

# Employing Thresholding and Sobel Technique to Detect Autism from MRI

B.J. Bipin Nair, Navaneeth Vijayan

**Abstract---** *In our proposed work we are doing various Segmentation methods to detect the autistic disorders using cerebral brain MRI. In this work we are collecting brain MRI image for autistic disorders and uses an efficient pre-processing technique to remove the noise from brain MRI, then for locating the damaged tissue from brain MRI we are using an efficient segmentation techniques like thresholding and sobel to extract the affected region, then proceeds with checking how efficiently we are detecting the affected region .*

**Keywords---** *ABIDE, MRI, Sobel edge detection, Digital Image Processing (DIP).*

## I. INTRODUCTION

Digital image processing is the practice of computer procedures to accomplish image processing on digital images. As a subgroup of signal processing, DIP has several rewards over correspondent image processing. It permits a much broader range of procedures to be applied to the input data and can evade complications such as reducing noise and signal. Since images are well-defined over dual scopes. DIP may be displayed in the method of multidimensional constructions. Medical imaging is the practice and course of generating visual pictures of the interior of a body for medical investigation, as well as visual depiction of some structures or tissues. Medical imaging pursue out to reveal internal structures secreted by the brain and bones, as well as to spot and treat sickness. Medical imaging also generates a best of normal anatomy and physiology to make it probable to find the irregularities. In our proposed work we will give additional contribution to medicinal field and it can do common detecting test to analyze and predict complex disease, using MRI image investigation, we can overcome all those things as well as it will help society to spot and diagnose deviations in children in the initial stage and can treat them accordingly.

## II. LITERATURE SURVEY

Mousumi Bala et al [1] is about the spectrum ailment; some of the people have the learning infirmities, psychological health related issues and hearing losses etc. To discover the explanations of autism disease, the study of corpus callosum of brain is supported out amongst the persons in which fMRI examined imageries are taken as the parameter. Primarily Sobel, Prewitt and Robert edge recognition is practiced correspondingly to spot the close boundaries of callosum and thresholding approach is practiced for segmentation. R Geetha Ramani et al [2] is

about Data Mining techniques and are widely used in medical field. Computerized scrutiny of Brain, a compound tissue is beneficial to Neurologists to sense ailments. ASD is the at most shared syndromes of Brain is found through computational methods. There are functional and structural connectomes used for this purpose. Structural connectome data's are used for classification. The structural connectomes are being made from the neuro images and bared. Here, the structural connectomes build from the Diffusion Tensor Imaging of Typically Developing (TD) and ASD are considered for classification of the typically developing and autism developing group of children. Classification Regression Tree (CR-T) Random Tree (RT) Naïve Bayes (NB), ID-3, K-Nearest Neighbor (KNN), Support Vector Machine (SVM) Ball Vector Machine (BVM) and Core Vector Machine (CVM) are being applied and the classifiers are built. These filtering and classification algorithms produce classification rules which are utilized in the detection of ASD and TD. Rachna Ahuja et al [3] is about an appraisal of technology-based involvements must primarily explain the use of the term technology. The duration is approximately defined as "the real claim of facts or the focused features of a particular turf of effort. This broad description covers effectively any evidence or entity that has been used in request to a field of homework. For example, the request of incentive control is skill to a communication clinician. An extra precise use of the tenure denotes the use of electromechanical progressions that repeatedly rise effectiveness and decrease manual procedures done by older technologies. Rajneesh Mahajan et al [4] is about the request of endophenotypes knowledge to neuroimaging in ASD. They first observe the impression of endophenotypes, the genetic and medicinal heterogeneity of ASD and examine the prevailing understanding of the brain liberal path in ASD.

The dataset used is Functional Magnetic Resonance Image technique (fMRI) and the various algorithm used are Magnetic Resonance Spectroscopy (MRS) and ADOS. Lena Lim et al [5] says about the Attention Deficit Hyperactivity Disorder is neuro disorder syndrome, but noticed by particular experimental and evaluation trials. The aim is to put on Gaussian classification to Grey matter measurable data, to evaluate whether separate ADHD youths can be acceptably distinguished from vigorous panels based on detached, brain construction actions and whether the disorder is related to ASD.

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VBM-DARTEL Image Pre processing, Image acquisition are the tactics used. In upcoming days use of machine learning based pattern identification studies help in the variance analytic sorting of ADHD with an added neutral and dependable degree such as a swift structural MRI scan. Jeffrey S. Anderson et al [6] here, they used a data-driven method to illustrate whole-brain efficient connectivity anomalies in a dataset of teenagers and young grown-ups with autism and certainly emerging controls, and to regulate whether these abnormalities could precisely classify individual matters with autism. The algorithm used are Regression. Future studies might explain whether more precise path length amounts for connections such as that may be grown with diffusion tensor tractography and controlling connections to those with reasonable anatomic substrates may expand accuracy of the classifier. DP Wall et al [7] says it is sensed over behavior features. Spotting autism has been distinguished with tools carefully planned to quantity losses revealing of autism in 3 rising zones: verbal and message, social communications and restricted or orthodox comforts and activities. Mostly machine learning techniques are used in this such as ADOS which agrees to the dataset. Horst Karl Hahn, et al [8] speaks that the Computer-assistance has grasped nearly every area within the arena of remedial imaging. Neuroimaging is where several of the recent image study methods have introduced but also where computer-aided decision in its lesser sense does not play a key role nowadays. Clinically used tackles rather narrate to computer-supported explanation and quantification of brain scrapes in CT and MRI, perfusion training from active imaging, restricted study of diffusion possessions, renovation of white matter extents from a sequence of diffusion-weighted MR imageries, and quantification of brain wither uses for the finding purposes. Christine Ecker, et al [9] says about the conventional of five morphological constrictions including volumetric and geometric constructions at respectively altitudinal location on the cortical surface was castoff to classify among people with ASD and controls by means of a support vector machine systematic method, and to treasure a spatially dispersed shape of regions with utmost cataloging weights. The range to which these groups differ at the equal of brain composition is unknown, and may be explored using SVM in future. Joseph Piven et al [10] says that this paper is to observe the scope of subparts of the corpus callosum in autistic persons. Process: The parts of 3 subparts (anterior, body, posterior) of the corpus callosum stood plotted on midsagittal MRI whose age is 18 years and 36 strong valuation focusses harmonized on phase and IQ. Results: After observing for entire brain capacity, gender, and performance IQ, the writers sensed a knowingly lesser scope of the physique and posterior sub regions of the corpus callosum in the autistic persons. Assumptions: In the framework of current intelligences of enhanced brain size in autism, numerous possible machineries are measured in discovering the implication of a slighter qualified extent of the callosum in autism. Dongyun L et al [11] is the investigation of MRI studies. Here the current Mri lessons is obsessed on the young kids with ASD targeting to offer vigorous Biomarkers for the judgement of childish ASD. The structural imaging method, Structural connectivity

study, DTI are the approaches used here. Evdokia Anagnostou et al [12] is the aim of this analysis is to recap the developing refrains from neuroimaging trainings created on numerous imaging systems, and to reflect the propositions of these outcomes and the probable next steps that may more explain the pathophysiology of Autism Spectrum Disorder. The main method used in this is FMRI. Hala Ali et al [13] suggest a innovative scheme for a brain MRI image dissection, which is made on a morphological phase over FCM bunching. In the initial stage, they uses multi-resolution to remain latitudinal situation among pixels. Next they practice the practical phase to rage the resultant images with the novel image to rise acuity and lessening noise in the handled image. Lastly, they use FCM repetition to segment the treated images. Brian Scassellati et al [14] says that the paper attentions on our efforts to progress the analytic values of autism by consuming social robots to deliver computable, objective dimensions of common retort. Though there are a handful of plans world-wide that observe the usage of automatons as part of a satisfying treatment for entities with autism. The methods used are iron chelation and MAO inhibition. Dataset composed from passive and individual items. The future measurements are for the evaluation of peoples of entities and to trail the variation in social ability presentation of a solitary individual. N Momeni et al [15] says that the studies is carried to discover out a candidate biomarker connected to the growth of these illnesses, but now no steady biomarker is remaining. Mass spectrometry practices have been castoff for protein delineation of blood plasma of children with such sicknesses in directive to find peptide that may be used as biomarkers for finding of the illnesses. Peptide summarizing and its sequencing methods are used for the findings with the use of the blood samples. Bipin Nair B J et al [16] The work proposes that they are relating computational procedure for illustration and the erection of suppressor medicine. Then they are citing the autistic suppressor's method and the operational formula. N Shobha Rani et al [17] the work is, a procedure is projected for finding of inconstant areas from matured leaflets by retaining the article uncovering practice and further histogram structures are linked to the bordering classifier. Bipin Nair B J et al [18] the work is, they have reformed the drug 2D structure through numerous predicting procedures and envisioned drug protein dealings through molecular dynamics and molecular docking techniques

### III. PROBLEM DEFINITION

Employing Thresholding and Sobel Technique to detect Autism from MRI. In this first we are going to collect the data sets of autistic MRI images. These images are further undergone through the preprocessing techniques which helps in the noise removal, then applying the various segmentation techniques to detect the autism. These accurate algorithm may help for the better detection and diagnosing purposes.

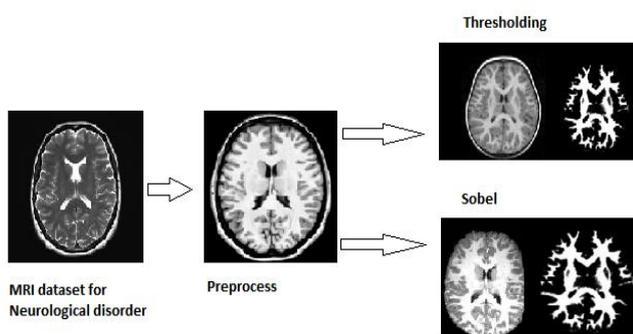
#### IV. METHODOLOGY

From our approach first, we are collecting the data set of brain MRI image, proceeded with pre-processing to locate the damaged tissue. In this method we are using median filtering technique to remove the unwanted noise, increases quality of image and enhances the image. After that applying various operations followed by segmentation such as edge based detection and thresholding methods to extract the disorder and finally extracts the affected region.

#### V. DATASET

The datasets are collected from the ABIDE and it is of about thousands. Out of thousand more than nine hundred images shows the accurate detection when we are applying the preprocessing and segmentations methods.

#### VI. FLOW OF DIAGRAM



The above diagram says us about the various steps to undergo to the detection of autism. First of all we are collecting the brain MRI images. These MRI images are further undergoes to the following techniques to detect the autism. The techniques used are preprocessing and semantic segmentation. Here we used median filter as a preprocessing techniques, It will enhance the image, remove noises from the image and increase the quality of the image and secondly we are using Sobel edge detection and thresholding segmentation methods.

#### Algorithm

Pseudocode for Median Filter  
 allocate outputPixelValue[img width][img height]  
 allocate wndw[wndw width \* wndw height]  
 edgea = (wndw width / 2) rounded down  
 edgeb = (wndw height / 2) rounded down  
 for a from edgea to image width - edgea  
   for b from edgeb to image height - edgeb  
     i = 0  
     for fa from 0 to wndw width  
       for fb from 0 to wndw height  
         wndw[i] = inputPixelValue[a + fa - edgea][b + fb - edgeb]  
         i = i + 1  
       sort entries in wndw[]  
     outputPixelValue[a][b] = wndw[wndw width\* wndw height / 2]  
 Pseudocode for Sobel operator  
 fn sobl(X : as 2d img arry)  
 Ga=[-1 0 1; -2 0 2; -1 0 1]  
 Gb=[-1 -2 -1; 0 0 0; 1 2 1]  
 rws = size(X,1)

```
col = size(X,2)
mg=zeros(X)
for k=1:rws-2
  for l=1:col-2
    f1=sm(sm(Ga *X(k:k+2,l:l+2)))
    f2=sm(sm(Gb *X(k:k+2,l:l+2)))
    mg(l+1,l+1)=sqrt(f1.^2+f2.^2)
  end for
  td = limits for apk [0,255]
  otpt_img = max(mg,td)
  otpt_img(otpt_img==round(td))=0;
  ret otpt_img
end fn
```

#### Mathematical formulae: Sobel

$$Ax = (C7+2C8 +C9) - (C1+2C2+C3)$$

$$AY = (C3+2C6 +C9) - (C1+2C4+C7)$$

Pseudocode for Threshold

```
1: Inpt1. 'Gy' is a gray scale
ii. Set td value
iii Set size 'Wnd'
iv 'Binriz' for binarize vector
2: for all rw 1 to ht-Wnd for col 1 to width-Wnd
  cur.pxel=Gy[rw, col];
3: Chk If (cur.pxel < avrg-td) Labl Binriz [rw, col] =0;
  else Labl Binriz [rw, col] =1; end;
4: end
5: Retn Binriz.
```

#### Mathematical formulae: Threshold

$$\sigma^2 = \frac{[(T) - \mu]^2}{B} \quad q_B(T)q_o(T)$$

#### VII. EXPERIMENTAL RESULT

In this proposed work we are going to find an efficient way of detecting the autism using a combined approach of two segmentation techniques. First we are going to do the preprocessing technique such as median filter. Then applying the thresholding and Sobel method.

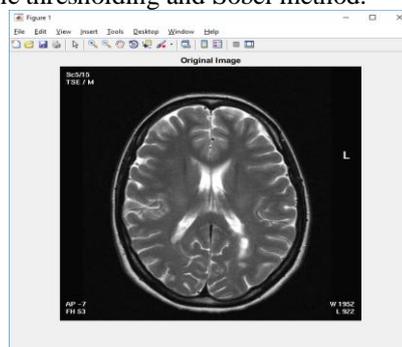


Figure 1: Original Image

Figure1 shows the original MRI image of an autistic brain.

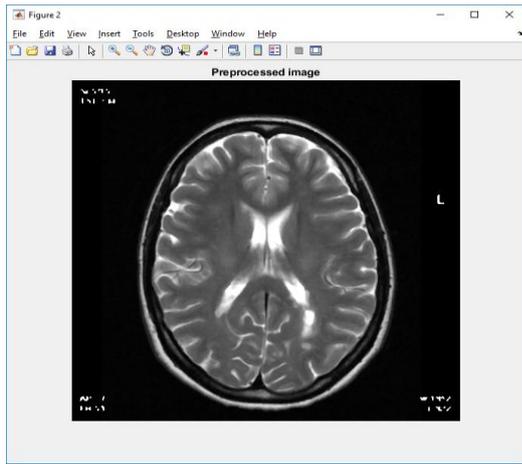


Figure 2: Preprocessed Image

Figure 2 shows us about the preprocessed image of an autistic MRI image. Here we are using the Median filter technique.

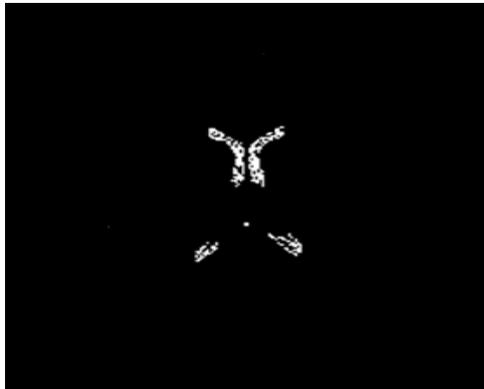


Figure 3: Threshold segmentation

Figure 3 shows us about the segmentation of MRI image and the used technique is Threshold segmentation. It will help to detect the autism. The white region is mentioned as autistic region.

Table 1: Accuracy rate of Threshold segmentation

Accuracy rate of Threshold segmentation	
start	stop
0.0450	0.0594

This result value shows the accuracy range of Threshold segmentation. It depicts that it takes more time for the segmentation method compared to the sobel edge detection.



Figure 4: Sobel Edge Detection

Figure 3 shows us about the segmentation of MRI image and the used technique is Sobel edge detection. It will help us to detect the affected region and the white edge corresponds to autism.

The collection of the datasets helps for the easy detection and the system will get accurate result. Collection of thousands of datasets and in those more than nine hundred datasets shows us the accurate result. Maximum possible accuracy of 88.5% is achieved through the proposed methodology. This system can help the neurology medical experts in analysing the disorder.

Table 2: Accuracy of Sobel Edge Detection

Accuracy rate of Sobel Edge Detection	
Start	Start
0.0450	0.0253

This result value shows the accuracy range of sobel edge detection. Sobel operator takes less time to complete the segmentation .The best accurate method is Sobel edge detection. This will helps us in the better detection and diagnosing.

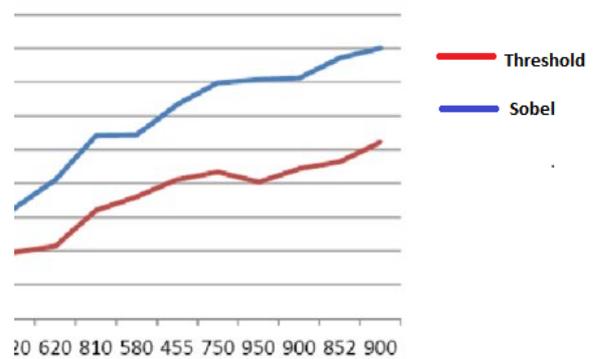


Figure 5: Depicting accuracy of Threshold segmentation and Sobel edge Detection

The above figure depicts us the accuracy range of both the segmentation techniques and it results us that the accuracy rate is higher for the Threshold segmentation compare to the Sobel edge detection. So that the best accurate method is Sobel edge detection. This will helps us in the better detection and diagnosing.

## VIII. CONCLUSION

Autism Spectrum Disorder is a brain affected ailment which disturbs the communication and interaction. Automated methods are sought to analyse. First we are going to do the preprocessing technique ie, median filter. This median filter helps to reduce the noise in an image and enhance the quality of the image. Then applying the thresholding and Sobel method. The Thresholding method will us to convert grey scale image to binary so that the intensity value is produced to white and black. The white regions will corresponds to Autism and black to unwanted. The Sobel edge detection method helps in the same way where the affected regions edges will be enhanced and identified. The future will provide finding an efficient way of detecting the autism using a combined approach of two segmentation techniques. So that the combination of two segmentation method will help to produce a new efficient and accurate algorithm in order to the detection.



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