International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0028

e ISSN: 2584-2854
Volume: 03
Issue:02 February 2025
Page No: 161-166

Detecting Autism Spectrum Disorder(ASD) Using CNN and its Methods in Deep Learning Techniques

A. Aafiya Thahaseen[1], S. M. Karpagavalli[2], M. Rabiyathul Fathima[3], S. Sangeetha[4], M. Lidiya[5]
[1,2,3,4,5]Assistant Professor, Computer Science and Engineering, Al-Ameen Engineering College, Erode, Tamil Nadu, India.
Email ID: *aafiya.alameencse@gmail.com[1], karpagam.rathan@gmail.com[2], rabiyacse95@gmail.com[3], sangeethanandhi13@gmail.com[4], lidiya86@gmail.com[5]*

Abstract

The world has seen the advent of numerous illnesses that cannot be medically recognized, such as Autism Spectrum Disorder (ASD). Autism, now called autism spectrum disorder (ASD), is a neuro developmental disorder. ASD is a developmental disability caused by differences in a person's brain. People with ASD may behave, interact and learn in ways that are different from other people. They may have trouble with social interactions and with interpreting and using nonverbal and verbal communication. Autism is known as a "spectrum" disorder because there is wide variation in the type and severity of symptoms people experience. People of all genders, races, ethnicities, and economic backgrounds can be diagnosed with ASD. Like all people on the autism spectrum, people don't naturally read social cues and might find it difficult to make friends. They can get so stressed by a social situation that they shut down. They don't make much eye contact or small talk. People on the spectrum who are high-functioning can also be very devoted to routine and order. They might have repetitive and restrictive habits that seem odd to others. Early diagnosis based on different health and physiological characteristics seems feasible with the rising usage of machine learning-based models in predicting many human diseases. The proposed study with aims to use deep learning techniques like CNN, VGG16, VGG19, Densenet, Alexnet to predict the likelihood of ASD with a better degree of precision and minimal error rate and better accuracy. Further study is also required to find out much more optimized technique for the ASD detection

Keywords: *Autism Spectrum Disorder (ASD), CNN, VGG16, VGG19, Densenet, Alexnet*

1. Introduction

A neuro-developmental disorder is the classification given to autism spectrum disorder (ASD). Generally, hyperactivity, problems with social communication, learning challenges, and language impairments are some of the characteristics that define them. An extensive overview of neuro-developmental problems, including ASD and other related illnesses, was published in an article by the America's Children and the Environment (ACE) organization [1]. ASD can have multiple origins, including as environmental conditions, particular substances in diet, and genetics. With an estimated ratio of 1 in 68 children, the frequency of ASD has been rising. Depending on the youngster and the severity of their ASD symptoms, diagnosing an individual with ASD usually takes two to three days. Usually, a number of medical professionals with different disciplines manually diagnose ASD in children based on their behavior. Typically, this manual diagnosis identifies ASD in children three years of age or older [2]. It could take a while before any benefits from starting therapies at this point become apparent. Numerous studies have been conducted recently with the goal of accelerating the diagnosis process in order to detect ASD early and enhance treatment outcomes. Out of all the methods investigated, machine learning has proven to be a dependable and effective way to identify ASD, cutting down on processing time considerably. This method has demonstrated promise in improving overall diagnostic efficacy and facilitating prompt treatments for improved ASD management. It is true that machine learning techniques can train systems on

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0028
e ISSN: 2584-2854
Volume: 03
Issue:02 February 2025
Page No: 161-166

historical data, allowing them to predict ASD in a reasonably short amount of time. Supervised and unsupervised learning are the two main categories into which machine learning falls. For the purpose of forecasting ASD, supervised learning is seen to be more appropriate and precise [3]. It uses a rule-based methodology to build accurate predictive models for ASD by looking at empirical facts. Many algorithms exist in the field of supervised learning. The goal of this study has been to find effective algorithms for the detection of autism spectrum diseases, particularly in the field of neural networks. The autism dataset gathered from the ABIDE repository has been subjected to these methods. The research analyses the accuracy attained and displays the outcomes of various network methods [4]. Making educated decisions on the early-stage prediction of autism spectrum disorder (ASD) can be aided by these precise results. Through the development of their behavioral and emotional skills, early autism treatments employing deep learning techniques thus offers autistic individuals a new avenue to potentially lead a better life. ASD, deep learning, supervised learning, the analysis procedure, and result analysis are covered in the ensuing sections [5].

2. Problem Statement

To assist clinicians in reaching an early and more accurate diagnosis, a Computer Aided Detection (CAD) tool for iterative autism detection should be developed. It should also offer a sufficient description of the methodologies used to construct the tool, which include feature selection, extraction, and classification of neuroimaging images [6].

3. Literature Survey

A neurodevelopmental disorder known as autism spectrum disorder (ASD) frequently results in repetitive behaviours and impairs social interaction and communication abilities. Deep neural networks have proven to perform exceptionally well in a wide range of applications [7]. A convolutional neural network (CNN) with the ResNet-50 architecture is one method that suggests being used to identify young children who are at risk of ASD at an early age. This approach has produced good results in terms of sensitivity and specificity by analysing photos of people with ASD and normal controls. In a different study, self-attention graph pooling and graph convolutional networks (GCNs) applied directly to a population-averaged brain network are used to create an ASD prediction model. Once trained, this model is simply applicable to new patient diagnosis and has achieved much higher accuracy on the ABIDE-I database than previous models. Due to the complexity of its mental symptoms and the paucity of available neurobiological data, diagnosing ASD is still difficult [8]. Convolutional and recurrent neural networks, among other deep learning models, have been used, nevertheless, to look at the strategic and structural elements of ASD. Researchers have visualized combinations of brain regions that are highly suggestive in the classification process by training 3D convolutional neural networks. Recurrent neural networks have also been used to effectively classify brain area sequences. Important structural and strategic evidence has been found in this probe, especially in relation to subcortical regions like the basal ganglia (BG), which are involved in the characterization of ASD. Accurately identifying and screening children for ASD is challenging due to the dearth of ASD specialists in rural areas, despite the importance of early diagnosis. Numerous methods have been developed to assess the efficacy of ASD and identify it in its early phases. A dataset comprising scans of 300 children with and without ASD was made available for the 2019 Saliency for ASD Challenge in order to evaluate saliency prediction for ASD and classification algorithms. In applications related to computer vision and image analysis, deep learning has demonstrated remarkable performance. A suggested method for classifying ASDs makes use of convolutional neural networks (CNNs). When LeCun et al. first presented CNNs in 1989, they were effectively used to recognize handwritten zip code digits for the US Postal Service. It was shown that CNNs are more capable than standard pattern analysis and classification techniques in handling massive amounts of low-level data directly. However, CNNs were not widely employed until two decades later due to limits in processing power.In applications related to computer vision and image analysis, deep learning has demonstrated remarkable performance. A suggested

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0028
e ISSN: 2584-2854
Volume: 03
Issue:02 February 2025
Page No: 161-166

method for classifying ASDs makes use of convolutional neural networks (CNNs). When Le-Cun et al. first presented CNNs in 1989, they were effectively used to recognize handwritten zip code digits for the US Postal Service. It was shown that CNNs are more capable than standard pattern analysis and classification techniques in handling massive amounts of low-level data directly. However, CNNs were not widely employed until two decades later due to limits in processing power. Chellapilla et al.'s 2006 introduction of potent GPUs (Graphics Processing Units) greatly sped up CNN computations. The original CNN method has been improved in a number of ways, including the addition of max pooling by Huang et al. in 2007. Using deep convolutional neural networks, Alex Krizhevsky et al. revolutionized large-scale image recognition in 2012 and produced remarkably accurate results on the ImageNet dataset. Deep convolutional neural networks have since been effectively used in many different industries.

4. Methodology

In the proposed system we are going to collect the x ray reports of brain and we will analyse effective autism prediction and detection tool using the deep learning model in the mere future. In this paper we will be comparing the results of various CNN methodologies for the autism disorder prediction and we will be comparing the results to find out the most effective algorithm. The data sets can be collected from kaggle database and the classes of data could be "Autism detected" and "No symptoms of Autism". We can use these image datasets and apply in any algorithm like CNN, CNN, VGG16, VGG19, Dense-net, Alex-net. The most promising result can be considered for the accuracy.

5. Convolutional Neural Network(CNN)

An artificial intelligence technique called a neural network trains computers to process information in a manner similar to that of the human brain. Deep learning is a kind of machine learning technique that uses networked nodes or neurons arranged in a layered pattern to mimic the organisation of the human brain. Computers can utilise this adaptive approach to learn from their errors and keep getting better. As a result, artificial neural networks make an effort to more accurately address challenging problems like document summarization and facial recognition. The convolutional neural network, often known as Conv-Net or CNN, is a deep learning network design that learns information directly from data. Dozens or even hundreds of layers may make up a convolutional neural network, and each layer learns to identify a distinct aspect of an image. Every training image has filters applied to it at varying resolutions, and the result of every convolved image serves as the input for the layer after that. The attributes that define an object uniquely can be achieved by increasing the complexity of the filters, which can begin with highly basic features like brightness and edges. When trying to find patterns in photos to identify objects, classes, and categories, CNNs are quite helpful (Figures 1 & 2). They can also be very useful in the classification of signal, time-series, and audio data.

5.1 Layers, Classification, and Feature Learning

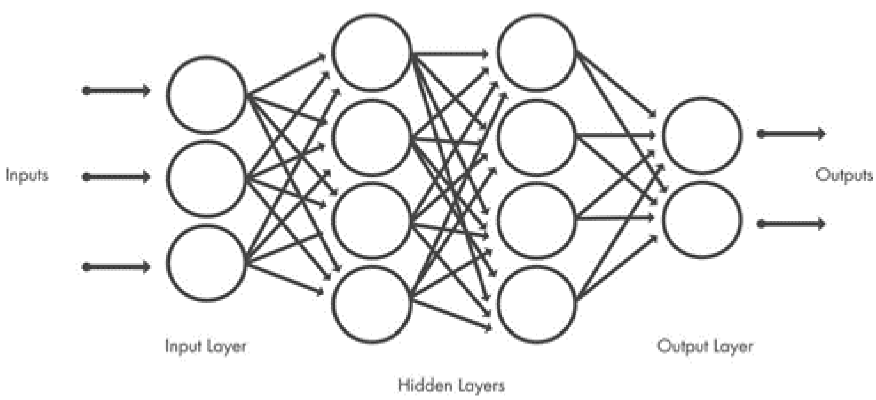

Figure 1 Convolutional Neural Network (CNN)

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0028
e ISSN: 2584-2854
Volume: 03
Issue:02 February 2025
Page No: 161-166

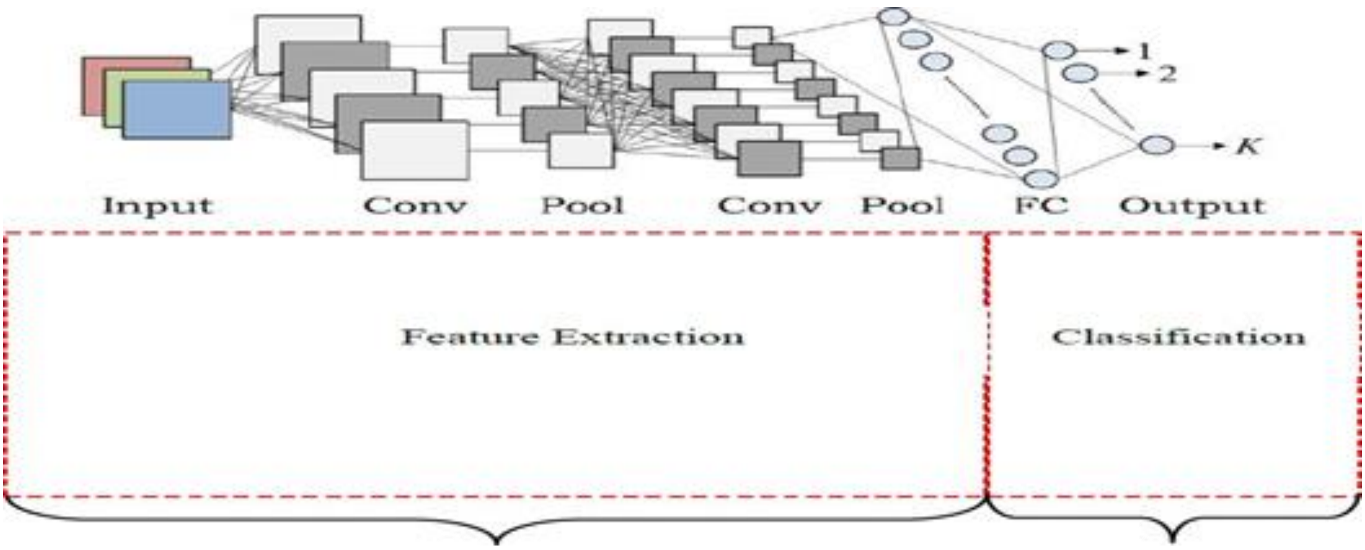

Figure 2 **Visual Representation of a (CNN)**

These layers carry out data-altering activities with the aim of identifying properties unique to the data. The three most used layers are pooling, activation (also known as ReLU), and convolution. Through a series of convolutional filters, each of which activates a different feature from the input images, convolution processes the images. The Rectified Linear Unit (ReLU) preserves positive values while translating negative values to zero, enabling quicker and more efficient training. Because only the activated characteristics continue into the next layer, this is frequently referred to as activation. By executing nonlinear down sampling, pooling reduces the number of parameters that the network needs to learn and simplifies the output.

5.2 VGG16

Convolutional neural networks, or CNNs, like the VGG16 model are thought to be among the best computer vision models available today. The model's developers assessed the networks and used an architecture with minuscule (3 × 3) convolution filters to increase the depth, demonstrating a notable advance above previous state-of-the-art setups. They increased the depth to roughly 138 trainable parameters by pushing it to 16–19 weight layers. In VGG16 there are thirteen convolutional layers, five Max Pooling layers, and three Dense layers which sum up to 21 layers but it has only sixteen weight layers i.e., learnable parameters layer.

5.3 VGG19

The VGG-19 is a 19-layer convolutional neural network. The ImageNet database contains pertained versions of the network that have been trained on over a million photos [1]. Images may be classified by the previously trained network into 1000 different object categories, including various animals and keyboards, mice, and pencils.

5.4 Alex Net

The first convolutional network to employ a GPU to increase performance was called Alex-Net. There are five convolutional layers, three max-pooling layers, two normalisation levels, two fully connected layers, and one softmax layer in the Alex-Net design. A nonlinear activation function (ReLU) and convolutional filters make up each convolutional layer. Max pooling is carried out via the pooling layers. The existence of completely connected layers results in a fixed input size. Although the input size is stated as 224x224x3 in most places, it actually comes out to be 227x227x3 because of some padding. There are 60 million parameters in all for Alex Net.

5.5 Dense Net

An example of a convolutional neural network that makes use of dense connections between layers is a Dense Net. Dense Blocks allow us to connect all layers directly, provided that their feature-map sizes match. Every layer receives extra inputs from every layer that came before it and transmits its own feature maps to every layer that comes after it in order to maintain the feed-forward nature (Table 1).

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0028
e ISSN: 2584-2854
Volume: 03
Issue:02 February 2025
Page No: 161-166

Table 1 CNN Architectures with Parameters

CNN Architecture	Year	Developed by	No. of Parameters
CNN	1990	Yann Le-Cun	Sum of all weights and biases
Alex-Net	2012	Alex K et al	62.3 million
VGG-16	2014	Simonyan, Zisserman	138 million
VGG-19	2014	Simonyan, Zisserman	144 million
Dense-Net	2016	Gao Huang et al.	20 million

5.6 Feature Extraction Classification

To find the deep learning model that predicts autism with the highest accuracy rate, this study applied a number of different models, including CNN, VGG16, VGG19, Dense-Net, and Mobile-Net. These results show that the results generated from this study are more accurate than those from medical scoring systems used to warn cardiac patients about their risk of autism. Results are shown in Figures 3 & 7.

5.7 Accuracy Comparison

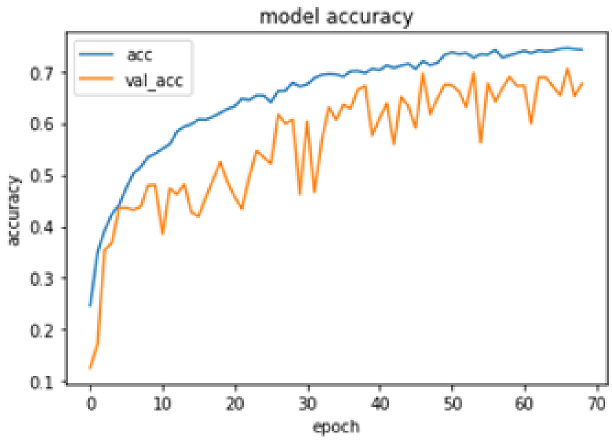

Figure 3 CNN

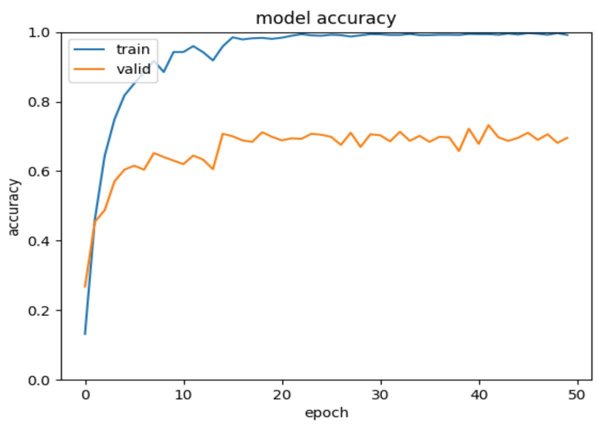

Figure 4 Alex-Net

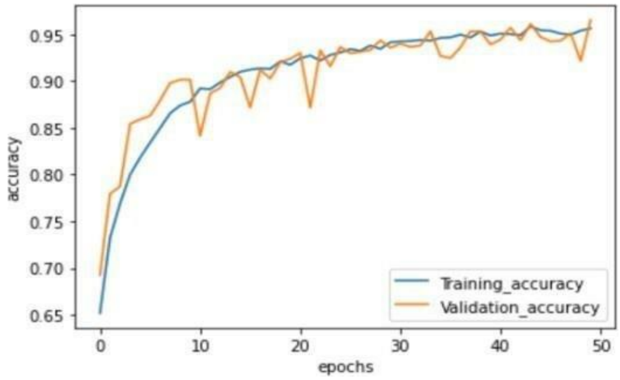

Figure 5 VGG16

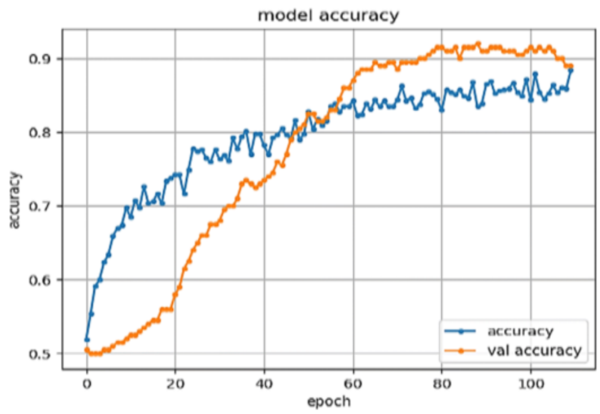

Figure 6 VGG19 Alex-Net

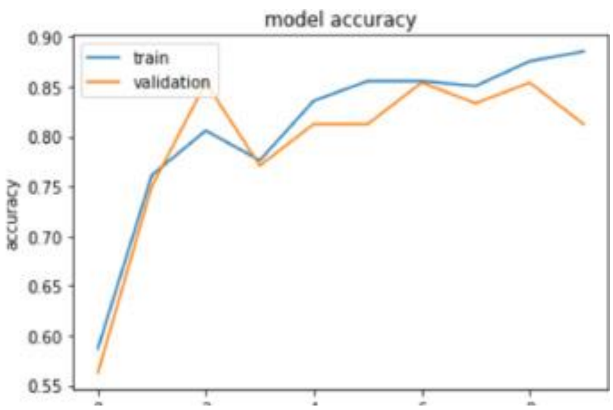

Figure 7 Dense-Net

Conclusion

In particular, the fields of prognosis and data analytics heavily rely on deep learning for disease prediction in the healthcare industry. Using patient health records, comparisons with prior instances, observations, or inspections are made in order to leverage data for analysis in this technique. A number of human experts must be involved in the process of extracting concepts or decision-making procedures from a single source due to the complex range of risk factors linked to autism. Still, the most significant obstacles to disease prediction stem from the large amount of heterogeneous and complex medical data. Therefore, algorithms with very high accuracy are essential for diagnosing medical conditions. Nevertheless, little is known about how these algorithms were developed, even though they are essential to healthcare. When certain advantageous conditions are met, such properly planned and prepared inputs, optimal performance is attained. Consequently, throughout the prediction process, deep learning makes it possible to reveal previously undiscovered or unarticulated knowledge. This knowledge helps doctors make better decisions by giving patients helpful advice and cautions about the unpredictable nature of autism.

References

[1]. International Journal of Advances in Engineering Architecture Science and Technology Autism Spectrum Disease Prediction using Deep Learning, Manjesh R, Ninada D, Neema Jain V Namitha M, Abhilasha H A, ISSN: 2583-7346, June 2023, Volume-1, Issue-3, pp. 14-22.
[2]. Dinh C Nguyen-Integration of Blockchain and cloud of things: Architecture, applications and challenges-2020.
[3]. Xing yang, samansaraf, Ning Zhang.2018. Deep Learning based framework for Autism MRI Image Classification. Journal of the Arkansas Academy of Science: Vol. 72, Article 11.
[4]. Rawat W and Wang Z. 2017. Deep convolutional neural networks for image classification: A comprehensive Neural computation 29(9):2352-2449.
[5]. Shikauchi, Y., Nakae, K. (2015). Deep learning of fMRI big data: a novel approach to subject -transfer decoding. arXiv:1502.00093 [stat.ML].
[6]. Chellapilla K, S Puri, and P Simard. 2006. High performance convolutional neural networks for document processing. In: G. Lorette, editor. Tenth International Workshop on the Frontiers in the Handwriting Recognition, La Baule(France), (Universite de Rennes 1, Suvisoft. http://www.suvisoft.com) p 386-408.
[7]. Huang FJ, YL Boureau, and Y LeCun. 2007. Unsupervised learning of invariant feature hierarchies to object recognition. In 2007 IEEE Computer Conference on Computer Vision and Pattern Recognition.
[8]. Krizhevsky A and GE Hinton. 2012. ImageNet classification with deep convolutional neural networks. In: Advances in neural information processing systems. p 1097-1105.