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AUTISTIC DISORDER SPECTRUM USING INCEPTION V3

Computer Science

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ABSTRACT

When diagnosed early, autism spectrum disorder (ASD) can cut healthcare expenses by as much as 80% if not more. On the ImageNet dataset, Inception v3 has been demonstrated to achieve above 75% accuracy in picture recognition. One of the techniques used in the healthcare industry is called Deep Transfer Learning (DTL).
Inception V3 gives 86% accuracy for Image dataset of Autistic Kids, train loss 0.6695, Val loss 0.9823 .The model made up many convolution layers with wide range of parameters, pooling layers helps in reducing the dimensions which helps in finding feature maps efficiently. Batch Normalization, spatial factorization, using Auxiliary filters and reduce Grid size are the major highlights.

KEYWORDS

Autism Spectrum Disorder, Detection, Classification

INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental disorder that affects the nervous system. There is a wide range of symptoms and abnormalities in children with autism spectrum disorder (ASD). every kid develop different types of effects , few are social and interactive communication. If they don't don't recover in normal way , they will face situation like odd man out in society and leads to depression.

Autism starts with someone less interactive with other kids and sitting alone ,very depressed, angry, less interaction with social involvement in communication. Guardians should put extra effort to look after these kids, Exact correct cause for this disease still not found. There is no cure for autism spectrum condition, but if it is discovered early on, there is a chance of lessening its severity. Main intention of this paper is to show the Parents and society with disease to detect by facial expression of kids while interacting with other person.This work has implemented in Spyder IDE, python libraries like Pandas, Deep learning Algorithms ,Tensorflow.

The paper shows basic Inception V3 architecture. Section II Represents the Inception V3 algorithm. Section III overview Literature Review ,Section IV overview Methodology,SectionV describes Experimental Analysis ,Section VI tells about Conclusion of this Paper and Section VII References.

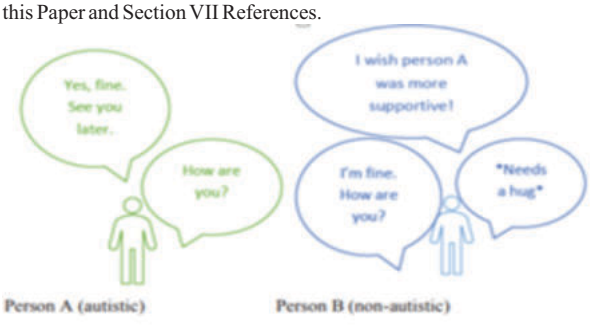


Fig 1: Conversation

INCEPTION V3

Basic Components of original Inception Model shown in Fig 2

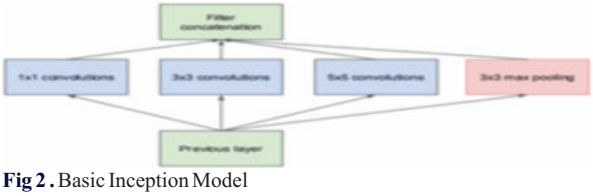


Fig 2 . Basic Inception Model

The 1*1 convolution, 3*3 convolution, 5*5 convolution, and 3*3 max pooling of the Basic Inception Model assist lower the size of the feature.

An issue with Inception v1 is its 5*5 convolution layer, which is both expensive and time-consuming. Adding a 1*1 convolution layer before each convolution layer decreases the network's size and speeds up processing to address this problem.

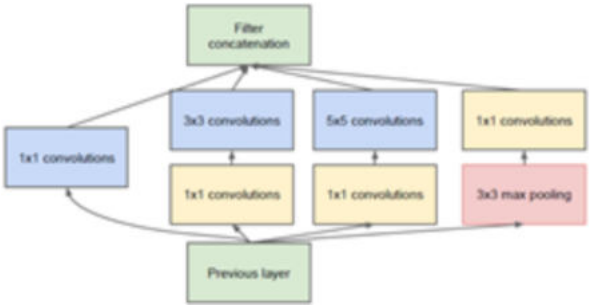


Fig 3 . Inception V1 Model

Compared to the original V1 model, the new Inception V3 is a significant improvement. Changes to Inception V3 include a reduction in grid size, the use of Auxiliary classifiers, and factorization into smaller components.

Since 5*5 is conventional layer which as computationally expensive as mentioned earlier ,

To reduce the computational cost 5*5 is replaced with two 3*3 convolution layers. eventhough larger convolution are factorized into smaller convolution. Further 3*3 convolution as reduced to 1*3 and 3*1 convolution. This reduces the layer cost and reduces the usage of Computational power.

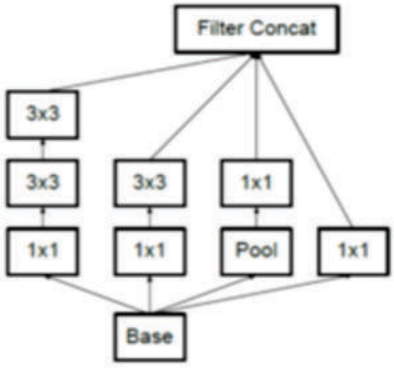


Fig 4 : Filter Module In Inceptionv2

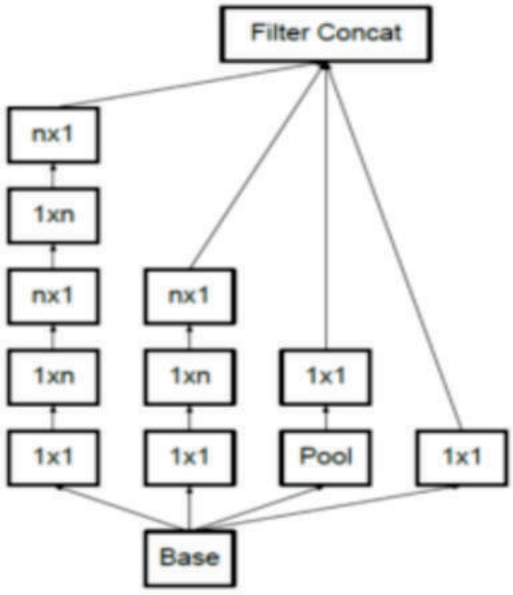


Fig 5: Filter Module In Inception v2

To improve the convergence of extremely deep neural networks, the primary goal of using an auxiliary classifier is to do just that. In Deep networks, the Auxiliary classifier is used to address the problem of disappearing gradients.

Initially, Auxiliary classifiers did not improve accuracy, but towards the end, their accuracy had surpassed that of a network without Auxiliary classifiers.

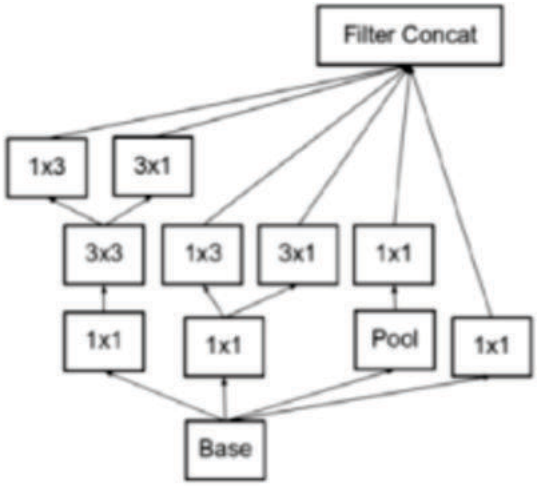


Fig 6 : filter module of Inception v2 model

Reducing the grid size of feature maps is accomplished through the use of methods such as maxpooling and average pooling. Even though this model has 42 layers, the efficiency of the new Inception v3 model is quite remarkable.

Data Augmentation:

Data Augmentation is process of Increasing the amount and diversity of data. we transform the existing data and produce a new data which contains different dimensions which improves the model prediction.

Inorder to predict accurately deep learning algorithms needs more variety of datasets in thousands to millions. This increases variability in dataset.

$$[x_1, y_1, 1] = [x, y, 1]T = [x, y, 1]\begin{bmatrix} a_{11} & a_{12} & 0 \\ a_{21} & a_{22} & 0 \\ a_{31} & a_{32} & 1 \end{bmatrix}$$

Frequent operations followed are Rotating, shearing, zooming, cropping, flipping and changing the brightness level.

LITERATURE REVIEW:

The research has taken from IEEE Digital Library to get references to the subject . The paper contains studies related to usage of Deep learning Algorithms in the field of Medical Healthcare, Detection of Diseases and helps the mankind in early detection and helping society.

Paper [1] contains the dataset which used in this project contains 2500+ images for training data and 500+for testing data which contains wide variety balanced dataset.

Paper [3] research paper consists of pattern based technique in maintain the data quality in dataset which helps in model building for Machine learning programs and Convolution Neural networks.

Paper [4] Software Engineering Perspectives and Applications in Intelligent Systems, Vol. 2, includes the paper "Cost Effective Framework for Complex and Heterogeneous Data Integration," CSOC 2016.

Paper [9] presents research on Convolution neural networks applied to facial emotion identification, which yields an accuracy of 60% when compared to the ANN. also these research papers used CNN models which is Compute High resources will consume when size of dataset got Increased .These reasons will lead for using Transfer learning techniques where model is trained with predefined Imagenet dataset which can be used in various applications. In this papers we are using Transfer learning Inception V3 technique for detecting Autistic , Non-Autistic syndrome in kids.

Architecture Diagram:

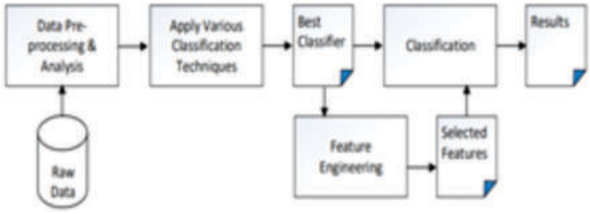


Fig 7: Autistic Disorder Spectrum

Architecture Diagram states the detailed steps we are following during the detection of ASD for a child.[1.1] Steps containing Data preprocessing and Analysis and apply various Transfer learning techniques like Resnet152,Resnet50 ,Inception V3 and many more .later we will choose best classifier according to accuracy , time taken for computation and get expected desired results.

METHODOLOGY:

Parameters and Content Dataset used in this project is from Github link mm909 [1]

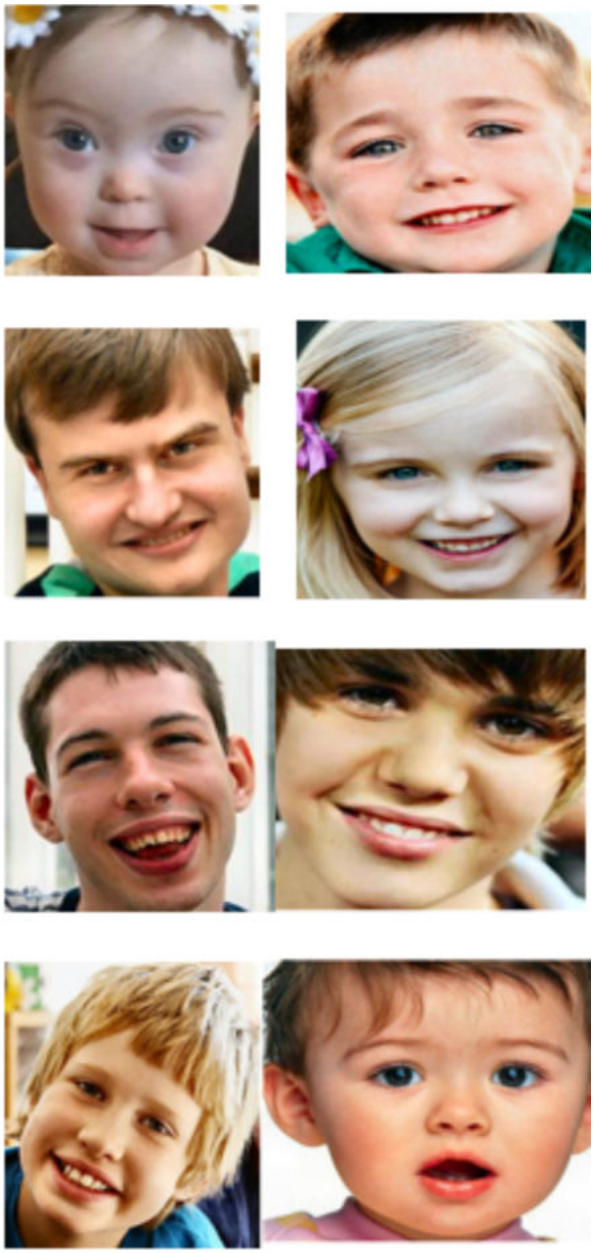
Dataset contains images with 2 different Emotions

0=Non-Autistic , 1=Autistic

Training set :2654

Validation set : 280

Autistic **Non_Autistic**



Dataset consists of Autistic and Non Autistic images divided into multiple folders. Train folder consists of 2654 images in two different folders Autistic, on-Autistic folders. Tensorflow ,keras and numpy are the libraries used during model building.

Training_set , test set are the variables used to initialize the training dataset. Input images are taken at (224,224) with batch_size 32,class_mode as "categorical". Train the model with 20 epochs and we got accuracy of 88% .

Model Diagram Screenshot:

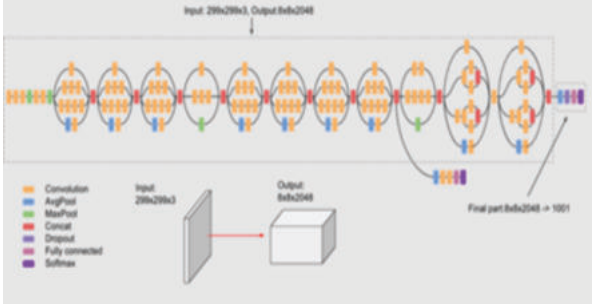
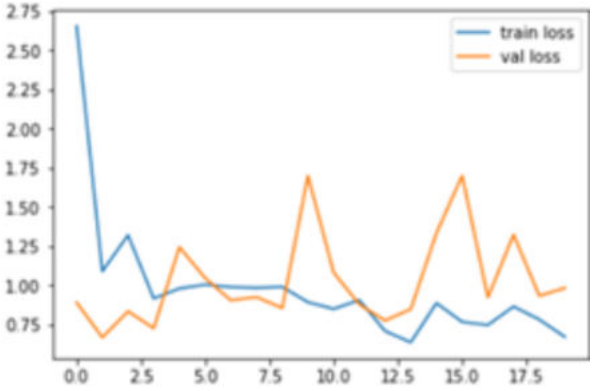


Fig 8: Inception V3 Model

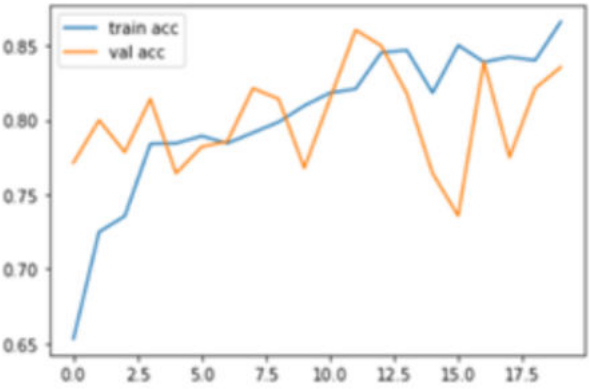
EXPERIMENTAL RESULTS

Deployment of Inception V3 ,an Average accuracy got for 86% basically ranging between (84% to 88%). We can improve the accuracy of model by including high resolution,wide range of images . in current dataset contains 2500+ training images and 500+ test images which is balanced dataset .if we improve the quality of dataset and accuracy can be increased better.



X-axis & Y-axis represents numbers and have no labels.

Fig 9.1 Validation Loss vs Train loss



X-axis & Y-axis represents numbers and have no labels.

Fig 9.2 Validation accuracy vs Training Acc

Table 1 Comparison Between Different Models.

Model	Accuracy	Parameters
Inception V3	88	2,19,05,186
Resnet152	91	5,85,32,354
Resnet50	63	2,37,88,418

Inception V3 accuracy is less but computationally give Good performance vs Resnet152.

CONCLUSION AND FUTURE WORK

Inception V3's real-time autism detection algorithm had an 88 percent success rate. Utilizing softmax in the network resulted in a better outcome than using other models. When compared to Inception V3, we can see that Resnet152 performs better, but the amount of input parameters is higher and requires more computer power to run.

This model is giving better accuracy compared to earlier transfer learning models . to achieve better accuracy we need to increase the quality of dataset by implementing Data augmentation techniques, using high computational machines with high resolution,wide variety . This model will help in Healthcare Industry by detecting the Autistic disease in early stages. This model can be extended to recover from disease with the help of implementation of sensors ,IOT ,Robotics etc.

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