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A Review on Brain Tumor Detection using Image Processing Techniques

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Abstract – *Brain Tumor detection is incredibly advanced work for doctors, even with large advancement in medical technology. Image processing plays important role in tumor detection. It is attainable to sight brain tumor in early stages with computer assisted image analysis. Different types of image processing technologies like imaging scans, X-rays and Magnetic resonance Imaging (MRI) that facilitate doctors to acknowledge injuries in human brain. The most focus of medical image process is to diagnose authentic and important knowledge exploitation pictures with the smallest amount fault tolerance. Main focus of this work is to focus on the techniques planned in contemporary world literature by encapsulating novel facts of analysis.*

Key Words: Brain Tumor detection, Image processing, image analysis, etc.

1. INTRODUCTION

The medical image processing is extensively employed in several areas. In earlier detection and treatment of those diseases is incredibly useful to search out the abnormality problems therein image. The brain is one of the necessary organs of the chassis because it coordinates every and each action of the human body.

2. LITERATURE SURVEY

The author of paper titled as "Two-step verification of brain tumor segmentation using watershed-matching algorithm" has proposed a model that has two levels of authentication system to detect tumor area. It is known as watershed-matching algorithm. Tumor region was segmented using watershed-algorithm and then SIFT (scale-invariant feature transform) algorithm was used for matching and calculating the segmented region with the original image. The area of the tumor was calculated and based on that a decision was taken whether it is in a critical or initial stage. This status checking made the system more robust.

The paper titled "Automatic Human Brain Tumor Detection in MRI Image Using Template-Based K Means and Improved Fuzzy C Means Clustering Algorithm" has proposed K-Means Clustering Algorithm and Fuzzy C-Means Clustering Algorithm. Magnetic resonance imaging (MRI) image acted as a input the proposed algorithm. In this method template is selected on the basis of temper and gray level intensity in the brain image along with conventional K-means and membership function is modified by the image features.

The author has discussed various image processing steps i.e. image preprocessing, segmentation, feature extraction and classification and for each step author has discussed number of techniques in his paper titled "Recognition of Brain Tumor utilizing Image Processing Techniques". For image preprocessing Median filter, Mean filter, Wiener Filter, Hybrid filter and Morphology Based De-Noising. For segmentation Threshold segmentation, Morphological based segmentation, K-means algorithms are discussed. And for feature extraction techniques of Edge detection, Histogram based feature extraction are discussed along with their comparison of complexity and accuracy.

The paper titled "Image-based Classification of Tumor Type and Growth Rate using Machine Learning: a preclinical study" has discussed the use of texture features which help to predict and scan the tumor-region and type of tumor. Gray-level co-occurence matrix(GLCM) and various machine learning models are used to optimize prediction. Standard medical images are used to predict & classify tumor type. Machine learning can identify texture features of these images which helps to classify region and type of tumor. By this study we can to evaluate the tumor growth, with model performance, varying as a function of GLCM size, tumor region, and tumor type.

Another paper titled "Brain tumor detection, Segmentation using Water Shed Algorithm" have used the Stages for finding the tumor area as Image Acquisition, Preprocessing Stage, Processing Stage, Post-Processing Stage, Calculation the tumor area by using the watershed segmentation and morphological operations. As watershed meets the criteria of less computational complexity it gives very good segmentation results.

The paper titled as "BRAIN TUMOR DETECTION USING K-MEAN CLUSTERING AND SVM" has discussed unique framework for classification supported Gray level co-occurrence matrix(GLCM) extracted from the magnetic resonance imaging i.e. MRI images. In this paper different types of scans have discussed like MRI, CT, Angiogram, Myelogram and Positron Emission Tomography. The K-means clustering algorithm for segmentation is used and for the classification of the brain tumors SVM i.e. Support Vector Machine is used.

The paper titled as "Enhancement of Images Using Histogram Processing Technique" discussed following points: Histogram processing is the act of altering an image by modifying its histogram. A common use of histogram processing is

normalization by which we can make the histogram of an image. Histogram Processing is an efficient method for image enhancement. In this paper they have used four techniques on a low contrast image. Out of these BBHE (Brightness Preserving Bi-Histogram Equalization Technique) has the lowest MSE and hightest PSNR and hence gave best results.

3. METHODS IN LITERATURE SURVEY

- Watershed segmentation Algorithm

The watershed transform may be a morphological based tool for image segmentation. The idea of watershed are often deem a landscape immersed during a lake; catchment basins are going to be filled up with water starting at each local minimum. Dams must be built where the water coming from different catchment basins could also be meeting so as to avoid the merging of catchment basins. The water shed lines are defined by the catchment basins divided by the dam at the very best level where the water can reach within the landscape. As a result, watershed lines can separate individual catchment basins within the landscape.

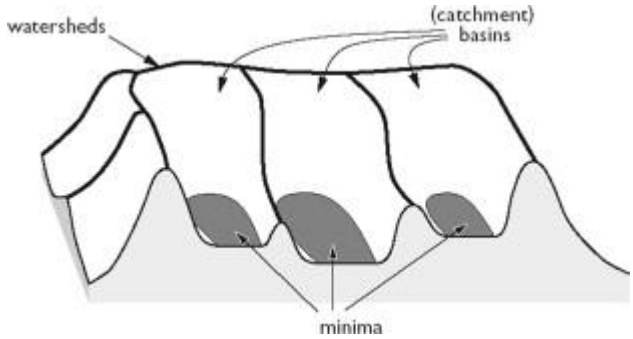

Fig -1: Principle of the watershed transform where the intensity values define hills and basins. For segmentation purposes, basins could also be flooded so as to mix corresponding regions.

Watershed segmentation could also be a region-based technique that utilizes image morphology. It requires selection of at least one marker with respect to every object in the image, addition with the background as a another separate object. The markers are selected by an operator or are provided by an function that takes the consideration of application-specific knowledge of the objects.

- CNN Algorithm

Convolutional neural network is one of the foremost categories to undertake to to pictures recognition, images classifications. CNNs are widely used in different areas like medical image classification, object detection, etc. CNN image classification takes an image as a input, do some processing and classify it under certain categories (e.g. brain tumor detected, not detected). Computers see an image as an array of pixels and it depends on the resolution of the input image. Supported the image resolution, it'll see h x w x d(h = Height, w = Width, d = Dimension). Eg., a picture of 6 x 6 x 3 array of matrix of RGB (3 refers to RGB values) and a picture of 4 x 4 x 1 array of matrix of grayscale image.

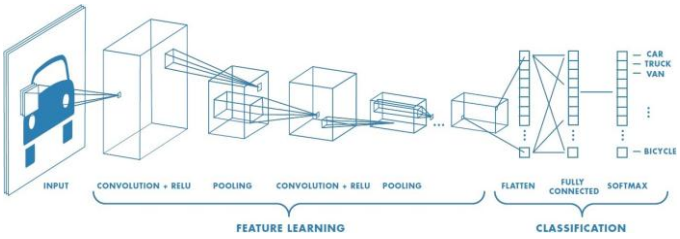

Fig -2: Neural network with several convolutional layers

Convolution Layer: Convolution is that the primary layer to extract features from an input image. It's a mathematical operation that takes two inputs like image matrix and a filter or kernel.

Pooling Layer: Pooling layers section would reduce the quantity of parameters when the photographs are overlarge.

Fully Connected Layer: The layer we call as FC layer, we flattened our matrix into vector and feed it into a completely connected layer kind of a neural network.

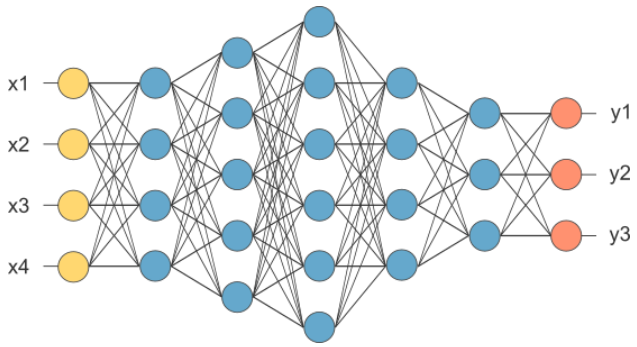

Fig- 3: After pooling layer, flattened as FC layer

4. OBSERVATIONS

Table -1: Comparison of methods with respect to literature Survey

Sr. No.	Author	Year	Methods	Advantages	Drawbacks	Accuracy (%)
1	S. M. Kamrul Hasan and Mohiudding Ahmad [1]	2018	Preprocessing by median filter and trilateral filter Segmentation by watershed Segmentation and Scale invariant features transform(SIFT)	Watershed Segmentation provides a very good result, and at the same time, it is computationally easy and less complex.	Preprocessing should be carefully done for getting accurate results.	98.5
2	Tonmoy Hossain, Fairuz Shadmani Shishir[2]	2019	CNN, FCM, Medical Image, segmentation, SVM	It provides high computational Efficiency	does not perform well when the data set has noise	97.87
3	Anushree A. Wankhade, dr. A.V.Malviya[3]	2018	Segmentation by K-means algorithm and classification by Support Vector Machine	Accuracy is high as compared to other techniques	Feature extraction should be carefully done and it uses many methods	98.6
4	P. Muthu Krishnammal, S.Selvakumar Raja	2019	Convolutional Neural Networks, K-means Segmentation	It provides more accuracy	It does not work well with the clusters of different sizes and different densities	Undefined
5	Anushree A. Wankhede, DR. A. V. Malviya [6]	2018	Segmentation by K-means algorithm and for feature extraction GLCM,HOG and LBPH, classification by Support Vector Machine(SVM)	Accuracy is high as compared to other techniques	Feature extraction should be carefully done and it uses many methods	98.6
6	Sathya Narayan N., Vidya T.	2019	Random Forest Algorithm	It provides more accuracy	Complex and noise removal is tough	96

5. CONCLUSION

We were able to create and train a model that gave us high accuracy on unseen data using relatively low input data. Proper images processing based on the problem statement is what separates a good model from a bad one. In the study, we did a partial survey of proposed methods for categorization of MR images. On the basis of performance criteria like efficiency, correctness, sensitivity and their real-time applications, various techniques have been recommended to increase the prophecy/prediction.

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