Image Processing On Neural Network Based Brain Tumor Recognition Using Machine Learning

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Abstract- *Brain tumor means the aggregation of abnormal cells in some tissues of the brain. Brain tumor can be cancerous or noncancerous. The most common types of brain tumors are Glioma, Meningioma and Pituitary tumor. Early detection of tumor cells plays a major role in treatment and recovery of patient. Diagnosing a brain tumor usually undergoes a very complicated and time consuming process. The MRI images of various patients at various stages can be used for the detection of tumors.*

There are various types of feature extraction and classification methods which are used for detection of brain tumor from MRI images. Convolution Neural Network image classification algorithm helps in detecting the tumor at early stage. We proposed a technique that implements three approaches like CNN, KNN and RNN to predict the presence of Brain tumor cells in the image. Also the comparison between those three techniques is implemented in this system to provide most accurate results. The results showed that Recurrent Neural Network architecture for detection of tumor cells gives accuracy of about 92.44% whereas the other two techniques shows only around 60% accuracy in prediction level. Thus the prediction of Brain tumor is implemented in an effective manner in this system.

I. INTRODUCTION

Brain tumor is the collection or mass of abnormal cells in the brain or central spine canal. Our brain is enclosed by skull which is very rigid. Any growth inside such a restricted space can cause many problems for human. Brain tumors can be both cancerous (malignant) or noncancerous (benign). The pressure inside the skull increase when benign or malignant tumors grow. This will result in brain damage, and it can be life-threatening.

Brain tumors usually appear in various locations with different dimensions and shapes. Brain tumors are categorized as primary or secondary. A primary brain tumor originates in our brain. Many primary brain tumors are benign. A secondary brain tumor, which is also known as a metastatic brain tumor, occurs when cancer cells spread to our brain from another organ, such as lung or breast. Early detection of tumor cells can save large number of human lives.

Detecting the brain tumor and its stage undergoes a very complicating and time consuming process. The patient refers to MRI when some symptoms related to tumors have appeared. After examining the brain images, if tumor existence is suspected, the patient's brain biopsy comes into action. Biopsy is an invasive procedure and in some cases it may even take up to a month for a definite answer.

Intracranial Neoplasm or Brain tumor is abnormal growth of cells in the brain. Brain is the most complicated part of our body. The symptoms of a tumor may be frequent headaches and migraines. Over the years it may even lead to vision loss. At this moment science is scarce about the origins and factors leading to this abnormal growth. Tumors are classified on two bases: whether they are cancerous or not and their place of origin. The noncancerous form of the tumor is referred to as Benign. These are easily distinguishable and have a slow growth rate. Cancerous tumors are called Malignant. These are very aggressive and can be life threatening as these are hard to detect. When it comes to detecting a tumor, doctors can opt for either an X-ray or an MRI. MRI's are appropriate when all other test fail to provide sufficient information. An MRI scan uses the properties of magnetism and radio waves to produce accurate images.

Neurosurgeons most commonly prescribe MRI's as it provides them with sufficient information to detect even the smallest abnormalities. Sanjeev Thakur, Professor Amity School of Engineering and Technology Amity University, Noida sthakur3@amity.edu However, as MRI uses magnetic waves, so it is unsuitable for patients with pacemakers and metal implants. Now once we have the scanned image of the brain, it is important to accurately detect the tumor, its size, and its location. All this information is necessary for the Neurosurgeon to complete his diagnosis. This is where Computerized Image Processing comes to help. With the use of different segmentation techniques and feature extraction method, we can accurately detect the tumor.

II. LITERATURE REVIEW

Brain tumors can threaten human life directly. If the tumor is detected at an early stage, the patient's survival chance increases. Magnetic resonance (MR) imaging is widely used by physicians in order to determine the existence of tumors or the specification of the tumors [1]. The qualification of the brain cancer treatment depends on the physician's experience and knowledge [2]. For this reason, using an automated and flawless working tumor detection system is extremely important to aid physicians to detect brain tumors. Detection of tumors in the brain via MR images has become an important task and numerous studies have been conducted in recent years. A hybrid fuzzy c-means clustering algorithm and a cellular automata-based brain tumor segmentation method were presented in [3]. The authors used a gray level cooccurrence matrix (GLCM) and a new similarity function based solution for seed growing problems in traditional segmentation algorithms.Feature extraction was then performed by using GLCM, gray level run length matrix (GLRLM), and histogram based techniques. The random forest classifier was used as a classifier. At the end of the study, tumor detection was performed using fast bounding box and tumor segmentation by using an active contour model. A total of 120 patient's data were used to evaluate model performance.

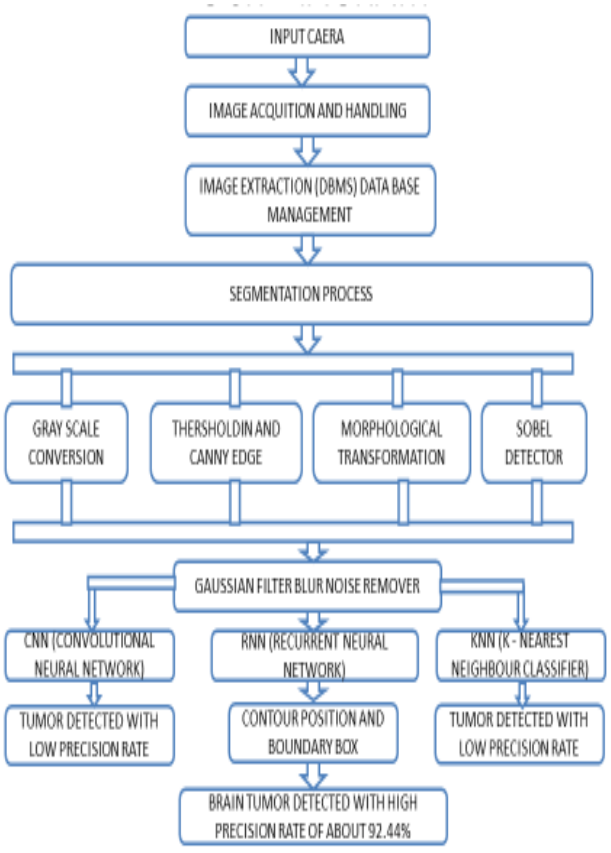

Fig No: Architecture design for proposed system.

III. SYSTEM MODULES

3.1 Image pre-processing

Image pre In this module the features can be extracted from input MRI images.As mentioned before images can be classified into many sections and on the basis of many parameters.For training a network all the images which are being used or which are being stored should be uniform.Images can be distinguished on the basis of RGB and Gray-Scale.The MRI scans are mostly in the gray scale format so all the images stored in the folder should preferably be in the gray scale format.The dimensions of the image should be uniform as well for which one should resize the image and change its dimensions to 277*277 which is the required dimension when a network is being formed. RGB image hence it.

3.2 Segmentation process

Segmentation partitions an image into distinct regions containing each pixel with similar attributes.To be meaningful and usefull for image analysis and interpretation, the regions should strongly relate to depicted object or features of interest.Meaningful segmentation is the first step from low-level image processing transforming a grayscale or color image into one or more other images to high-level image description in terms of features,object,and scenes.The success of image analysis depends on reliabilty of segmentation,but an accurate partitioning of an image is generally a very challenging problem.

3.3 Database Module

The two different type of images can be stored in database system.The positive and negative images,here the negative images for brain tumor images, and positive images does not contain brain tumor.

3.4 Image Enhancement

Image Enhancement is the process of adjusting digital images so ,that the result are more suitable for display or further image analysis.For example,you can remove noise,shapen or brighten of digital images,marking easier to identify key feature.Methods:

- Filtering with morphological operation.
- Histogram equalization.
- Noise removal.
- Linear contrast adjustment
- Median filtering. Etc.

Edge Detection Technique
Canny edge detector

3.5Recognition Module

In this module the brain tumor can be detected using CNN (Convolutional Neural Network), KNN (K-Nearest Neighbor) and RNN (Recurrent Neural Network) algorithm by comparing with database system. Also the comparison of performance of those three techniques is undertaken for better analysis and found out that the RNN approach shows better results in prediction values than other two approaches.

3.6 Contour Position Module

In the brain tumor is detected ,the contour positioning technique can be marked the position of brain tumor detected.Morphology is a tool of extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons, and the convex hull. In morphological operation, there are two fundamental operations such as dilation and erosion, in terms of the union of an image with translated shape called a structuring element. This is a fundamental step in extracting objects from an image for subsequent analysis.

IV. RESULT AND DISCUSSINON

Our proposed technique showed better results in prediction of brain tumor without false alarms. Further the comparison between three familiar and widely used techniques such as CNN, KNN and RNN provides us a better analysis of the system function in terms of performance of the technique and it helps us in providing good and precise results. In consideration of medical image processing, the accuracy in the prediction is indispensable as it directly affects the diagnosis of the particular ailment and thus influences the treatment efficiency. That leads to the better health care performance in providing good care to the patients. Thus our system ensured the effective prediction of brain tumor in MRI images using Image processing techniques and by the implementation of Neural networks successfully.

CNN ALGORITHM

Fig No:2 Original Image

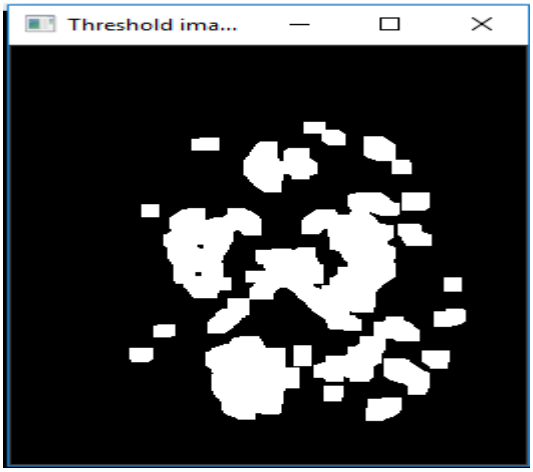

Fig No:3 Output Image

KNN ALGORITHM

Fig No:2 Original Image

Fig No:3 Output Image

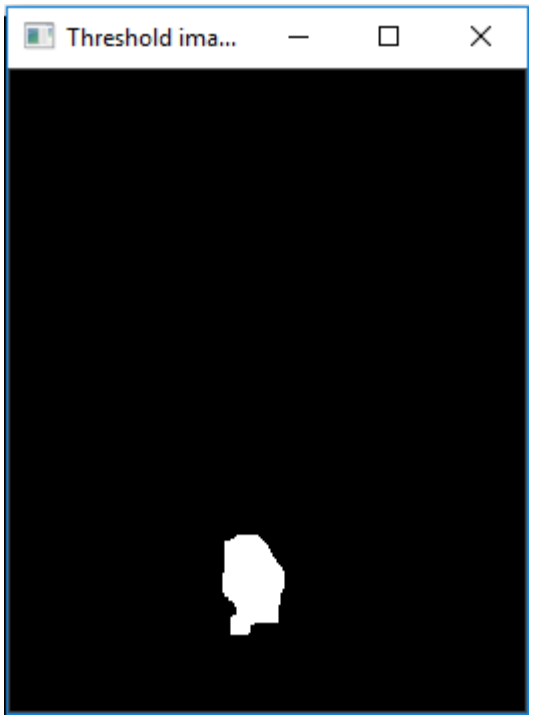

Fig No:3 Output Image

RNN ALGORITHM

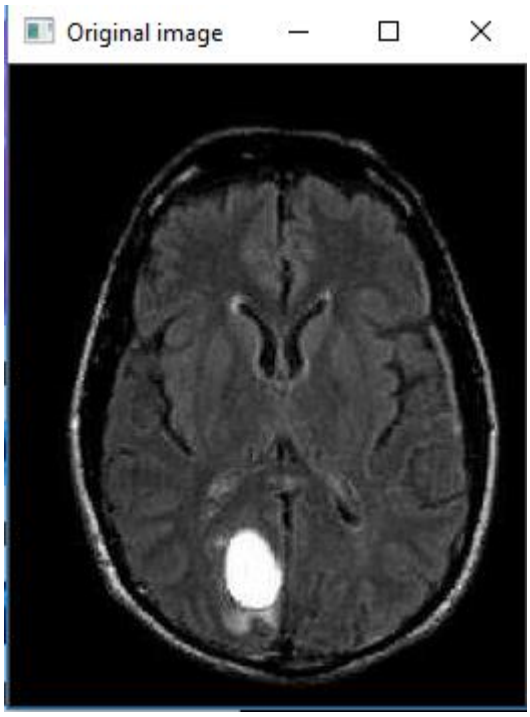

Fig No:2 Original Image

V. CONCLUSION

In this project, a new method is proposed in which the different techniques are used. CNN, KNN and RNN are used to predict the presence of tumor cells in Brain. The comparison among those three techniques is also implemented. RNN shows the best results which is based on the combination of feature extraction algorithm for tumor detection from brain images is presented. The RNN is capable of detecting a tumor. The RNN is very useful for selecting an auto-feature in medical images. Images were applied to the RNN after preprocessing. In order to evaluate the performance of the RNN has been used by other features. The RNN has been able to categorize accurately 92.44% images in two normal and patient classes; and from a total of images, images have been constrained by the RNN. Using the proposed method of feature extraction and applying to the RNN. Due to the importance of the Diagnosis given by the physician, the accuracy of the doctor's help in diagnosing the tumor and treating the patient increased high medical accuracy of the proposed method.

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