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BRAIN TUMOR DETECTION USING DEEP LEARNING

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Abstract: The formation of aberrant cells in the brain, some of which may progress to cancer, is known as a brain tumor. Magnetic Resonance Imaging (MRI) scans are the most common tool for detecting brain tumor. Information on aberrant tissue growth in the brain is identified using MRI imaging. The detection of a brain tumor has been discussed in a number of studies. Machine Learning and Deep Learning algorithms were used to accomplish this. When these methods are used on a data set, MRI scans The diagnosis of a brain tumor is done quickly, and the higher the accuracy, the better the patients' therapy, this forecast aids the radiologist in making timely decisions In the proposed scenario. In this study, an Artificial Neural Network (ANN) and a Convolution Neural Network (CNN) with self-defined parameters are used in recognizing the presence of tumor in human brain and the action is analyzed.

Index Terms **- Convolution neural network (CNN), Artificial neural network(ANN), Magnetic resonance image(MRI).**

I. INTRODUCTION

Brain tumors are serious and life-threatening diseases that are categorized according to their level of malignancy by the World Health Organization (WHO). Brain tumors are the abnormal and uncontrolled growth of brain tissues or cells. It has been discovered that the most effective strategies of reducing death rates from brain cancer include early detection and therapy. The later start as a cancer in many locations throughout the body and progress to the brain region, the earlier they start in the brain and tend to stay there. One essential tool in meticulous and effective treatment planning is brain tumor segmentation. The separation of brain tumors by MRI has been a highly explored field. Brain tumors can take many different forms and have varied sizes when they develop. different numbers of tumors.

Bio One of the most crucial tools for making a diagnosis is the use of medical photographs, which provide details about the appearance and functionality of human bodily parts. Medical graphics serve as a unique tool for managing therapeutic action. To locate the sickness or affected area inside our bodies, a variety of medical imaging procedures are performed. One of the major causes of death for both men and women is cancer. Early cancer detection can aid in the complete eradication of the disease. Therefore, the need for methods to identify cancer nodules in their early stages is growing nowadays. Unwanted growth in brain tissue is the source of the condition known as brain tumors.

II. LITERATURE SURVEY

[1]: Detection of Brain Tumor in MRI Images, using Combination of Fuzzy C-Means and SVM – Parveen, Amritpal singh - IEEE - 19-20 Feb. 2015.
MRI is the most important technique, in detecting the brain tumor. In this paper data mining methods are used for classification of MRI images. A new hybrid technique based on the support vector machine (SVM) and fuzzy c-means for brain tumor classification is proposed. The purposed algorithm is a combination of support vector machine (SVM) and fuzzy c means, a hybrid technique for prediction of brain tumor. In this algorithm the image is enhanced using enhancement techniques such as contrast improvement, and mid-range stretch.

[2]. Efficient Detection of Brain Tumor from MRIs Using K-Means Segmentation and Normalized Histogram - Garima Singh, Dr. M.A. Ansari - 2016 1st India International Conference on Information Processing (IICIP) – IEEE - 12-14 Aug. 2016.
Magnetic resonance imaging (MRI) is a technique which is used for the evaluation of the brain tumor in medical science. In this paper, a methodology to study and classify the image de-noising filters such as Median filter, Adaptive filter, Averaging filter, Un-sharp masking filter and Gaussian filter is used to remove the additive noises present in the MRI images i.e. Gaussian, Salt & pepper noise and speckle noise.

[3]. MR Image classification using adaboost for brain tumor type - Astina Minz, Prof. Chandrakant Mahobiya - 2017 IEEE 7th International Advance Computing Conference (IACC) – IEEE - 5-7 Jan. 2017.
In this paper, we are proposing a method which can be utilized to make tumor detection easier. The MRI deals with the complicated problem of brain tumor detection. Due to its complexity and variance getting better accuracy is a challenge. Using Adaboost machine learning algorithm we can improve over accuracy issue. The proposed system consists of three parts such as Preprocessing, Feature extraction and Classification. Preprocessing has removed noise in the raw data, for feature extraction we used GLCM (Gray Level Co- occurrence Matrix) and for classification boosting technique used (Adaboost).

[4]: Brain Tumor Segmentation and Classification Using MRI Images via Fully Convolution Neural Networks - Sanjay Kumar, Dr. Ashish Negi, Dr. J.N Singh, Dr. Amit Gaurav - 2018 International Conference on Advances in Computing, Communication Control and Networking (ICACCCN) – IEEE - 12-13 Oct. 2018.
Charismatic timbre Imaging be the favorite picture modality intended meant pro assess brains tumor plus segmentation be essential designed on behalf of analysis plus action preparation. Consequently, vigorous routine segmentation method is requisite. Mechanism education proposal anywhere the representation be educated as of information be pretty victorious. Hierarchical segmentation approach first section the complete brain tumor follows through intra growth hankie classification.

[5]: Classification of Tumors and It Stages in Brain MRI Using Support Vector Machine and Artificial Neural Network - Rasel Ahmmed1 , Anirban Sen Swakshar2 , Md. Foisal Hossain3 , and Md. Abdur Rafiq4 - 2017 International Conference on Electrical, Computer and Communication Engineering (ECCE) – IEEE - 16-18 Feb. 2017.
Cell is the smallest unit of tissues, whose abnormal growth causes tumor in Brain. Support Vector Machine (SVM) and Artificial Neural Network (ANN) based tumor and its stages classification in brain MRI images is presented in this research work. This work is started with the enhancement of the brain MRI images which are obtained from oncology department of University of Maryland Medical Center. The integration of Temper based K-means and modified Fuzzy C-means (TKFCM) clustering algorithm used to segment the MRI images based on gray level intensity in small portion of brain image.

III. METHODOLOGY

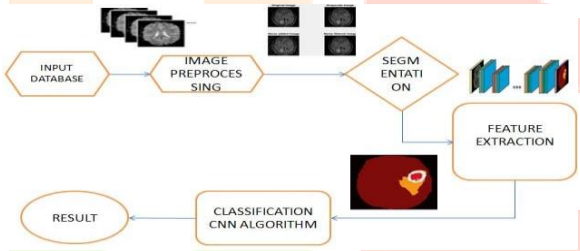


Fig: system architecture

1. Image Collection:

The Magnetic Resonance Images (MRI) are taken as input for the proposed system.

2. Image Preprocessing:
Pre-processing aims to improve image data by minimizing undesirable distortions and enhancing some image attributes crucial for additional image processing. There are three main components to image pre-processing a) Converting to grayscale b) Removing noise c) Image augmentation.

3. Image Segmentation
After image pre-processing, the Brain Tumor region was separated from the surrounding MR images. To improve segmentation, the contrast of a black-and-white image was changed.

4. Feature Extraction:
In order to extract the information from an image, feature extraction is crucial. For this texture picture analysis, we are utilizing GLCM. The spatial dependency between image pixels is recorded using GLCM. The most prevalent features including contrast, entropy, energy, homogeneity, correlation, ASM, and cluster-shade are captured by GLCM using the grey level image matrix. By measuring specific values or features that aid in classifying various images from one another, feature extraction (GLCM) aims to suppress the original image data set.

5. Classification:

Convolution Neural Network refers to the binary classifier that uses the hyper-plane, also known as the decision boundary between two classes. Pattern recognition issues like texture categorization using CNN are among the issues. In high dimensional space, CNN's mapping of non-linear input data to linear data produces accurate classification. CNN maximizes the minimal distance between various classes.

IV. CONVOLUTION NEURAL NETWORK

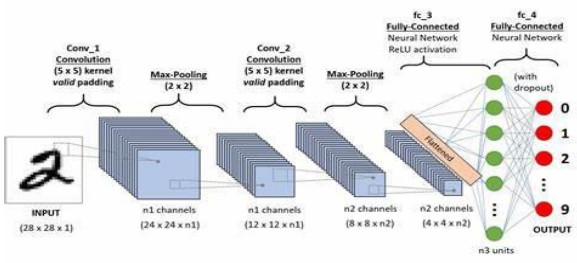


Fig: convolution neural network

A class of deep neural networks called convolutional neural networks (CNN/ConvNet) are most frequently used to analyse visual imagery. Normally, matrix multiplications come to mind when we think of a neural network, but that is not the case with ConvNet. It makes use of a unique method called convolution. Convolution is a mathematical procedure that takes two functions and creates a third function that expresses how the shape of one is changed by the other in mathematics.

V. IMPLEMENTATION

Data Augmentation:

Image data augmentation is a method for artificially increasing the size of a training dataset by producing altered versions of the dataset images. The ability of fit models to generalize what they have learnt to new images can be improved by training deep learning neural network models on more data. Additionally, augmentation techniques can produce variations of the images. Through the Image Data Generator class in the Keras deep learning neural network framework, it is possible to fit models with the addition of image data.

$$(f * g)(t) \stackrel{\text{def}}{=} \int_{-\infty}^{\infty} f(\tau) g(t-\tau)\, d\tau = \int_{-\infty}^{\infty} f(t-\tau) g(\tau)\, d\tau.$$

Image acquiring:

Acquiring images is the primary phase. The obtained photos must be produced with a broad range of vision after the image collecting. With the help of the uigetfile and imread mat lab functions, first capture the input photos from the available source.

Data Pre-processing:

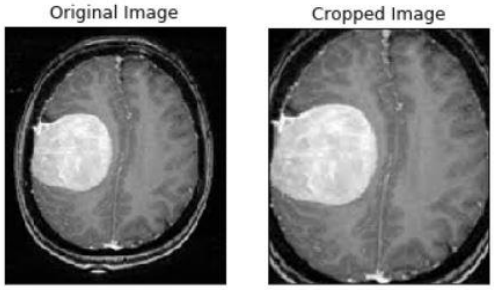
For every image, the following pre-processing steps were applied:

1. Crop the part of the image that contains only the brain (which is the most important part of the image).
2. Due to the fact that the images in the dataset come in various sizes, resize the image to have the following shape: (240, 240, 3)=(image width, image height, number of channels). Therefore, for the neural network to accept them as input, all images must have the same shape.
3. Use normalisation to scale the values of pixels to a range between 0 and 1.

Next process is carried out:

Each input x (image) has a shape of (240, 240, 3) and is fed into the neural network. And, it goes through the following layers:

1. A Zero Padding layer with a pool size of (2, 2).
2. A convolutional layer with 32 filters, with a filter size of (7, 7) and a stride equal to 1.
3. A batch normalization layer to normalize pixel values to speed up computation.
4. A ReLU activation layer.
5. A Max Pooling layer with f=4 and s=4.
6. A Max Pooling layer with f=4 and s=4, same as before.
7. A flatten layer in order to flatten the 3-dimensional matrix into a one-dimensional vector.
8. A Dense (output unit) fully connected layer with one neuron with a sigmoid activation (since this is a binary classification task).



Data split

The data was split in the following way:
70% of the data for training.
15% of the data for validation.
15% of the data for testing.

Training the model

In this process the split data are trained with test size value 0.3.
i.e, number of training examples = 1445
number of development examples = 310
number of test examples = 310
X_train shape: (1445, 240, 240, 3)
Y_train shape: (1445, 1)
X_val (dev) shape: (310, 240, 240, 3)
Y_val (dev) shape: (310, 1)
X_test shape: (310, 240, 240, 3)
Y_test shape: (310, 1)

Validation

For better understanding, the loss and accuracy are plotted in graphical representation as shown:

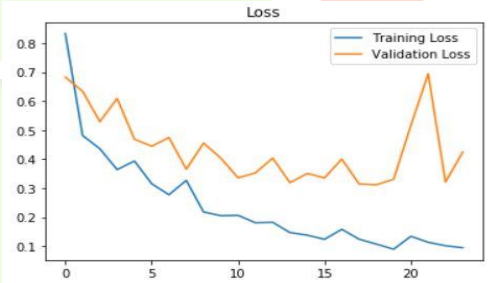


Fig: Loss rate

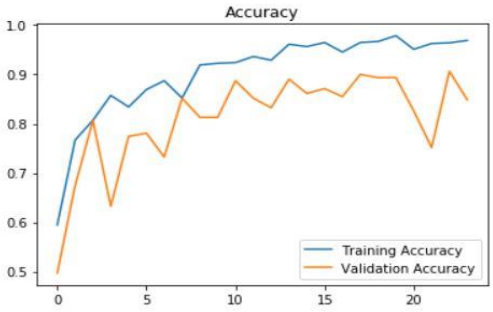


Fig: Accuracy rate

VI. RESULT

```
ex_img = cv2.imread('yes/Y100.jpg')
ex_new_img = crop_brain_contour(ex_img, True)
```

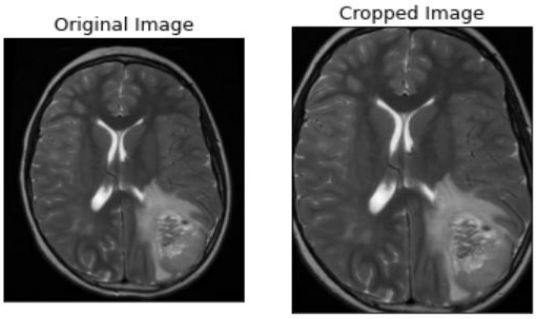


Fig: Input

```
b = np.expand_dims(img3, axis=0)
res = model.predict(b)

plt.imshow(img)

if res > 0.3:
  print("YES ,IT IS AFECTED BY CANCER")
else:
  print("NO, IS NOT AFECTED BY CANCER")
```

```
NO, IS NOT AFECTED BY CANCER
```

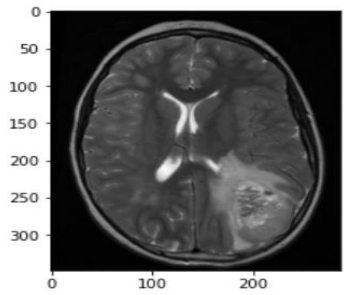


Fig: Output

VII. CONCLUSION AND FUTURE WORK

Convolution Neural Network segmentation is used to identify the tumor location in the MR images once the input MR images have been read from the device and converted to grayscale images. With few errors and a less computational time, the suggested model will achieve an accuracy of 84%.

The goal is to use 3D brain imaging in the future to segment brain tumors more effectively. It will be more difficult in this regard to work with a larger dataset.

VIII. REFERENCES

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[2]. Mokhled, “Brain Tumor Detection Using Image Processing Techniques”, Leonardo Electronic Journal of Practices and Technologies (LEJPT), ISSN 1583-1078, Issue 20, January-June 2012, pp. 147-158.
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