



# AUTISM SEGMENTATION AND CLASSIFICATION USING MACHINE LEARNING

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**ABSTRACT:**

Autism Spectrum Disorder(ASD) is a neuro disorder, Because of this disorder an effected person has a lifelong effect on their interaction and Communication with other persons properly. Autism can be Diagnosed at any stage of that particular effected person life. Autism Spectrum Disorder(ASD) starts with childhood and it continues to keep going on its adolescence and adulthood of the person. Propelled with the rise in use of machine learning techniques in the research dimensions of medical diagnosis for various disorders, in this paper there is an attempt to explore the possibility to use Convolution Neural Network(CNN) for predicting and analysis of ASD problem in child using their thermal images as our input dataset. This project extends the recognizable proof of Autism from thermal image pictures utilizing auto encoder organize. Results given a proof that Machine Learning Strategies and methods bringing out the better classifiers delivering a great degree of arrangement exactness as in results. In our project we have used algorithms such as Support Vector Machine(SVM) and Convolution Neural Network(CNN) which will be compared in terms of accuracy.

**Keywords:** *Autism Spectrum Disorder(ASD), Convolution Neural Network(CNN), Support Vector Machine(SVM), Machine Learning*

**1. INTRODUCTION**

Autism Spectrum Disorder (ASD) is a very serious neurological disorder, appears in children between 6 and 17 years of age which impairs the ability to communicate and interact with the surrounded people. Autism Spectrum Disorder in patient affects the social interactions and Communications and causes repetitive behaviors[1].According to WHO , out of 160 there be an one child suffering by ASD and these ASD affected children often having other menta problems like anxiety, depression and attention deficit hyperactivity disorder[2]. Early

stage of ASD diagnosis during childhood is so much necessary for improving the social skills and communication to enhance the quality of life of the ASD affected children. This was the crucial thing that to identify autism in early stage and to diagnosis this problem[3].

In Simple one way we can say that they are not sure about what they want to talk or respond. Ex: if we shown alphabet letter “B” and “D” then they get confused with the both letters and can’t able to answer for it. Autism Spectrum Disorder impacts that the child’s nervous system and affects the overall emotional, social and physical health of the effected individual[4]. So it will be more difficult to the child if we don’t identify the autism disorder in the early stage of children. The word or the expression “SPECTRUM” in the “Autism Spectrum Disorder” is a sign of the wide scope of indications and seriousness of the disorder. The major or the main reason for the ASD is genetic and some environmental factors[5] . To be frank there are a lot of reasons for the cause of disorder in child. We will see what they are: having an immediate family member who’s having or suffered with autism, Certain genetic Mutations, because of the low weight of the new born baby as compared to the normal child birth weight, be a child or born to the old parents, Exposure to heavy metals and environmental toxins ex: while taking care of new born baby, parents using that so called chemical powder to prevent from rashes and those powder are made with toxic ingredients like silica, magnesium[6].

Autism Spectrum Disorder(ASD) is majorly diagnosed by the observation on the behavior changes in the child as compared to the behavior of a normal child. For the detection of autism spectrum disorder in a child is possible only when the symptoms as shown in the child means like core behavioral symptoms. The is possible when the child is grown more than 3 years. Thus, it is much more important and needed to identify imaging-based biomarkers in the stage diagnosis of autism spectrum disorder. Previous findings indicate that an abnormal pattern of the amygdala and hippocampal development in Autism persists through childhood

and adolescence. However, because of the low tissue distinction and tiny structural size of amygdaloid nucleus and hippocampal subfields, our information on their growth in autistics in early stage remains terribly restricted. In this paper, for the first time, we have a tendency to propose a volume-based analysis of the amygdaloid nucleus and hippocampal subfields of the baby subjects with risk of ASD at 24 months. Specifically, to deal with the challenge of low tissue distinction, we have a tendency to propose a completely unique deep-learning approach. Experimental results on National information for syndrome analysis (NDAR) show the benefits of our proposed method in terms of segmentation accuracy.

Now if we discuss about the treatment or cure for autism disorder there is no proper and certain treatment is available. But still there are few therapies and medications are in use for the autism. Diagnosing ASD can be very difficult because there is no specific medical test is available like blood test, to diagnose the disorder. The goal of the treatment is for ASD is to be maximize the child's symptoms and supporting development and learning. So Identifying the disorder in early stage of child like 18 months or younger it will be easier to control or cure Autism. The main problem comes here only that the symptoms of the autism child will be seen by others is when the child grows up means the autism suffering child cheeks looks differs than others. So to sort out this problem, We are going through the proposed model using Convolution Neural Network (CNN) with this proposed system we find the autism spectrum disorder in early stage of children[8].

- Classification with less time consumption and more accuracy.
- And User Friendly and should be applicable to all images.
- A **convolutional neural network (CNN)** is a class of deep neural networks, most applied to analyzing visual imagery.
- CNN is a type of feed-forward artificial neural network in which the connectivity pattern between neurons is inspired by the organization of the animal visual cortex.
- IN one word , we can say that an visual cortex on brain works like it analysis the objects on the picture or in video frame by layer wise it processed and provides awareness what exactly it is ,same as Convolution Neural Network Algorithm works.
- Along with CNN algorithm we are using Resnet50 Architecture for the classification of image.

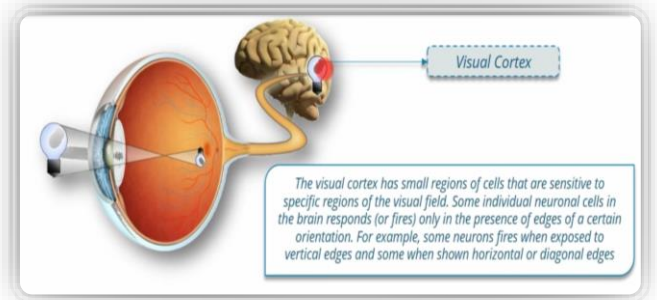


Fig 1: Visual Cortex

## 2. PROPOSED WORK

- The main objective of our system is that will identify the children has been affected by autism spectrum disorder or not with the help of Image Classification Technique. Here for the proposed system I am using Convolution neural network (CNN) Algorithm to find the child is normal or autism with the help of thermal images in the early stage of the children.

### 3. METHODOLOGY

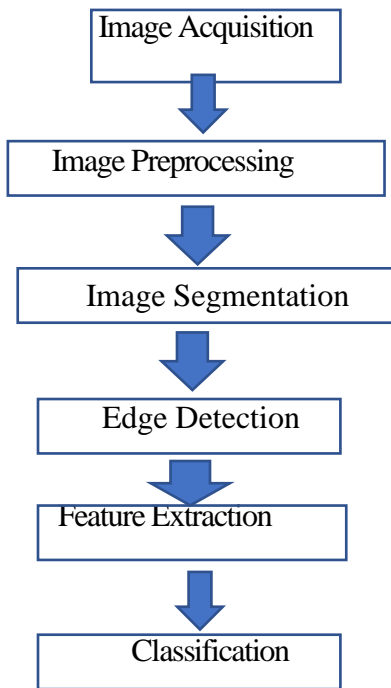


Fig 2: Flow Chart

**There are six elements that are included with in the system. We will get a look on each:**

- (i) IMAGE Acquisition
- (ii) Image Preprocessing
- (iii) Image Segmentation
- (iv) Edge Detection
- (v) Feature Extraction
- (vi) Classification

#### *i) IMAGE ACQUISITION*

In image acquisition, the real time autism thermal images of the children has been collected. The image samples that are used for this project are downloaded from online dataset provider Kaggle.com. The thermal images I was collected and used in this project are shown below.

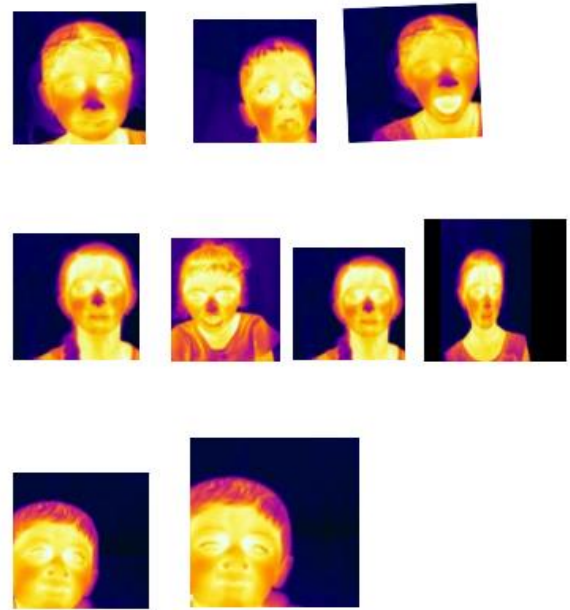


Fig 3: Input Images

The downloaded these thermal images are converted to gray normal images. Grayscale images have the combination of black and white. Grayscale images help to reduce the noise and background normal then these images memory has been reduced for the better classification purpose. The Input images after completion of converted to gray and reduction of memory are shown in below figure.

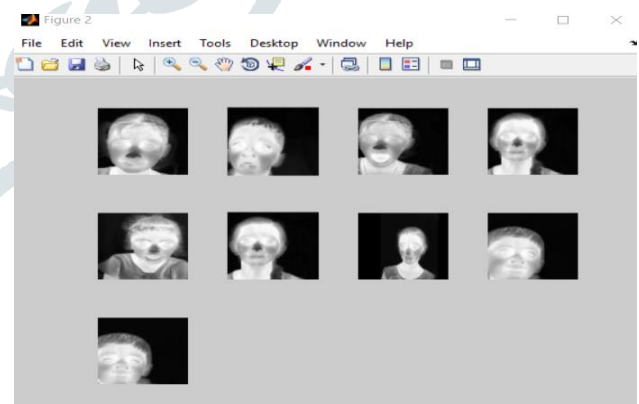


Fig 4: After black& white Conversion

## ii) Image Preprocessing

In Image Preprocessing, the converted grayscale images pass through the Median filter, then the noise in the every converted images will be reduced. “Median filter” is a non-linear digital filtering technique, which best technique for removing noise from the image. That means the blueness of those images has been reduced. It also helps to improve the brightness of the images. Images After Preprocessing Completion are shown in below figure.

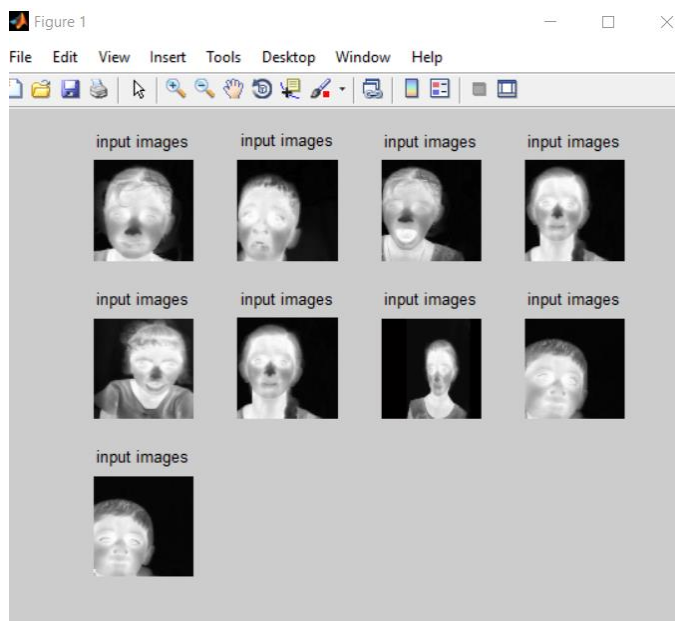


Fig 5: Preprocessed Images

## iii) Image Segmentation

Image Segmentation is nothing but to break down the images into a meaningful region. It divides the digital image into multiple segments. The main goal or purpose of this image segmentation is that to simplify or change the representation into meaningful image. It differentiates between the objects or a specific portion in an image that we want to inspect further and the other objects or background. It Consists of segmenting the converted grayscale images using “Region growing” Image Segmentation method. The region growing method is a well-developed technique for image segmentation. Images After Image Segmentation are shown in below figure.

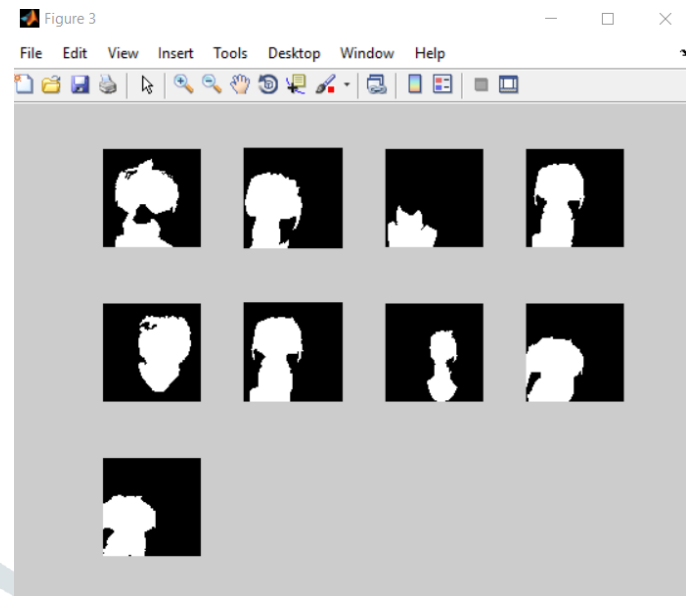


Fig 6: Segmented Images

## iv) Edge Detection

Edge detection is an image processing technique for finding the boundaries of objects within images that we are used for classification. Edge detection allows users to observe the features of an image for a significant change in the gray level of the particular image we used. This texture indicating the end of one region in the image and the beginning of another in the same image. It reduces the data in the image and preserves the structural properties of an image.

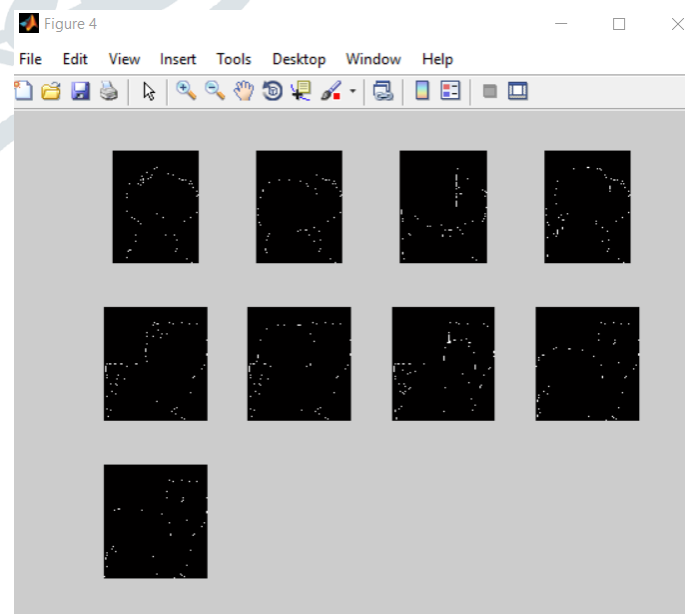


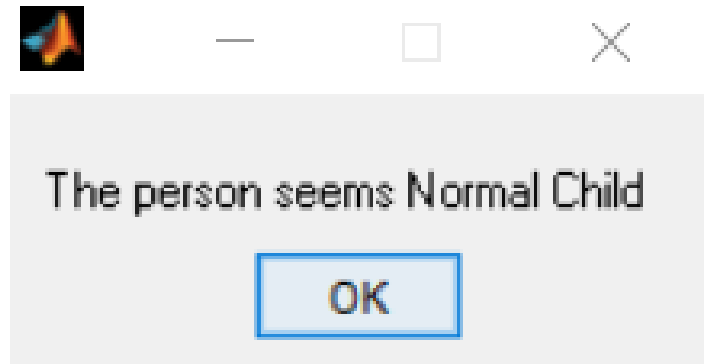
Fig 7: Edge Detected Images

### v) *Feature extraction*

Feature Extraction is nothing but extracting of the segmented portion of the image we processed so that the classification becomes easy. Features are extracted in order to differentiate between the images we are processing. The main goal of the features extraction is that to convert the segmented objects into representations that better describes their main features. After Segmentation and Edge Detection There will be output image in that image we are mainly focusing on parts like eyes, nose and mouth. The feature extraction process is done on basing these three parts. For the understand of an image to the machine learning algorithm ,In feature extraction the features of the segmented image will be extracted by converting the image in gray level co-occurrence matrix. With the help of this the algorithm considering few parameters like entropy of the image, contraction, energy of the image with the help these parameters of the segmented image the further classification step works.

### vi) *Classification*

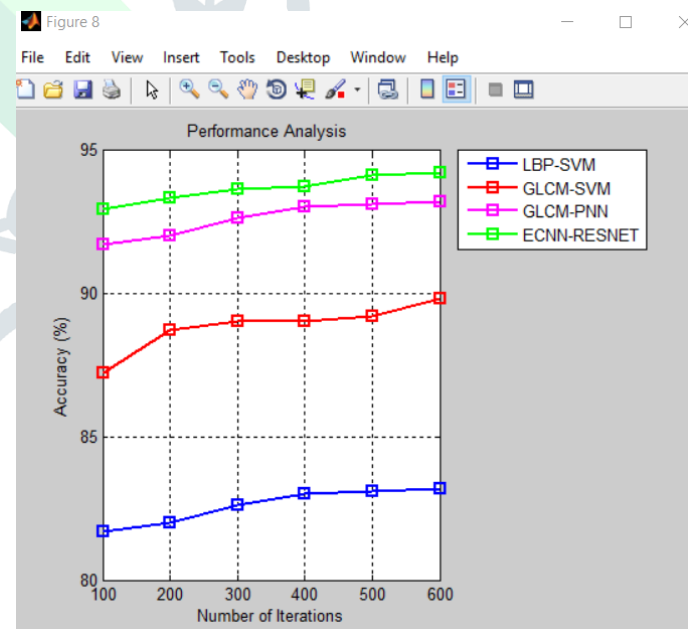
Here in classification step, the concept of Convolution Neural Network (CNN) for classification method has been used. In this Classification module includes Tensor flow and machine learning algorithms are used. Tensor flow is a MATLAB-friendly open-source library for numerical computation that makes the machine learning faster and easier so it will become a part or including in the classification. Tensor flow allows developers who are using it, is to create dataflow-graphs- structures that describe how data moves through a graph, or series of processing nodes. Each node in the graph represents a mathematical operation and each connection or edge between nodes is multidimensional data array or tensor. And In this Classification, we get into a conclusion for that the images we used are that the images are belongs to normal child or autism child, means we find that the child is autism child or a normal child.



**Fig 8: Result**

### Accuracy-Graph:

Accuracy Graph, the below shown image is an accuracy graph. Accuracy comes out to 93 for 100 iterations. That means our Convolutional Neural Networks Algorithm with RESNET50 Architecture is doing a great job for classification of autism spectrum disorder.



**Fig 9: Accuracy Graph**

#### 4. Conclusion

In the present study the performance of machine learning model has been improved. The Proposed Model has been achieved on an accuracy of 93% .To improve the performance, few changes has been done such as number of layers were increased, number of iterations increased. The achieved accuracy good when compared to test results.

#### Bayes-Classifer-

[Park/b78965bf829cd33798264321be4b21df7a290624#citing-papers](https://www.researchgate.net/publication/3578965bf829cd33798264321be4b21df7a290624#citing-papers)

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