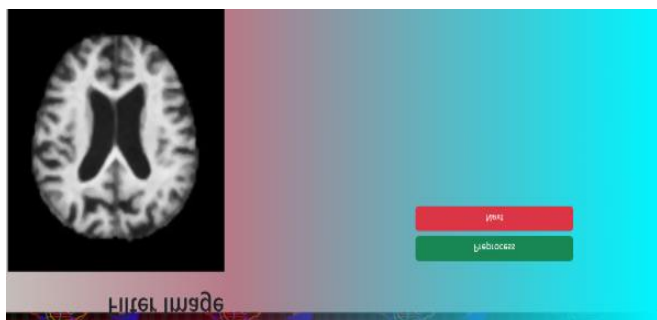


IV. MODULE

A. Data Collection and Preprocessing:

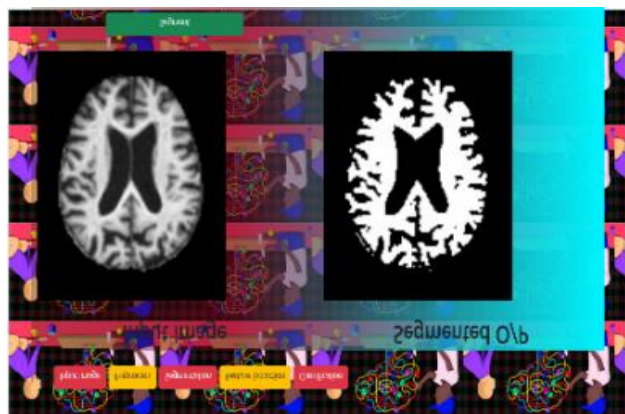
Collect MRI dataset from Kaggle and preprocess the images in the dataset. Preprocessing is the step where the raw data is cleaned, normalized, and transformed into a format suitable for further analysis. In image processing, preprocessing steps may include resizing images to a standard size, converting color spaces, removing noise, and enhancing contrast.





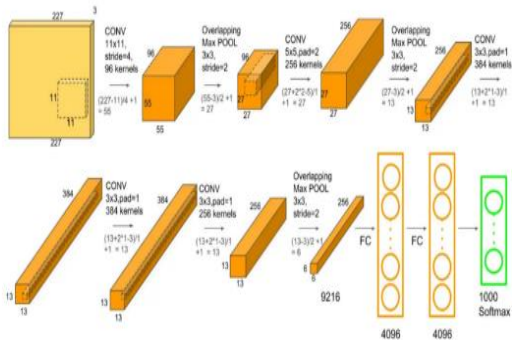
B. Data Segmentation:

Split the dataset into training and testing sets. The training set is used to train the model, while the testing set is reserved for evaluating its performance. Segmentation is the process of dividing an image into meaningful regions or segments based on certain criteria, such as color, intensity, texture, or boundaries. This step is crucial for tasks like object detection or image analysis, as it helps isolate the regions of interest from the background or other irrelevant parts of the image.

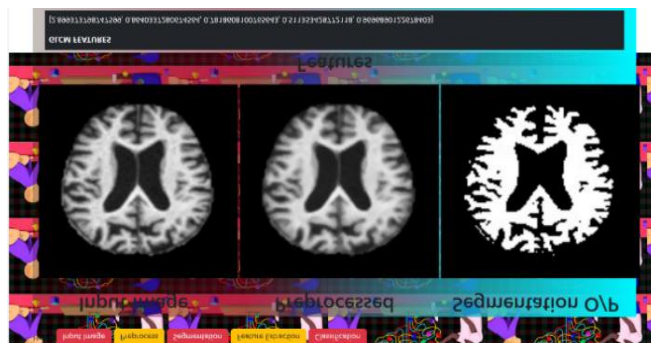


Model Construction: The ResNet50 model is used for classification. It consists of 50 layers and uses residual connections to improve training of deep networks. The model is pre-trained on ImageNet and fine-tuned on the ASD MRI dataset.

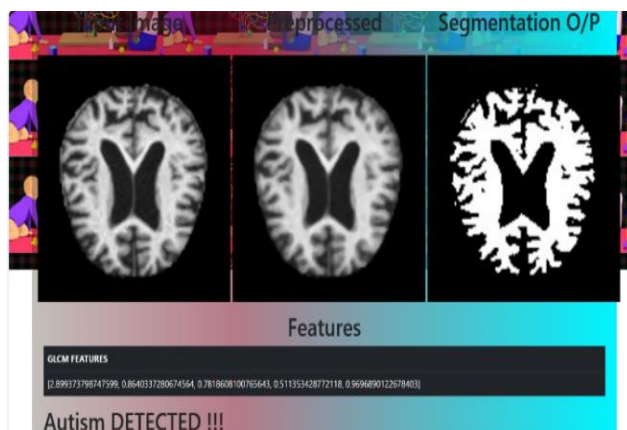
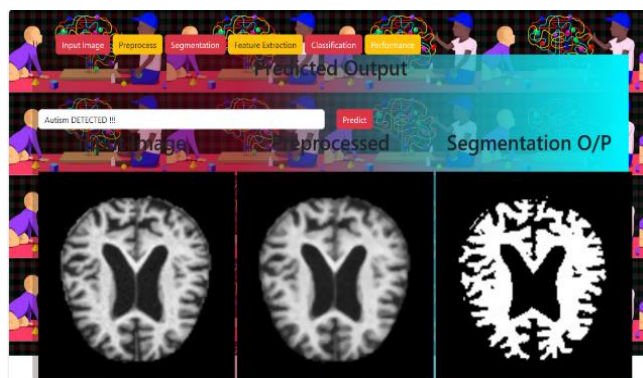
Initialize ResNet50 model. This involves specifying parameters such as the learning rate, maximum depth of trees, number of trees (boosting rounds), and other hyperparameters.



Feature Extraction: ResNet50 automatically extracts deep hierarchical features from MRI images, capturing complex spatial patterns and reducing reliance on manual feature extraction techniques.



Prediction: The processed images are fed into the ResNet50 model, which classifies them into ASD or non-ASD categories with improved accuracy due to residual learning.



V. CONCLUSION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects individuals across their lifespan. It is characterized by difficulties in social communication, repetitive behaviours, and restricted interests or activities. Although there is no known cure for autism, various treatments and therapies can help individuals with ASD manage their symptoms and improve their quality of life. Deep learning, a subset of machine learning, has emerged as a promising tool for

autism prediction due to its ability to analyze large datasets and extract meaningful patterns from diverse sources of information. Deep learning models such as convolutional neural networks (CNNs), recurrent neural networks (RNNs), and their variants have shown significant success in various healthcare applications, including medical image analysis, genomics, and clinical decision support. Feature extraction is a critical step in deep learning-based autism prediction, where the model automatically learns relevant features from the input data. For instance, CNNs can capture spatial patterns in neuroimaging data, while RNNs can model temporal dependencies in sequential behavioural data. Feature selection methods may also be employed to enhance model interpretability and generalization. The performance of deep learning models for autism prediction is evaluated using metrics such as accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve (AUC-ROC). Clinical validation studies are essential to assess the model's reliability, clinical utility, and potential impact on early

diagnosis and intervention strategies for individuals with ASD. Overall, deep learning holds promise for advancing our understanding of ASD risk factors and improving personalized care for affected individuals.

REFERENCE

- [1] APA (1980) Diagnostic and Statistical Manual of Mental Disorders, 3rd Edition (DSM-III). Washington, DC: American Psychiatric Association.
- [2] APA (1994) Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV). Washington, DC: American Psychiatric Association.
- [3] APA (2013) Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5). Washington, DC: American Psychiatric Association.
- [4] Asperger H (1944). [Die "Autistischen Psychopathen" im Kindesalter]. *Archiv für psychiatrie und nervenkrankheiten*, 117: 76–136.
- [5] Translated and annotated by Frith U (1991). Autistic psychopathy in childhood. In Frith U (ed), *Autism and Asperger Syndrome*. Cambridge, UK: Cambridge University Press, p37–92.
- [6] Attwood, T. (2004). *Exploring feelings: Cognitive behaviour therapy to manage anxiety*. Future Horizons.