**Bangabandhu Sheikh Mujibur Rahman Science and Technology University**
**Department of Computer Science and Engineering**

# Research Project Proposal

Research Title: **Detection of Autism Spectrum Disorder by Feature Extraction of EEG Signals**

Type: Classification


Student Information:

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| Session | **2018-19** |

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## Abstract:

Autism Spectrum Disorder (ASD) is a neurodevelopmental that impact the social interaction and communication skills. Diagnosis of ASD is one of the difficult problems facing researchers. This research work aimed to reveal the different pattern between autistic and normal children via electroencephalogram (EEG) by using the deep learning algorithm. The brain signal database used pattern recognition where the extracted features will undergo the multilayer perceptron network for the classification process. The promising method to perform the classification is through a deep learning algorithm, which is currently a well-known and superior method in the pattern recognition field. The performance measure for the classification would be the accuracy. The higher percentage means the more effectiveness for the ASD diagnosis. This can be seen as the ground work for applying a new algorithm for further development diagnosis of autism to see how the treatment is working as well in future.[1]


## Introduction:

Autism Spectrum Disorder (ASD) is a syndrome that adversely affect a child where the behavioral symptoms start to appear during the first year of life. This early childhood onset includes symptoms such as lack in social interaction and very slow language skills development as stated by researchers. A continuous characters and behavioral assessment is conducted by specialist in order to detect autistic presence in a child. A documented analysis done by pediatrics stated that, an autistic child at approximately 24 months, are still unable to produce two meaningful word that do not involve imitating and repeating.[2] Despite so much research being conducted, the exact factors to why this disorder occurs remain unanswered. As of why this atypical behavior is very difficult to detect is maybe due to the barely noticeable changes of the primary neural impairment itself.

**Background and Motivation:**

Current ASD diagnostics based on behavioral assessments are subjective and time-consuming. The motivation lies in seeking objective biomarkers to enhance diagnostic precision and enable early intervention.

**Objectives:**

Develop a new feature extraction method to detect ASD using EEG signals. Investigate EEG as an objective ASD detection tool.Apply advanced signal processing for EEG data enhancement.Identify relevant features within EEG signals for ASD biomarkers.Develop machine learning algorithms for precise ASD classification.

## Related Literature Review:

Researchers have found hopeful signs in using EEG to detect ASD. One study noticed unique gamma frequency patterns, while another looked at the timing of brain responses (ERPs). Another study used smart computer programs and achieved good results, but they pointed out that more testing across different groups is needed. Even though we've made progress, we still need to figure out the best way to use EEG for ASD diagnosis in different situations. And we will use Time Domain Feature in this research. Time domain features are extracted directly from the raw EEG signal in the time domain. These features provide information about the amplitude, variability, and statistical properties of the signal.

## Research Methodology:

We propose a hybrid lightweight deep feature extractor to obtain high classification performance. The system was designed and tested with a big EEG dataset that contained signals from autism patients and normal controls. In this work, features are extracted from EEG signal using one-dimensional local binary pattern and the generated features are utilized as input of the short time Fourier transform to generate. There are few feature extraction:

1. Time-domain feature extraction
2. Decomposition-domain feature extraction
3. Spatial domain feature extraction
4. Frequency-domain feature extraction
5. Joint time-frequency domain feature extraction
6. mRMR feature extraction

**Research Type:**
This study adopts a quantitative research approach to investigate the detection of Autism Spectrum Disorder (ASD) through Electroencephalography (EEG) signals. The quantitative approach allows for systematic analysis and numerical measurement, essential for objective assessments and the development of a machine learning model.

**Data Sources and Description:**
The primary data source for this research comprises EEG recordings obtained from individuals diagnosed with ASD and neurotypical individuals. Ethical considerations will be paramount, and data will be collected from established clinical databases, research institutions, or through collaboration with medical professionals. The EEG recordings will capture brain activity during specific tasks or at rest, providing a comprehensive dataset for analysis.

**Research Methods:**

- Data Pre-processing
- Feature Extraction
- Machine Learning Classification
- Cross-Validation
- External Validation

## Expected Results:

We aim to develop a machine learning model that effectively uses EEG signals to distinguish between individuals with Autism Spectrum Disorder (ASD). We expect that the new feature extraction model can demonstrate high accuracy and robustness, demonstrating its potential for practical application in early ASD detection. Additionally, we anticipate identifying specific EEG features that serve as reliable biomarkers for ASD, contributing valuable insights to the field. This may result in a more accurate and reliable classification model compared to existing methods.

## Significance and Implications of the Study:

This research is crucial because it addresses the need for a more reliable and objective way to detect Autism Spectrum Disorder (ASD). By using EEG signals and developing a smart computer model, we aim to make the diagnosis process quicker and more accurate.The research is expected to advance our knowledge by identifying specific EEG features associated with ASD. This new understanding can contribute to a more precise and scientific approach to ASD diagnosis.

## References:


1. Autism spectrum disorder classification on electroencephalogram signal using deep learning algorithm.
2. Automated ASD detection using hybrid deep lightweight features extracted from EEG signals.
3. Energy-Efficient EEG-Based Scheme for Autism Spectrum Disorder Detection Using Wearable Sensors.
4. A study on EEG feature extraction and classification in autistic children based on singular spectrum analysis method
5. Accurate detection of autism using Douglas-Peucker algorithm, sparse coding based feature mapping and convolutional neural network techniques with EEG signals
6. Autism spectrum


**Signature of the Board Members: (Use for presentation's Board)**

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Comment: i) Accept ii) Contitional Accept iii) Not Accept

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Recommand for Project Exibition: Yes / No Supervisor Signature and Seal