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Brain Tumor Detection

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- ***Abstract – In the field of medical Brain tumor is very risky, uneasy to detect and very harmful disease. The Brain Tumor is detected using MRI images by doctors. In this paper, the detection of Brain Tumor is done by using the MRI images by implementing different Machine Learning techniques. The CNN(Convolutional Neural Network) is performed by using keras whereas the SVM(Support Vector Machine), KNN(K Nearest Neighbor) are performed by using scikit, sklearn. The different techniques are used in this paper to get more accuracy and predictions in detecting the tumor accurately.***

- ***Keywords – Classification system, CNN, MRI, Medical, Brain Cancer, Machine Learning, SVM, KNN.***

1. INTRODUCTION

Medical imaging refers to a number of techniques that can be used as non-invasive methods of looking inside the body. Medical image encompasses different image modalities and processes to image the human body for treatment and diagnostic purposes and hence plays a paramount and decisive role in taking actions for the betterment of the health of the people. Image segmentation is a crucial and essential step in image processing which determines the success of a higher level of image processing. The primary goal of image segmentation in medical image processing is mainly tumor or lesion detection, efficient machine vision and attaining satisfactory result for further diagnosis. According to Brain and other nervous system cancer is the 10th leading cause of death, and the five-year survival rate for people with a cancerous brain is 34% for men and 36% for women. Moreover, the World Health Organization (WHO) states that around 400,000 people in the world are affected by the brain tumor and quality of images. The contrast adjustment and threshold techniques are used for highlighting the features of MRI images. The Edge detection, Histogram, Segmentation and Morphological operations play a vital role for classification and detecting the tumor of brain. Early detection of brain tumors can play an indispensable role in improving the treatment possibilities, and a higher gain of survival possibility can be accomplished. Brain tumor segmentation from MRI is one of the most crucial tasks in medical image processing as it generally involves a considerable amount of data. The main objective of this paper is to perform the analysis by using different algorithms for classification and compare their accuracies. The algorithms which are used in this paper are KNN, SVM, and the neural dense network that is Convolutional Neural Network is used.

2. PROBLEM STATEMENT

A. Statement of a problem

As there are many different techniques are there for detecting the brain tumor, in this paper the comparison among the CNN(Convolutional neural network, SVM(Support Vector Machine), KNN(K-Nearest Neighbor). The problem is about Comparison on the basis of Accuracy is done.

B. Existing systems

3. LITERATURE REVIEW

Many of the researchers proposed many methods, and algorithms for to find brain tumor, stroke and other kinds of abnormalities in human brain using mri images. Rajesh c. patil and dr. A. S. Bhalchandra et al, in his paper "brain tumor extraction from MRI images using matlab", they focused on meyer's flooding watershed algorithm for segmentation and also presents the morphological operation.

Vinay Parameshwarappa and Nandish s. et al, 2018 in his paper "segmented morphological approach to detect tumor in brain images", they proposed an algorithm for segmented morphological approach.

M. Karuna and Ankita joshi et al, 2017, in his paper "automatic detection of brain tumor and analysis using matlab" they presents the algorithm incorporates segmentation through nero fuzzy classifier. the problem of this system is to train the system by neural network and it desires many input images are used to train the network. the developed system is used only for tumor detection not for other abnormalities.

R. B. Dubey, M. Hanmandlu, Shantaram vasikarla et al, 2017, compare the image segmentation techniques in his paper "evaluation of three methods for mri brain tumor segmentation", they apply preprocessing techniques like; de-noising, image smoothing, image contrast enhancement and comparison of the level set methods and morphological marker controlled watershed approach and modified gradient magnitude region growing technique for mri brain tumor segmentation. they concluded the mgmrgt method gives better result.

Sentilkumaran n and Thimmiaraja et al, 2017 compare the image enhancement techniques in his paper "histogram equalization for image enhancement using mri brain images", they presented the study of image enhancement techniques and comparison of histogram equalization basic method like brightness preserving adaptive histogram equalization (AHE), local histogram equalization (IHE), global histogram equalization (GHE), dynamic histogram equalization using different quality objective measures in mri images. they also presented the better result on contrast using bpdhe method.

R. Preetha and G. R. Suresh et al, 2016, in his paper "performance analysis of fuzzy c means algorithm in automated detection of brain tumor" they used fuzzy c means clustering for segmentation. that method given the high computational complexity. fcm shows good performance result in segmented the tumor tissue and accuracy of tumor. segmentation was identified by applied the svm classifier.

Amer Albadarneh, Hasan Najadat and Ali m. alraziqi et al, 2016, proposed the method for brain tumor classification of mri images. the research work applied, based on neural network (NN) and k- nearest neighbor (K-NN) algorithms on tumor classification has been achieved 100% accuracy using KNN and 98.92% using nn.

Many researchers has proposed many algorithms and segmentation techniques to find abnormalities in the brain using MRI images. most of them proposed various algorithms to find the abnormality in the brain like brain tumor.

4. PROPOSED MODEL

In this paper the dataset is use from kaggle having the name of the dataset as 'Brain Tumor'. The dataset is actually is having the one folder named 'Brain Tumor', in that the 3,762 image files with .jpg extension.

PROPOSED METHOOLOGY FOR SVM AND KNN:

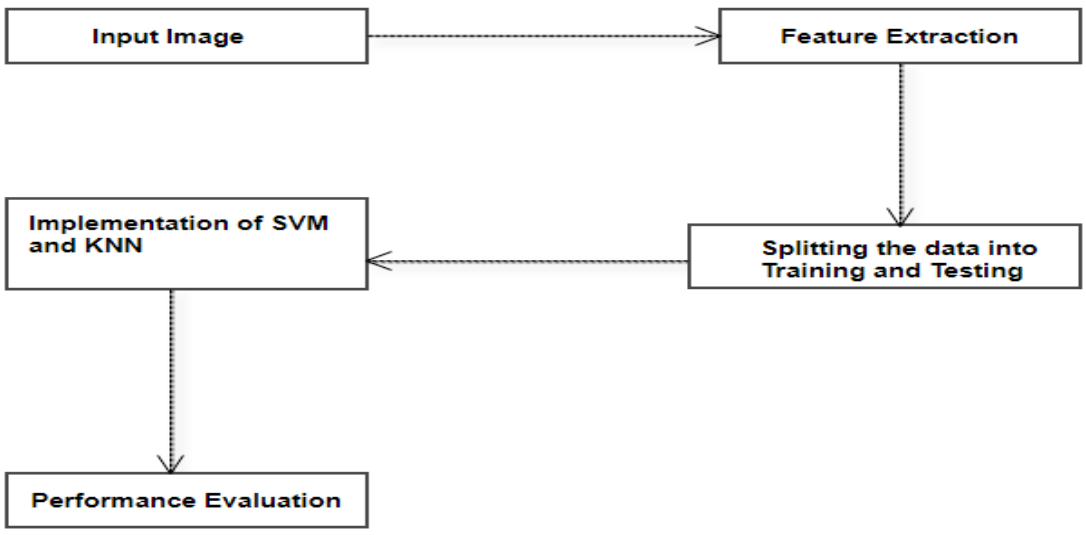

Figure 1 – Working of proposed methodology for SVM and KNN

Feature Extraction:

For extracting the features, the feature extraction is performed on the dataset and it saved in the form of another dataset in excel file(.csv). The name given to this excel file is 'Brain Tumor.csv'. The features are extracted in the form of columns. The following are the columns:

```
RangeIndex: 3762 entries, 0 to 3761
Data columns (total 15 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   Image               3762 non-null   object
 1   Class               3762 non-null   int64
 2   Mean                3762 non-null   float64
 3   Variance            3762 non-null   float64
 4   Standard Deviation  3762 non-null   float64
 5   Entropy             3762 non-null   float64
 6   Skewness            3762 non-null   float64
 7   Kurtosis            3762 non-null   float64
 8   Contrast            3762 non-null   float64
 9   Energy              3762 non-null   float64
 10  ASM                 3762 non-null   float64
 11  Homogeneity         3762 non-null   float64
 12  Dissimilarity       3762 non-null   float64
 13  Correlation         3762 non-null   float64
 14  Coarseness          3762 non-null   float64
dtypes: float64(13), int64(1), object(1)
memory usage: 441.0+ KB
```

Figure 2 – List of Columns that are formed in Brain Tumor.csv due to feature extraction

Splitting the data into training and testing:

The dataset of excel file is divided into two datasets that are Training and Testing. The target columns are Image and Class. The data use for Testing dataset is 33% of the data from excel file. The remaining is used as a Training dataset.

SVM Algorithm:

SVM or Support Vector Machine is a linear model for classification and regression problems. It can solve linear and non-linear problems and work well for many practical problems.

KNN Algorithm:

K-Nearest Neighbour is one of the simplest Machine Learning algorithms based on Supervised Learning technique.K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that is most similar to the available categories.K-NN algorithm stores all the available data and classifies a new data point based on the similarity. This means when new data appears then it can be easily classified into a well suite category by using K- NN algorithm.

PROPOSED METHODOLOGY FOR CONVOLUTIONAL NEURAL NETWORK:

The five-layer proposed methodology gives us the commendable result for the detection of the tumor. Convolution, Max Pooling, Flatten, and two dense layers are the proposed five layer CNN model. Data augmentation had been done before fitting the model as CNN is translation invariance.

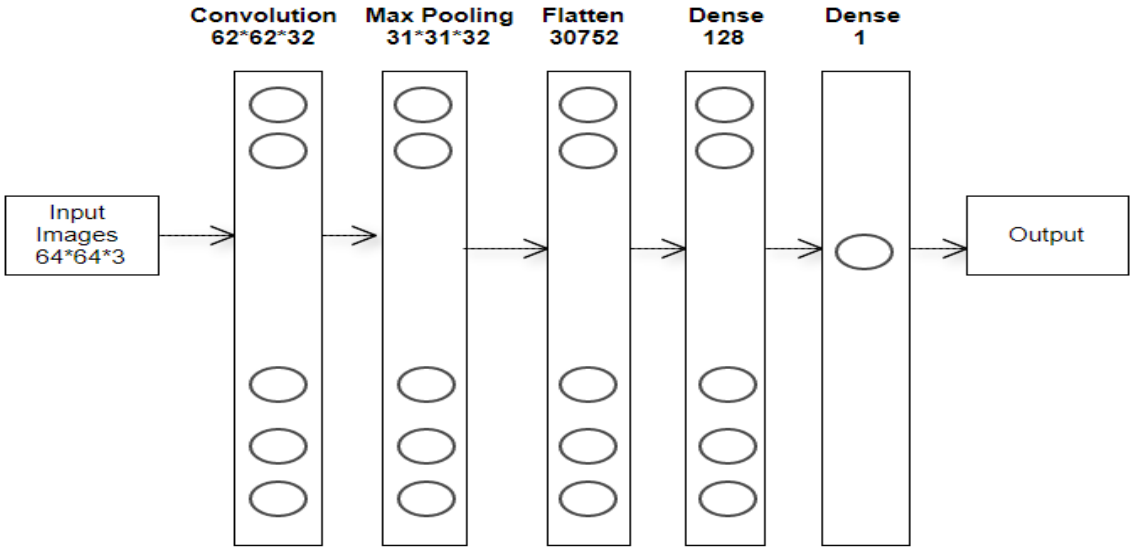

Figure 3 – CNN Architecture

We got 96.67% as accuracy which is remarkable in terms of using five-layer CNN. We analyzed with a different number of layers but the divergent of the outcomes were not very significant in terms of using this five-layer CNN model. Some of the aspects that we obtained when we increase the number of layers is- computation time, the complexity of the method batch size and steps per was immensely high.

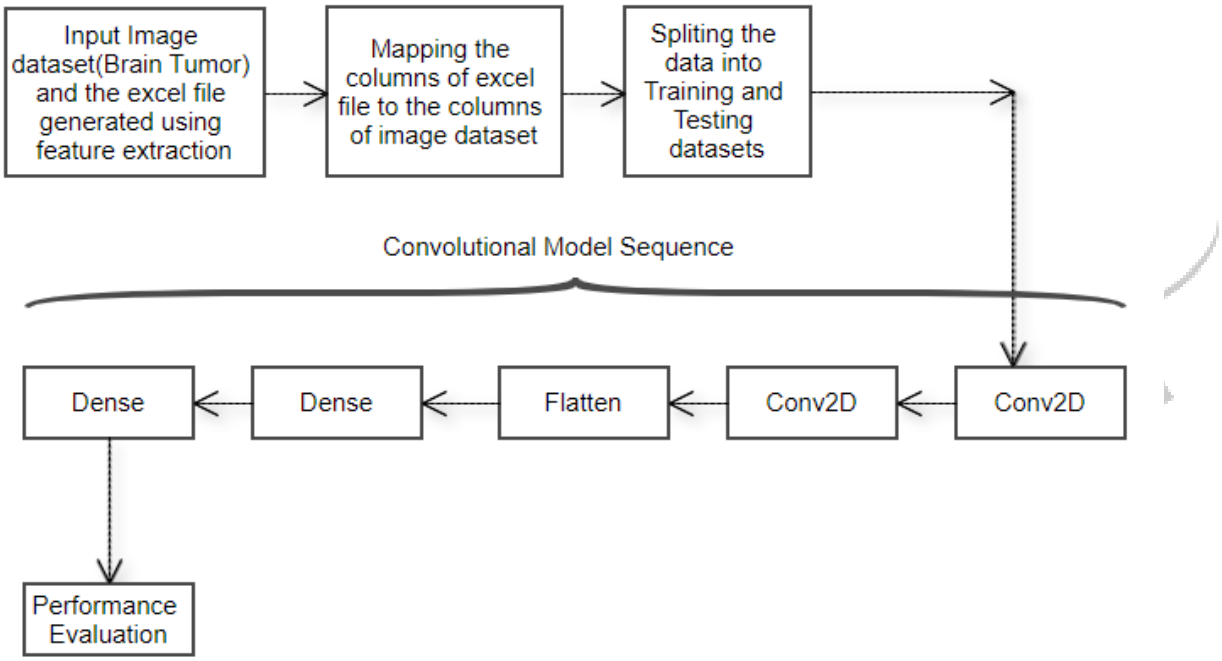

Figure 4 – Working of Proposed model of CNN

5. RESULTS

RESULT FOR PROPOSED METHODOLOGY OF TRADITIONAL CLASSIFIERS:

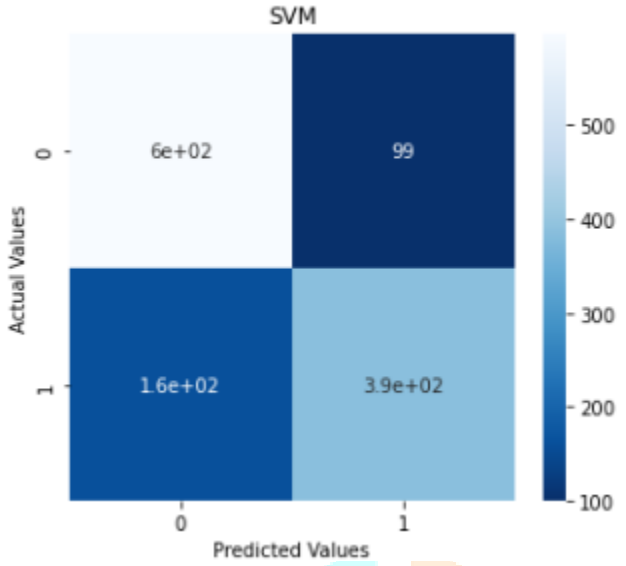

Figure 5 - Confusion Matrix for SVM

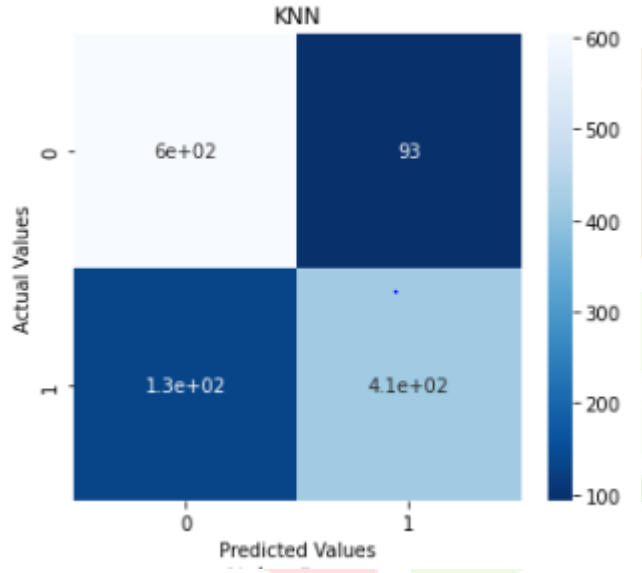

Figure 6 - Confusion Matrix for KNN

Performance Evaluation:

The evaluation is done for getting the final result.

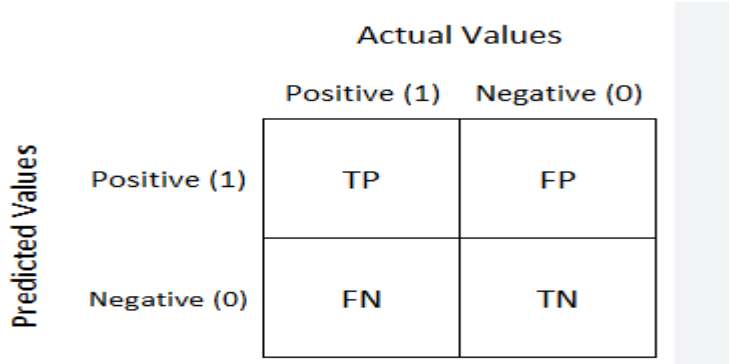

Figure 7 – Confusion Matrix evaluation

Algorithms	Accuracy	Misclassification	Precision	Sensitivity(Recall)
Support Vector Machine	77%	22%	0.257482	0.335043
KNN	75%	24%	0.232087	0.296260

Table 1 – Result for KNN and SVM

Accuracy = (TP+TN)/(TP+TN+FP+FN)
Misclassification = (FP+FN)/(TP+TN+FP+FN)
Precision = TP/(TP+FP)
Recall = TP/(TP+FN)

The Accuracy for KNN is 75% and SVM is 77%, which are best accuracies has got whereas the other algorithms cannot work well.

RESULT FOR PROPOSED CNN (Convolutional Neural Network):

Performance Evaluation:

The Training Accuracy is 99.83%. The Testing Accuracy is 96.67%. The total number of epochs were performed are 50 epochs.

```
eval_score = model.evaluate(X_test, y_test)
print("Test loss:", eval_score[0])
print("Test accuracy:", eval_score[1])
```

```
24/24 [==============================] - 2s 51ms/step - loss: 0.1641 - accuracy: 0.9668
Test loss: 0.16405567526817322
Test accuracy: 0.9667994976043701
```

```
eval_score = model.evaluate(X_train, y_train)
print("Train loss:", eval_score[0])
print("Train accuracy:", eval_score[1])
```

```
95/95 [==============================] - 5s 50ms/step - loss: 0.0061 - accuracy: 0.9983
Train loss: 0.006064833141863346
Train accuracy: 0.9983383417129517
```

6. CONCLUSION AND FUTURE WORK

Image segmentation plays a significant role in medical image processing as medical images have different diversities. For brain tumor segmentation, we used MRI and CT scan images. In this paper, the SVM, KNN and CNN is performed. The techniques like skull stripping, edge detection is not used in this paper which helps in getting more accurate result. Many algorithms are there which are already in used.

Further, for better results the more number of different algorithms can be used and do the comparison and prediction for getting the better result. The whole new classification system can be created using different algorithms as per their features.

7. REFERENCE

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