Experiment to Classify Autism through Brain MRI Analysis

B.J. Bipin Nair, N. Shobha Rani, S. Saikrishna, C. Adith

Abstract--- Medical image processing technologies have been experiencing rapid improvement and changes in the earlier few years to support the medical industry. In this work an automated cognitive system is developed in demand to classify the ASD from the Brain MRI. MRI analysis provides a dominant tool for studying brain structural variations in ASD affected individuals. After detecting the ASD, we will predict the causing neurotransmitter pattern which made easy to find Autistic region in the brain. In this research, we using PCA feature extraction technique and naïve Bayesian for classification of autism. First, we using PCA technique to extract feature and classify the MRI image into two labels. The steps involved are Using median and unsharp masking the image is pre-processed in order to remove noise and improve the image. The pre-processed image is segmented in order to extract feature, segmentation is executed using Otsu segmentation technique. The white matter region is segmented and the feature is extracted using PCA technique. The features like Mean, RMS, SD, energy, homogeneity features are extracted and classify the image based on the extracted feature using PCA technique. We conclude that the classification of ASD is capable to make clear some of the contradictions in the literature.

Keywords--- ASD-Autism Spectrum Disorder, SVM-Support Vector Machine, ABIDE-Autism Brain Imaging Data Exchange.

I. INTRODUCTION

Medical image processing, comprises the analysis, enhancement andvisualisation of the images taken through, MRI, optical imaging, x-ray, and nuclear medicine and ultrasound technologies [7]. Image renovation and modelling methods permit.

Immediate processing of 2D signals to make 3D images [5]. Autism is a developmental disorder categorised by difficulties with public interaction and by limited and dull behaviour. These symptoms often develop slowly, however some children with autism touch their developmental marks at a usual pace and then worse Using the System autism and neurotransmitter patterns[1] affected are early detected, so is it is early detected it help to diagnosis in early stages of autism itself. So it will we helpful for the doctors deeper study of disorders without performing costly clinical test. Our proposed work we are going to classify the autism and the neurotransmitter [1] changes. In the proposed model The 772 MRI image are tested and noted that the Energy level for autistic image lies on 0.7 to 0.8 and normal brain energy lies between 0.6 to 0.7.The Classification is performed on the basis of energy value and the MRI image is classified into two labels that is autism affected and normal brain image. The existing autism autism system is not identifying the variations in the MRI feature values, which will help doctors to identify the stage of autism and the system which only Predict the neurotransmitters are working on Brain electroencephalogram (EEG) which is high cost to take EEG[7] but using our system from MRI we classifying the autism from the brain MRI can be taken at cheap rate compared with EEG.

II. LITERATURE REVIEW

Felicia S. Manciu et al [1] describes a Spectroscopic Analysis, The drive of this effort is to prove the sights of Raman spectroscopy mapping for direct detecting the neurotransmitters. This study is in answer to the necessity for novelties in slightly invasive tools for biomedical study's. Rajendra D. Badgaiyan [2] describes an developing method, which increases the possibility of human neuroimaging study by permitting the training of neurochemical variation related with brain processing. Kenneth Hugdahl et al [3] describes the divergence occurrence thus offers an preliminary summary of the fundamentals of fMRI, established on the blood-oxygenation level hooked on MRS, acting as synaptic transmitters .dataset is taken as Brain MRI image R.GeethaRamani et al [4] decribes categorize ASD and TD brain from structural connectome of brain from side to side classification techniques, uses Fisher FilteringLogistic Regression filtering. The structure can help the neurologists in improved analysis of the disorder. The dataset is collected from UCLA. computational methods are required for exploration of Brain. This effort deals is to identification of ASD. Xiongyi Liu et al [5] describes The quick progress of computer knowledge's giving confidence to achieve previous and additional exact analyses of ASD by using the Eye Gaze Tracking. Also the cheap cost, the key advantage is to enable cure is that stimuli created through each period of the treatment can be measured, which assurances reliability across diverse periods, but makes it probable to emphasis on a solo phenomenon, which is tough enough for expert to do. All expertise aided schemes for ASD trainings can be demonstrated as human machine interactive systems wherever one or more contributors would constitute as the human module, and a computer- or a robotic-based system will based machine module.

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Dongyun L [6] describes A Review of MRI Studies, This work emphasis on trainings using structural imaging methods, MRS, as wellrs-fMRI. RidhaDjemal et al [7] describesefficiency of proposed technique for autism diagnosis Using Wavelet, Entropy, and ANN. The investigational outcomes show the efficiency of proposed technique for autism diagnosis. NeerajBattish et al [8] worked onmany pre-processing methods are evaluated and then superiority of an image is find using statistical parameters. contrast stretching &noise filtering approaches are used to advance superiority of an image.Ravi Tejwani [9] describes Assessed and equated the FC variability across brain regions autistic population by examining brain imaging data from as ABIDE. Nicolas Traut et al [10] describes efficient meta-analysis to inspect the changes across earlier reports and to decide a combined effect size of objectify the alterations of cerebellar volumes in ASD. In the second part, describe the examination of cerebellar volume in the ABIDE cohort, and study the consistency of these results with those from the meta-analysis. Finally, define the analyses of the influence of different causes of variability.Bipin Nair BJ et al[11] describes outlining the substance structure of thedrug for ASD using computational tool. Revealing the ASD suppressor's molecular formula and structural formula.ManishaShivajiPawar et al[12] describes method for image classification works watershed transform aimed at segmentation and as of which the Haar wavelet features are figured and focused for classification by SVM.

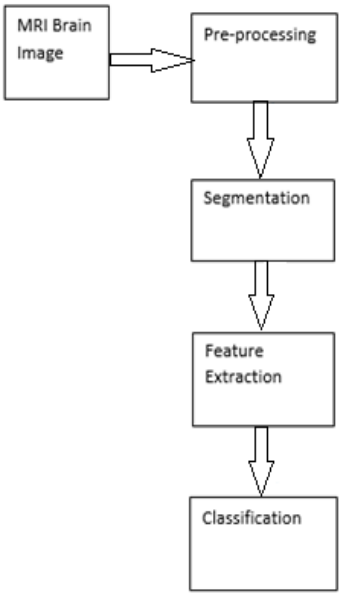
III. PROBLEM DEFINITION

Classification of Neuro Developmental Disorder through Brain MRI Analysis. Using median and unsharp masking the image is pre-processed in order to remove noise and improve the image. The pre-processed image is segmented in order to extract feature, segmentation is executed using Otsu segmentation technique. The white matter region is segmented and the feature is extracted using PCA technique. The features like Mean, RMS, SD, energy, homogeneity features are extracted. The 772 MRI image are tested and noted that the Energy level for autistic image lies on a certain level and normal brain energy lies between 0.6 to 0.7.The classification is performed on the basis of energy value and the MRI image is classified into two labels that is autism affected and normal brain image.

IV. METHODLOGY

In our proposed study we are using 10000 ASD MRI dataset.Using median and unsharp masking the image is pre-processed in order to remove noise and improve the image. The pre-processed image is segmented in order to extract feature, segmentation is executed using Otsu segmentation technique. The white matter region is segmented and the feature is extracted using PCA technique and classify the MRI image based on the feature values..The input image for the research is MRI brain image, which is taken as 2D form and taken in .JPEG format. After Uploading the pre-processing of the MRI image is performed. For pre-processing median filtering and unsharp masking have been used. After pre-processing the image is segmented using Otsu segmentation to extract the white matter region. For classifying the brain image as autism affected or normal MRI by using.The features like Mean, RMS, SD, energy, homogeneity features are extracted. The 772 MRI image are tested and noted that the Energy level for autistic image lies on a certain level and normal brain energy lies between 0.6 to 0.7.The classification is performed on the basis of energy value using naïve Bayesian classification and the MRI image is classified into two labels that is autism affected and normal brain image.

V. FLOW DIAGRAM



Collecting sample benchmark Brain autistic MRI images from ABIDE .Pre-processing the MRI image using median filtering and sharpening the image. The background is more seem in a section then use median of the earlier n frames as backgroundmodelsegmenting the Brain MRI using Otsu Thresholding

$$\sigma_x^2(a) = v_{0(a)}\sigma_0^2(a) + v_{0(a)}\sigma_1^2 \quad (1)$$

$V_0, V_1$are weight. The chances of twogroups divided by threshold and extracting the features from the MRI using PCA technique for feature extraction, where energy is considered as a main parameter. Energy (E) It measure the consistency of an image. While similar pixel values, the energy value high. It is defined as

$$E = \sqrt{\sum_{i=0}^{N-1}\sum_{j=o}^{N-1} M^2(Ai\,K)} \quad (2)$$

The brain MRI is classified using naïve Bayesian classification

$$P(s|a) = \frac{P(a|s)P(s)}{P(a)} \quad (3)$$

The chance of an incident happening given the chance of another incident that has already happened.

Where P represent posterior probability.

P(a|s)-Likelihood.

P(s)-class prior probability

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VI. DATASET

The data for the work is collected from ABIDE. ABIDE is a large database which consist of the human brain image data which is affected by autism. More than 10000 images are collected for the research work from ABIDE. The Brain images are downloaded in 3D format and using MRI slicer the 3D images are sliced converted it into 2D form. The Data are classified into two labels autism affected MRI image and Normal MRI image. For training 772 normal MRI image and 772 Autism affected MRI images are selected and trained.

VII. EXPERIMENTAL RESULT

The first module involved in this work, using median and sharpening noise is removed and the image is enhanced. The pre-processed MRI image is taken and it is segmented using Otsu thresholding in order to identify the autism affected region and that specific target region is segmented and the feature is extracted using PCA technique and classify the MRI image based on the feature values. The work is done by using MRI scan images From ABIDE Database taken as input in proposed work. Using the proposed work the Brain MRI is successfully segmented and the features are successfully extracted and the type of autism is classified. We are able to attain an accuracy of 88.3 % of detecting the disorder. Using region based segmentation the affected region of autism is segmented.

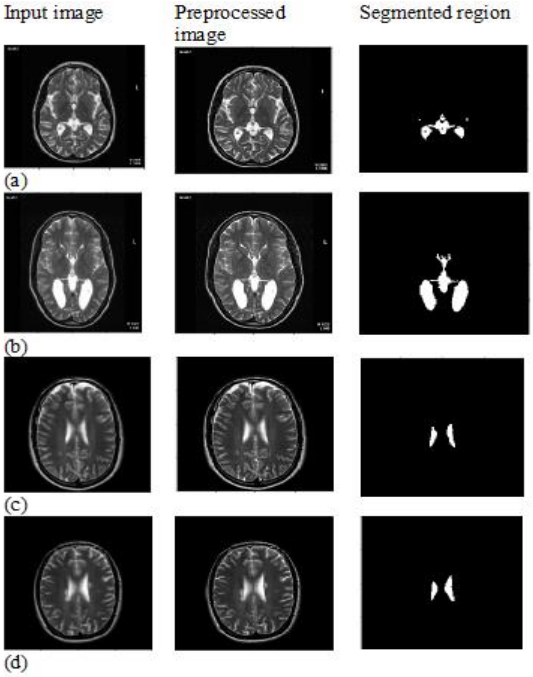

Fig. 1: Pre-processing and segmenting of brain image

In the above fig 1 a and b are Autism affected MRI brain Images and c and d are Normal Brain Images the corpus colosseum region of brain is segmented for feature extraction and classification. Using median and unsharp masking the image is pre-processed in order to remove noise and improve the image. The pre-processed image is segmented in order to extract feature, segmentation is executed using Otsu segmentation technique. The white matter region is segmented and the feature is extracted using PCA technique. The features like Mean, RMS, SD, energy, homogeneity features are extracted. The 772 MRI image are tested and noted that the Energy level for autistic image lies on a certain level and normal brain energy lies between 0.6 to 0.7.The classification is performed on the basis of energy value and the MRI image is classified into two labels that is autism affected and normal brain image.

Table 2: Feature extracted from MRI Brain image

Class	Mean	SD	Entropy	RMS	Energy
Normal Brain	0.0045	0.0896	3.4407	0.089	0.8237
Autism affected	0.0030	0.0897	3.2240	0.089	0.7543

The white matter region is segmented and the feature is extracted using PCA technique. The features like Mean, RMS, SD, energy features are extracted. The 772 MRI image are tested and noted that the Energy level is varying between autistic MRI and Normal Brain image.

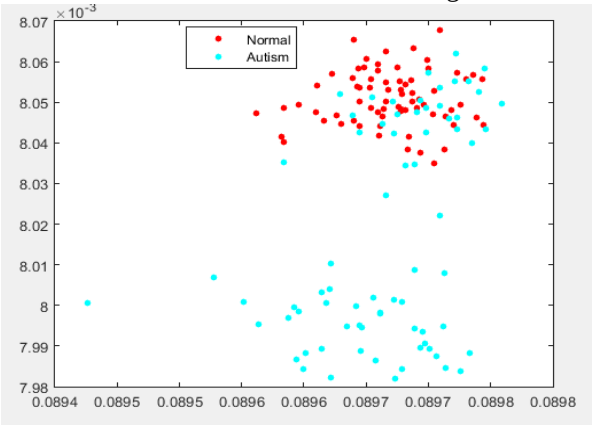

Fig. 2: Classification using naïve Bayesian

The MRI images are classified into two labels using naïve Bayesian classification algorithm, Autistic MRI and Normal MRI are classified into two groups.

Table 3: Confusion matrix

	predict_class1	predict_class2
Actual class 1	73	3
Actual class 2	3	71

Total Instance = 150
class1==>Normal Brain Image
class2==>Autism Affected Brain Image

Table 4: Two-Class Confusion Matrix

	True Positive	False Positive
False Negative	73	3
True Negative	3	71

Table 5: Overall Values

Accuracy	0.9600
Error	0.0400
Sensitivity	0.9605
Specificity	0.9595
Precision	0.9605
FalsePositiveRate	0.0405
F1_score	0.9605
MatthewsCorrelationCoefficient	0.9200
Kappa	0.9200

Using naïve Bayesian classification we are able to achieve an accuracy of 96% for classifying MRI images into two classes.

VIII. CONCLUSIONS

In short, imaging is widely used with radiosmaterials for recent research into decemptive disabilities. Provides a special insight into colinark imaging, collinjerg, dopaminemic and serotonergic systems. These are the non-identifiable mechanisms of the immune system in the healing phases.

Molecular imaging pathophysiology, mechanics at the designing disadvantages, and evaluating the consequences of the conduct of drugs, and also promotes the growth of drugs in the future. The continuous study of new methods of painting the central nervous system will also significantly improve our understanding of our changes in the structure of brain and in the structure associated with neurodegenerative disorders

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