Autism Spectrum Disorder

FYP Proposal

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Supervisor

Saad Akbar

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Group Introduction

Group Members

- Mujtaba Khan
- Nuha Amir
- Rubbaishe

Supervisor: Saad Akbar

Why we selected him as supervisor?

We selected him as our supervisor because we believe he is a professional person who can help us throughout the project resolving our issues in most convenient way.

Relevant Expertise

He have relevant expertise and experience in different areas of technology.

Relevant Experience

He has 15+ years of prolific experience in academia and IT industry.

Introduction

One of the most well researched developmental impairments is autism spectrum disorder (ASD). In addition to showing signs of constrained and repetitive patterns of behavior, interests, or hobbies, those with ASD's must also have chronic difficulties in social communication and social interaction. It denotes intricate, long-lasting neurodevelopmental abnormalities that are usually diagnosable prior to the child becoming three years old. ASD's etiology is still being investigated, but a growing body of research indicates that a complex interplay between hereditary and environmental variables is the likely culprit. There are hundreds of genes that have been connected to autistic problems, and the heritability of ASD is thought to be between 40 and 80%.

Problem Statement

Signal processing: In order to identify significant characteristics associated with ASD from the complex and noisy EEG recordings, advanced signal processing techniques are needed.

Feature extraction: is the process of extracting pertinent characteristics from EEG data that are correlated with characteristics of ASD, such as trouble interacting with others, trouble communicating, or repetitive activities.

Data Quality: Because noise and artifacts can seriously impair analysis and interpretation, it is imperative to ensure the accuracy and consistency of EEG data.

Machine Learning: The process of creating and refining machine learning models that can reliably divide people into ASD and non-ASD categories using EEG data.

Ethical Consideration: Participant permission, data anonymization, and potential biases in the dataset are among the ethical issues that must be taken into account while handling sensitive data pertaining to neurological diseases.

Project Objectives

To provide an accurate EEG signal diagnostic technique for autism spectrum disorder. This entails examining EEG data to find patterns and biomarkers linked to ASD, allowing people with and without the illness to be distinguished from one another.

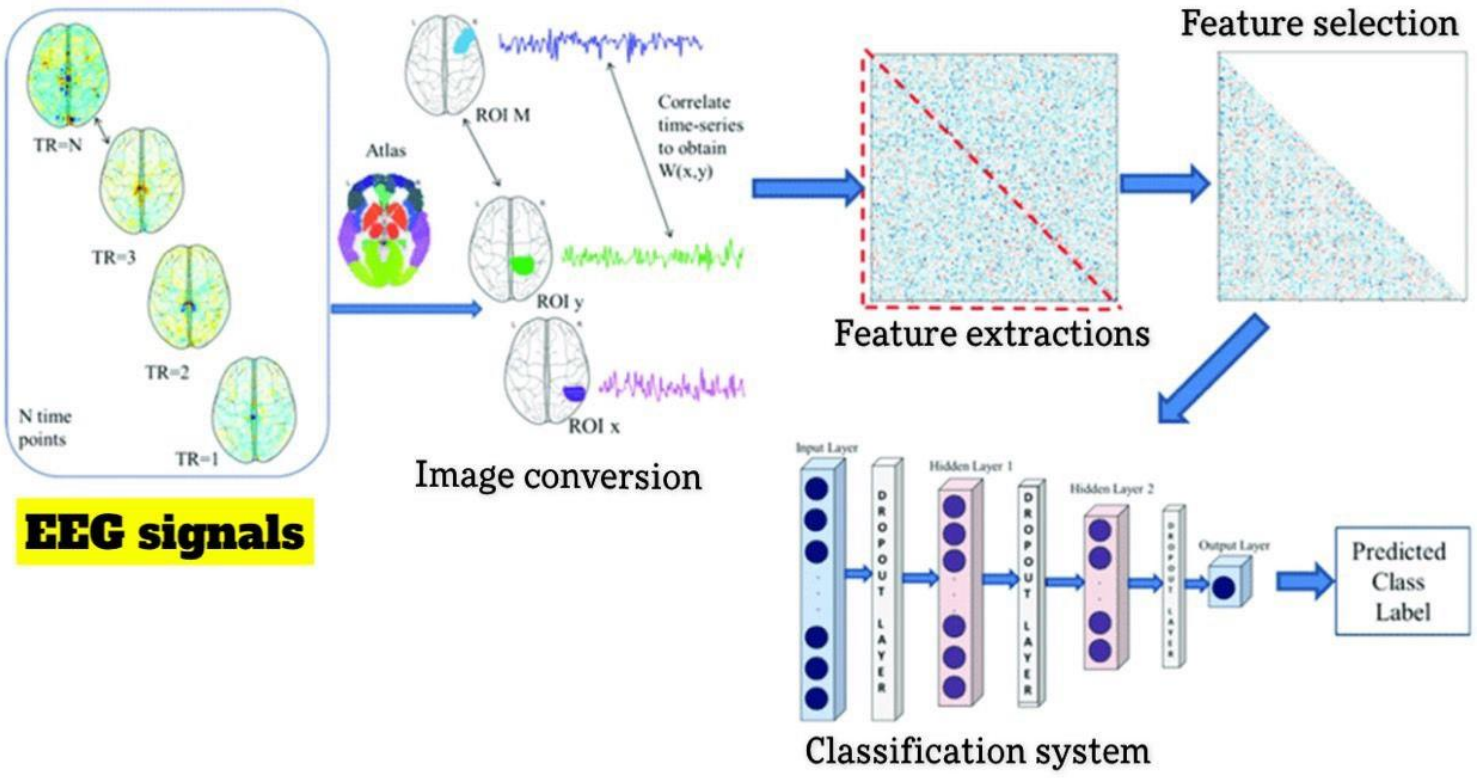
Effective intervention and assistance depend on an accurate and timely diagnosis. Behavioral evaluations, which may be subjective and time-consuming, are a common component of traditional diagnostic techniques for ASD. Electroencephalography (EEG) signals have attracted increasing attention in the past several years as a possible diagnostic and comprehension tool for ASD.

Project Scope

The goal of this research is to use electroencephalography (EEG) data to build a trustworthy, non-invasive diagnostic tool for autism spectrum disorder (ASD). We want to find distinguishing patterns and biomarkers that set apart neurotypical and ASD people through the analysis of EEG data. Improving early diagnosis will allow for prompt treatments and assistance for people with ASD.

Architecture Big Picture

Architecture Flow:



Project Methodology

1. Convert Signals into Images:

Signal to Image Conversion: Initially, the EEG signals will be converted into pictures using a 1-dimensional local binary pattern.

Spectrogram Conversion:

These features will then be transformed into spectrogram images using short-time Fourier transform (STFT).

2. Feature Extraction:

Advanced Deep Learning Models: We will employ advanced deep learning models such as MobileNet V2, ShuffleNet, and SqueezeNet to extract detailed features from the spectrogram images.

Hybrid Deep Lightweight Feature Generator:

This combination of models is referred to as a hybrid deep lightweight feature generator.

3. Select Important Features:

Relief Algorithm: We will use an algorithm called Relief to identify and select the most important features from the EEG signals.

4. Building the Detection System:

Feature Feeding and Classification: These selected features will be fed into various classifiers.

Testing and Validation: We will test the system using a method called 10-fold cross-validation.

Project Role & Responsibilities

- RACI Chart

TASK	MUJTABA	NUHA	RUBBAISHE
Project Planning	A	R	I
Data Collection	C	I	R
Data Preprocessing	I	A	R
Noise Reduction	R	I	A
Model Development	I	R	C
Model Training	R	C	I
Model Evaluation	R	I	A
Interpretation of Results	C	R	I
Validation	A	I	R
Report Preparation	I	A	R
Dissemination of Findings	R	I	A

Project Milestones

- Project Initiation and Planning
- Obtain and preprocess EEG data
- Create time-frequency representations
- Extract unique patterns and textures
- Train and optimize models
- Compare and validate models
- Develop and deploy the diagnostic tool
- Future Planning
- Dissemination and Knowledge Sharing

Project Plan

Gantt chart:

					MONTH	07	08	09	10	11	12	01	02	03	04	05
ACTIVITY	ASSIGNED TO	STATUS	Start	End		JULY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
Proposal Defense	Mujtaba,Nuha,Rubbaishe	Complete	2-Jul-24	2-Jul-24												
Comprehensive Analysis	Mujtaba,Nuha,Rubbaishe	Not Complete	24-Aug	24-Aug												
Planning	Mujtaba,Nuha,Rubbaishe	Not Complete	24-Sep	24-Sep												
Division Of Task	Mujtaba	Not Complete	24-Oct	24-Oct												
Division Of Task	Nuha,Rubbaishe	Not Complete	24-Nov	24-Nov												
Research the Assigned Task	Mujtaba	Not Complete	24-Dec	24-Dec												
Research the Assigned Task	Nuha	Not Complete	24-Dec	24-Dec												
Research the Assigned Task	Rubbaishe	Not Complete	24-Dec	24-Dec												
Analyzing	Mujtaba,Nuha	Not Complete	25-Jan	25-Jan												
Reporting	Mujtaba,Nuha,Rubbaishe	Not Complete	25-Feb	25-Feb												
Correction of Task	Mujtaba,Nuha	Not Complete	25-Mar	25-Mar												
Correction of Task	Rubbaishe	Not Complete	25-Mar	25-Mar												
Research Analization	Mujtaba	Not Complete	25-Apr	25-Apr												
Final Reporting	Mujtaba,Nuha,Rubbaishe	Not Complete	25-May	25-May												

Project Tools

Software Requirements

- Deep Learning Frameworks:

  TensorFlow, PyTorch
- Feature Selection:

  scikit-learn, Keras
- Data Repositories:

  PhysioNet, OpenNeuro
- Spectrogram Generation: MATLAB,

  Python (SciPy)

Hardware Requirements

- High-Performance GPUs

  (e.g,NVIDIA Tesla V100/A100)
- Large storage solutions

Project Deliverables

FYP-I Evaluation

- Project Plan
- Review of Literature and Assessment of Needs
- Data Collection and Analysis
- Research Design and Method
- SRS Document
- Project Report-I

FYP-II Evaluation

- Creation and Execution
- Assessment and Influence
- Awareness-Building Initiative
- Future Planning
- Budget Document
- Project Report-II
- Research Paper (First Draft)

References

Automated ASD detection using hybrid deep lightweight features extracted from EEG signals

- https://www.sciencedirect.com/science/article/abs/pii/S0010482521003425

Multi-View Separable Residual convolution neural Network for detecting Alzheimer's disease progression

- https://www.sciencedirect.com/science/article/abs/pii/S1746809424004336

Deep learning for neurodegenerative disorder (2016 to 2022): A systematic review

- https://www.sciencedirect.com/science/article/abs/pii/S1746809422006772

THANK YOU!