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Brain Stroke Detection Using CNN Algorithm

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***Abstract* - Strokes damage the central nervous system and are one of the leading causes of death today. Compared with several kinds of stroke, hemorrhagic and ischemic causes have a negative impact on the human central nervous system. One of the cerebrovascular health conditions, stroke has a significant impact on a person's life and health. In order to diagnose and treat stroke, brain CT scan images must undergo electronic quantitative analysis. An essential tool for damage revelation is provided by deep neural networks, which have a tremendous capacity for data learning. In this paper, we aim to detect brain strokes with the help of CT-Scan images by using a convolutional neural network. After training and testing the model on a CT-scan dataset comprising 2551 images, we obtained the best accuracy of 90%.**

Keywords: Stroke detection, CNN.

I. INTRODUCTION

We must employ technology as it develops in fields like healthcare to address pressing issues. Strokes were one of the most frequent causes of death in former years, Due to their effects on the human central nervous system. We can utilize deep learning algorithms to detect stroke in its early phases in order to address problems like stroke. Therefore, the death rate from strokes can be decreased with sophisticated picture recognition and categorization.

The Prediction model is used in this study to predict stroke risk in older individuals and those who are at increased risk of stroke due to a variety of variables, such as addiction. The same project may be expanded in the future to provide the stroke percentage based on project output.

By gathering data on the relevant risk factors and consulting doctors, this initiative can also be utilized to determine the likelihood of stroke in young and underage persons.

In this research, we apply the CNN algorithm to identify, categorize, and predict stroke from CT-SCAN pictures. The goal of the current research is to predict the threat posed by different types of strokes. We created the CNN model with 90% accuracy for stroke detection in order to overcome this constraint. We anticipate fewer stroke-related deaths as a result of this model. Stroke is currently one of the most significant health hazards because it has the highest mortality rate of all diseases. Regular medical check-ups are crucial to identify stroke risk factors and preventing stroke because most people do not experience any symptoms prior to having a stroke. People can get transient stroke symptoms. It's the greatest moment to work on solutions for identifying stroke from CT scan images with the help of deep learning algorithms because the healthcare sector can have countless uses for AI/ML in the coming years. With the use of its neural network, it can identify the stroke within a few minutes, potentially saving countless lives.

Identifying earlier stroke detection danger is the aim of the current research. We have compared numerous methods and techniques to overcome this constraint. Stroke detection is more accurate and precise with our unique Deep Learning CNN Model. We expect a reduction in the number of stroke-related deaths using CNN.

II. LITERATURE SURVEY

Here we present some of the related works where the convolution Neural network is used for classifying images

B. R. Gaidhani et al.[1] used a convolutional neural network using deep learning models. The model is used to separate brain stroke images into abnormal and normal images and displays aberrant regions utilizing semantic segmentation. For stroke detection, the convolutional neural network designs LeNet 5 and SegNet are utilized. Detection accuracy was 96% to 97% for LeNet 5 and 85 to 87% for SegNet, respectively.[1]

J. T. Marbun1 et al. classified cerebral stroke disease from CT-Scan pictures using a convolution neural network. Pre-processing of images is employed to increase the model's precision. Using image preprocessing techniques like Grayscaling, Scaling, and CLAHE, accuracy is raised from 92% to 96%. [2]

Dey et al., implement a web application for the diagnosis and prognosis of diabetes using machine learning. a synthetic neural network was used to get the greatest accuracy of 82.35%. Preprocessing with Min Max Scalar (MMS) is used to raise prediction precision. JavaScript's machine learning implementation uses Tensorflow.js. [3]

S. Albawi and others, The convolution neural network's problems are all examined. Convolutional neural network efficiency-affecting parameters are corrected and clarified. The amount of levels employed within the neural network affects how well it performs. The relationship between the network's layer count and the time needed for model training and testing is discussed in the study. [4]

H.D.Prasetyo., Implemented a website-based system for detecting rice plant diseases to ease the efforts in the agricultural field. This system is created by using the Deep Learning method. The image processing method is implemented using a CNN with the GoogLeNet architecture of a convolution neural network which is then connected with a web-based application. The derived outcomes display an increase in accuracy with the increase in the no. of epochs for CNN training models. [5]

Saman Sarraf et al. used CNN to distinguish Alzheimer's brain scans from normal brain scans. The model used LeNet-5 architecture and successfully classified functional MRI data of Alzheimer's from normal MRI data with a testing accuracy of 96.85%.. [6]

III. METHODOLOGY

A. *Dataset:*

We used the "Brain Stroke CT Image Dataset" data set from kaggle.com. The dataset comprises 950 images of strokes and 1551 photos of non-strokes in all of the 2551 CT scan images used for training and testing the model.

B. *Proposed Methodology:*

A CNN architecture consists of two basic components:

Extraction of features is a method used in convolution that separates and identifies the different aspects of the image for inspection.

In a Convolutional Neural Network, features are extracted through multiple pairs of convolutional and pooling layers. The output of the convolution process is then used by a fully connected layer to determine the image class based on the previously extracted features. This feature extraction model aims to reduce the number of features in the dataset by combining existing features into a single, new feature. The architectural diagram of the Convolutional Neural Network shows several levels of CNN.

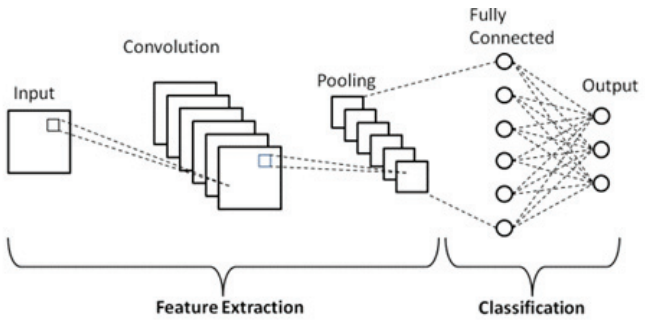

Fig. 1. Convolutional neural network. [7]

The Convolutional Neural Network is made up of three different kinds of layers: fully connected (FC), pooling, and convolutional layers. A CNN architecture is created when these layers are stacked. The dropout layer and the activation function, used in our model, are two additional crucial parameters in addition to these three layers.

C. *System Architecture:*

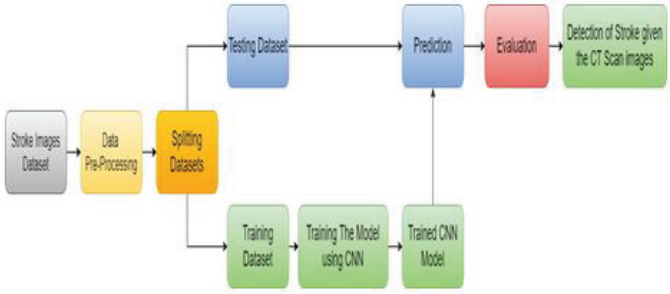

Fig. 2. System Architecture

The project's system architecture is depicted in the diagram up top. Our model operates by using a dataset of brain image CT-SCANs. The dataset is then pre-processed and divided into six equal halves, with sixty percent of the images that are used to train the CNN model and the remaining forty percent utilized for testing.

By carrying out the aforementioned procedure, the CNN model was created, and it is now employed for the identification of strokes on any given CT-SCAN image of the brain.

IV. RESULTS

When a Stroke image is given as input to our CNN-based model, it successfully predicts the brain stroke of the patient through a fed CT-Scan image with a 0.9572377 prediction probability.

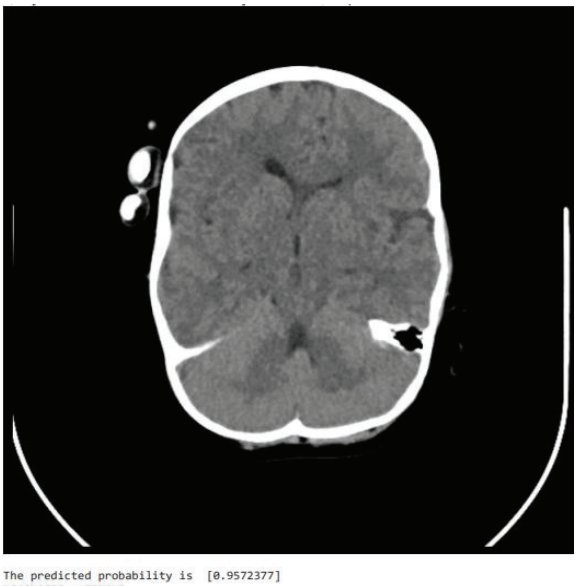

Fig. 3. Brain Stroke Prediction

The outcomes of our developed model is displayed in the graphs below. The accuracy graph in the first graph indicates that our model is getting better and producing better outcomes since it shows us that accuracy is increasing.

The other graph shows the model's loss, which is excellent because it suggests that the loss in the model is decreasing.

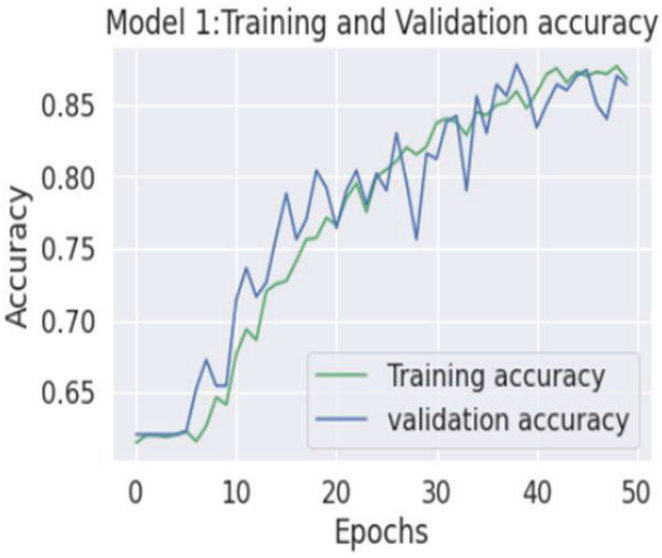

Fig. 4. Accuracy vs Epochs graph

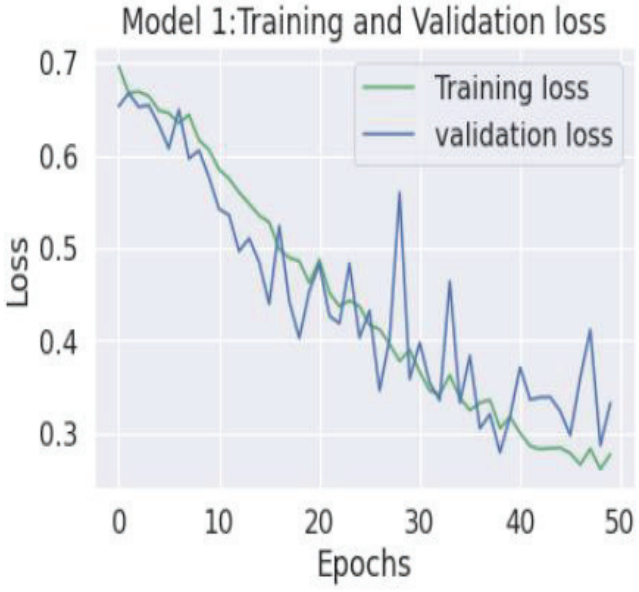

Fig. 5. Loss vs Epochs graph

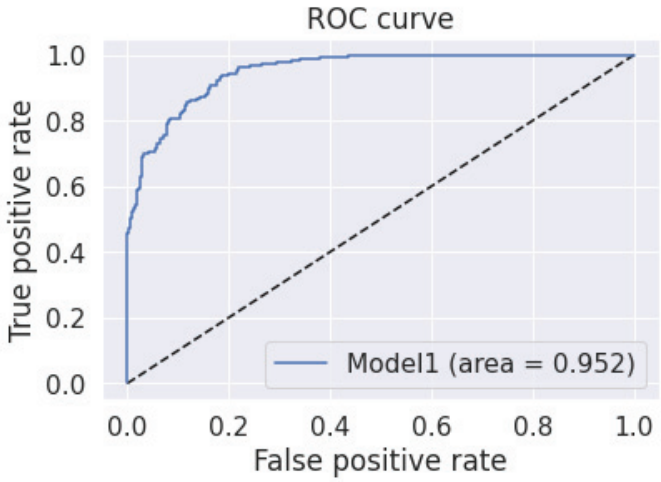

Fig. 6. ROC Curve graph

We have plotted the Receiver Operating Characteristic curve as a measure to obtain the overall performance of our model, a curve is plotted with the help of FPR and TPR values i.e Flase positive rate and true positive rate respectively, The TPR is the proportion of true positive cases (i.e., actual positive cases that are correctly identified by the model) and the FPR is the proportion of false positives (i.e., actual negative cases which are incorrectly determined as positive by the model). We Obtained a 0.952 AUC i.e area under the curve, which is close to 1. The higher AUC value of the ROC curve signifies the excellent performance of our model.

V. Conclusion

We have seen an overview of the CNN algorithm and examples of its use in the application of this project. This approach provides a superior stroke detection outcome.

As a result of our analysis of CNN's performance in numerous stroke detection tests, it is able to predict stroke precisely.

Our model is able to predict brain stroke in patients with the help of CT-Scan images with 90% accuracy.

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