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BRAIN TUMOR SEGMENTATION USING CNN

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Abstract – Brain tumors are the most common issue in children. Now-a-days number of patients suffering from brain tumor has been increasing.Human body consist of many number of cells.Each cell divide into different number of cells to form sub cells.These subcells are also necessary for body health.If these sub cells form without any shape,then it forms tumor cells.Tumor cells are the extra cells in our body.Tumor cells are of two types.They are high grade tumor and low grade tumor.High Grade Tumor refers to Malignant Tumor which is cancerous .Low Grade Tumor is benign tumor which is non cancerous tumor. Earlier cerebrum cancer segmentation is done by doctors.but it is time taking process and we need to depend on Human skills.hence cerebrum cancer segmentation using machine learning is introduced.but in machine learning methods we need to explicitly extract features.hence we now moved to cerebrum cancer segmentation using Convolution Neural Network is introduced.In convolution neural network accuracy is high because of Back Propagation method.Hence In this work we used Brain Tumor Detection Using Convolution Neural Network (CNN).

Keywords **- CNN, Tumor Segmentation, Deep learning.**

I. INTRODUCTION

Brain is the important organ in the body of a human, it consist of many cells. These cells divide into sub cells.The sub cells are also necessary for Human Health.If these sub cells are formed in an unordered shape then they are tumor cells.Tumor cells are the extra cells in our body. Cerebrum growth are partitioned into two kinds such as Low Grade cancer and high grade cancer[1]. High Grade Tumor refers to Malignant cancer which is cancerous.Malignant cancer spreads to the other parts of the body .Low Grade Tumor is benign cancer which is non cancerous tumor. Benign cancer is harmless.Subsequently it will not reach to the other parts of the mind.The high growth is a carcinogenic cancer. So it spreads to other parts of the body in very less time. It leads to quick death. Mind MRI picture is mostly used to distinguish the cancer.

This paper presents segmenting the brain tumor by using Convolutinal Neural Networks(CNN).The basic goal is to identify the brain tumor and segment it in the uploaded image.CNN architecture is used to identify the affect tumor in the uploaded image.The spread of wretched tissues which start in cerebrum is called as brain cancer.They spread fastly in short time.They can also spread in tissues like skull,pitutary organs,pineal organ and neurons.There are various kinds of cerebrum growth.Some of these are very harmful like Gliomas and they are very dangerous. Gliomas are mostly cancerous type.When they spread to their highest level then it leads to short life expectancy.The other type are non-cancerous or benign[2].Gliomas is the serious cerebrum cancer type which is widely recognized.Glioblastoma is the subset of Glioma.It starts from low-evaluated growth to high-reviewed harmful growth.

As per Cancer Organizations in United States of America(USA), around 80,000 individuals are recently determined to have disease each year around USA with 16,000 individuals kicking the bucket from malignant growth.In these,32% have a serious cerebrum growth.These cancers stay in the back of internal base of skull of human cerebrum.It is very hard to find it as they are present in internal base of skull.There are different kinds of tissues in the human cerebrum.Cerebrospinal liquid,white matter,edema,growth tissues and dark matter are the five different kind of tissues in the human brain.

The different kind of tissues seem to be very distinctive.These distinctions can be seen very clearly when MRI images are examined.MRI images gives a clear picture than normal CT check or ultrasonic images.By examining the MRI images the cancer tissues are portrayed effectively.In MRI images hydrogen part of our brain is demagantized and polarized[4].In High Graded Gliomas(HGG) cases,cancer tissues are portrayed easily because of hydrogen parts.So MRI images are considered for evaluation process.MRI images significantly give better results.MRI is the harmless strategy.But in Low Graded Glioma it is difficult to portray the growth of tissue.However MRI images produce better results than CT check.MRI is a harmless strategy.MRI images are used in often to detect the brain tumors.Later,SVM is used for the detection of brain tumor.SVM also produces good results for the detection of brain tumor.

II. LITERATURE SURVEY

Prior to our writings,there are many existing systems which are proposed to segment tumor in brain. One such paper is proposed to segment tumor using 3D U-Net.New and updated version of U-Net architecture is used[7].It uses multi-model MRI images as input, masked output of full resolution is generated after processing the input at different scales.The network used in this paper is changed or updated in such a way that there would be a greater gradient flow in it,which also should permit the network to learn better segmentation.

Another system is segmentation using water-shed matching algorithm[2].They tried to use medical imaging system which has less errors.It is possible only if the effected region is detected accurately.Earlier, biopsy is used but it takes more time and there may be chances for errors.But according to this paper,accurate results are segmented due to its two stage verification.Firstly,they segmented tumor affected region from the input image and then they prefered an algorithm which compares the segmented portion with the real image.The important feature of this algorithm is knowing the status of affected region by calculating and detecting its area. .To start the watershed matching algorithm,input image is filtered by applying filters which helps in improving different features of the image which inturn helps in good explaination.

There was also a system where segmentation is using bit-plane and U-Net[3].According to this paper,the identification of tumor tissues from 3D input images has a vital role in finding the glioma. Clinical data is used for seperating the sub-regions of glioma.They used Bit-plane to get MSB and LSB which helps in rise of input to a greater extent.Then U-Net,is used to segment gioma regions[3].IMultiple kernals are used in the implementation of UNet for acquiring accurate results.

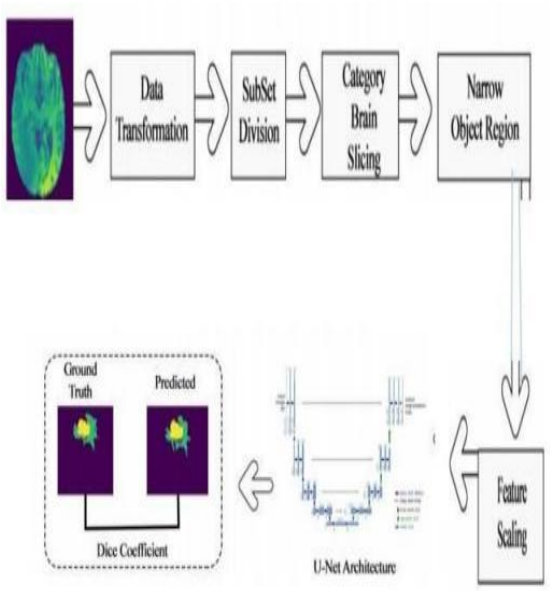
This paper segments the tumor using tensor flow[5],which is useful in implementing high level mathematical functions for which the anaconda frameworks are used and also CNN is used to get fully automatic segmentation..Due to early identifying lifespan of patients increases.Hence,in this paper they segmented brain tumor into separate classes which separates healthy tissues from affected ones.This is an essential step in identification of affected region,and planning schedule for treatment in order to improve the survival rate of the patient.

The last paper is about segmentation of tumor using deeplearning and MRI[6].The main purpose of proposing this paper is to implement a completely-automatic method of deeplearning for segmenting the effected region and predicting the rate of their survival.Segmentation of affected region in MRI images has very important implementations in identification of affected region,keeping track of treatment and perfect planning for the treatment.In this paper,distinct parametric MR images of well cured cases of tumor were considered,where a three-group framework is implemented,and these groups are further divided into three 3D-Dense U-Nets to detect the sub-regions of glioma[6].Different approaches and loss functions are used to train these groups.Different labels are made and a specific label is considered and put together and then further processed for the segmentation of the output.A linear regression model is extracted from the segmented components and survival analysis is done.

III. PROPOSED METHODOLOGY

In the proposed CNN based grouping doesn't need highlight extraction steps separately.The include esteem is taken from CNN itself. The arranged aftereffect of Tumor and Non-growth mind image.Hence the intricacy and calculation time is low and precision is high.The result of cerebrum cancer characterization exactness is given. At last, the grouping results as Tumor mind or non-cancer cerebrum in light of the likelihood score value.The typical cerebrum picture has the most minimal likelihood score. Growth mind has most elevated likelihood score esteem, when contrasted with ordinary and cancer cerebrum..

Fig. 1. Flowchart of the proposed system



Convolutional Neural Networks: Deep Learning has a special interest over the recent years in IT industry.Deep Learning is one of the subset of machine learning.Deep learning is a neural network which consists of three or more layers.These networks imitate how human brains think and learn.Some models in deep learning are Artificial Neural Networks(ANN),reinforcement learning and autoencoders.Convolutional Neural Network(CNN) is a type of Deep Learning algorithm and it is used to recognize and classify features in a image.They are commonly used for image analysis.CNNs are also used in classification of image,facial recognition,computer vision,natural language processing and analysis of a medical image.In mathematical function,convolution is a linear operation in which third function is produced by the multiplication of two functions.In simple terms,two matrices are multiplied to produce output.The features of the image are extracted from this output.

Basic Architecture of CNN:CNN architecture is divided into two parts:The first part is feature extraction in which different features are extracted from the input in convolutional layer and image size is decreased in pooling layer.The second part is classification where it uses the output of convolution process as an input to the fully connected layer and image class is known.

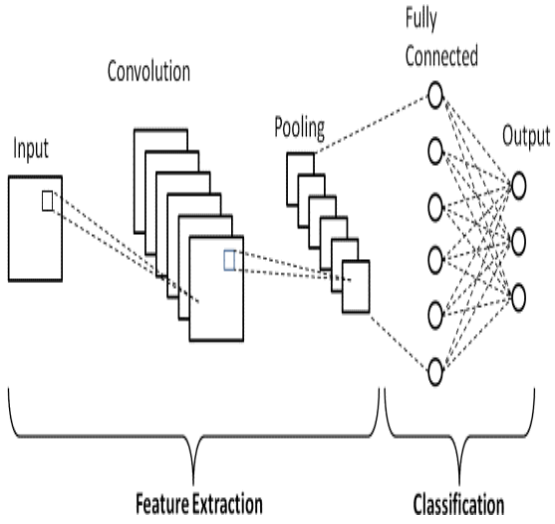


Fig. 2.Architecture of CNN

Convolution Layers:The layers used in making CNN are:Convolutional Layer,Pooling Layer,Fully connected layer.Architecture of CNN will be built when all these layers are mixed..Dropout layer and Activation function are the two significant factors defined in addition to the above three layers.

IV. IMPLEMENTATION

A. Upload Brain Tumor Image

In this module,we import the required libraries and load the images of of masked and brain input images and labels.

B.Data Preprocessing

When working on a CNN project, we don't always come across clean, well-prepared data. Before doing any operations on data, it is required to clean and format it. As a result, the data pre-processing task is employed. Data pre-processing is a process of converting the raw dataset into clean and error-free data that is suitable for training the machine learning model. It involves data normalization,data-augmentation,padding balancing of data.

C.*Model Generation*

In this module,we generate model for classifying image dataset.we split the dataset into training dataset and testing dataset in the ratio of 4:1.In training dataset ,we train the model by using the labeled data and In testing dataset,we test the model on hidden or unknown data.The testing is performed based on the level of training.

D.Build CNN Algorithm

In this module,we build CNN Algorithm.We used U-Net architecture.U-Net architecture is used for semantic segmentation.It includes contracting and expansive path..

E. Segmentation

In this module,the cerebrum tumor affected region is segmented.segmentation refers to separating the tumor affected region from brain input images.If their is no tumor affected region in brain input images then no segmentation takes place.

V. U-NET ARCHITECTURE

U-Net is a design for semantic division. It is made up of contraction and expansion.The left part is the contraction and right part is the expansion.An input image of size 572x572 is considered.The image is fed to two convolutional layers by which the size of image is decreased.Two convolutional layer are of size 3x3 and they are followed by a ReLU.In the next step max pooling is applied.Max pooling is used to decrease the dimensions of the image.In the contraction path all features are extarcated in different stages.The path next to contraction is expansion..The up-covolution is a link connecting from the contracting path to the expansion path.Up-convolutions consists of two 3x3 convolutions followed by a ReLU layer.Last layer is 1x1 convolution where the size of image is reduced from 572x572 to 388x388. In expansion all features are combined together by up-convolution.The segmented output is present at the last layer.The segmented brain tumor image can be seen in the last layer.

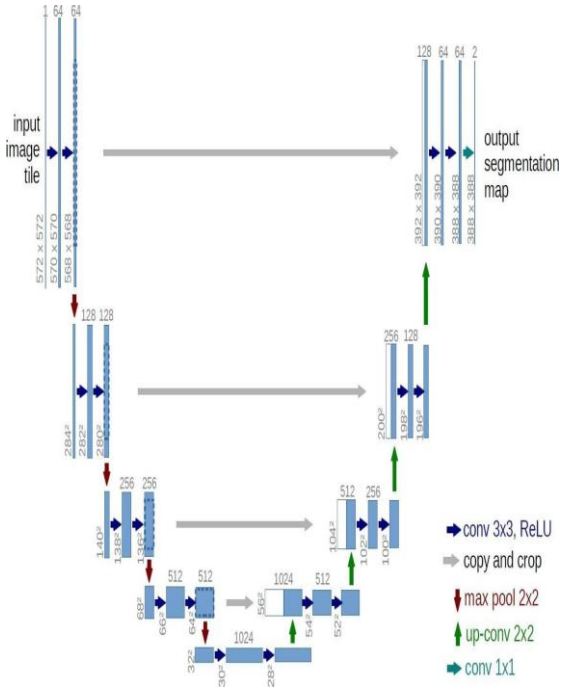


Fig. 3.U-Net Architecture

VI. RESULTS

A. Segmented Output

The segmented output can be seen in the fig 6.A brain tumor image is taken as input.Then the image is fed to various convolutional layers to extract the tumor region.In the last layer the tumor region is segmented.

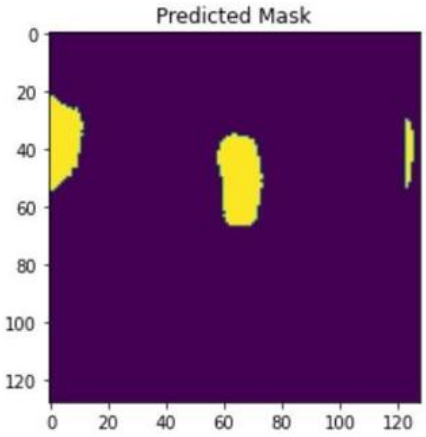


Fig. 4.Segmented output

B. Discussion of Results

For the analysis of results three image samples are considered.Each image sample has the parameters like accuracy,computational time and the type of tumor detected.The classifiers used for comparison are SVM and CNN.The accuracy is more for CNN than SVM for the input image samples.The computational time is also more for CNN in all the three image samples.Both SVM and CNN are detecting the type of tumor.But CNN is best to use as the accuracy is more in case of CNN.CNN is the best approach to segment the type of tumor as it can be implemented easily and it is cost-effective.

Table 1:Discussion of Results

Selected parameter	**Accuracy (%)**		**Computational time (s)**		**Type of tumor**	
Classifier	**SVM**	**CNN**	**SVM**	**CNN**	**SVM**	**DCNN**
Image sample 1	87.5	91.87	10.805	12.3	Malignant	Malignant
Image sample 2	85	98.9	11.576	13.2	Benign	Benign
Image sample 3	82.5	94.2	11.12	10.2	No tumor	No tumor

VII. CONCLUSION AND FUTURE SCOPE

The main objective of this project is to segment the cerebrum cancer affected region.In the existing project machine learning algorithms are used to segment the cerebrum cancer affected region.whereas in machine learning algorithms texture feature is done explicitly.Hence we moved for cerebrum cancer segmentation using CNN.Convolution neural network produces high accuracy because of back propagation approach.we have used U-Net architecture for cerebrum cancer segmentation and produces accurate results.

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