A SURVEY: BRAIN TUMOR DETECTION AND CLASSIFICATION USING TWO-TIER CLASSIFIER APPROACH

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ABSTRACT

Brain tumor is a mass of tissue and it occurs an abnormal growth of cells, then it form within the brain. Humans have different types of brain, it consists large or small. To identifying tumor detection and classification using brain MRI image. In this project classification process used an two-tier classification approach and adaptive pillar K-means algorithm for image segmentation. In two-tier classifier approach an proposed system, at first the Fuzzy based Support Vector Machines for clustering and features extracted from the GLCM matrix then consequently trained by the ANN for image classification and the testing process is also accomplished in two stages. ANN is highly effective algorithm and its used for pattern recognition. The proposed model is to design a system that is capable of processing the MRI image to identify the defective part.

Keywords— Classification, GLCM Technique, ANN algorithm, FSVM, Two-Tier approach

I.INTRODUCTION

Brain tumor is an intracranial solid neoplasm which is characterized by an cluster of abnormal growth cells within the brain or the central spinal canal[1]. Brain tumors present at any location and different types of shapes and sizes in image, then it occurring any person almost any age. Brain tumors can be malignant (cancerous) or benign (non-cancerous). Low grade gliomas and meningiomas are non-cancerous and glioblastoma multiforme is a cancerous tumor which represents the common primary brain neoplasm.Brain tumor are normally situated in the posterior fossa in children and in the foremost of the cerebral hemispheres, in fact it canaffect any part of the brain.

The common symptoms are headaches; numbness or tingling in the arms or legs; seizures; memory problems; mood and personality changes; balance and walking problems; nausea and vomiting; or changes in speech, vision, or hearing.

In this paper, first initially pre-processing process using MRI brain image for removing noise and stripping the skull from image, after pre-processed image it can be segmented by using an adaptive pillar K-means clustering algorithm. For feature extraction proposed system uses the Gray Level Co-occurrence Matrix(GLCM)for feature vector. Finally, for tumour classification, Fuzzy based support vector machines(FSVM) and Artificial Neural Network(ANN) classification algorithm is used. ANN algorithm is effective algorithm for pattern recognition[2]. ANN is detect complexnonlinear similarly dependent and independent variables and includes multiple training algorithm.

While using this two-tier classification process for overall performance and accuracy also increased compare other classification techniques.

II.RELATED ARTICLES

2.1 BRAIN TUMOUR CLASSIFICATION USING TWO-TIER CLASSIFIER WITH ADAPTIVE SEGMENTATION TECHNIQUE

The authors V.Anitha and S.Murugavalli proposed an adaptive pillar K-means for MRI segmentation and a two-tier classifier to classify tumors.Brain cancer is generally diagnosed by a specialist called a neurologist. Imaging tests performed on magnetic resonance imaging (MRI) and/or computed tomography (CT) scan utilise computer technology to engender detailed pictures of the brain

In the proposed two-tier classification system, initially the brain MRI is preprocessed to eliminate the noise and stripping the skull from the brain MRI and subsequently, the pre-processed image is segmented using adaptive pillar K-means clustering algorithm. For feature extraction proposed system uses the discrete wavelet transform (DWT) coefficients as feature vector. Finally for tumour classification, self organising map (SOM) neural network and K-nearest neighbour (KNN) classification algorithm is used.. The de-noised brain MRI is send for skull stripping, the skull and non-cerebral tissues are removed using Otsu thresholding and morphology segmentation. Then de-noising and skull stripping method used to provide better Image clarity.

In figure.2.1 shows the process flow of skull stripping using an mathematical morphology in otsu thresholding. , image segmentation to identify the cardinal tissues of brain MRI images[1][13].

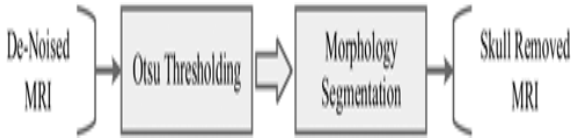

Fig.1Process flow of skull stripping using mathematicalmorphology

Finally, the classification algorithm works an cluster because it underlying data distributions. In clusters have separated two categories such as intercluster and intra-cluster. In large inter-cluster distances and small intra-cluster distances between the patterns of classes. In feature space have a problemof proposed work because, pattern corresponds have different classes, so it can be solved by an efficient two-tier classification method. In classification method used to decrease the dimensionality of the feature space as well as to improve the efficiency of the classification. In two-tier classification method the SOM neural network classifier trains the features, it used for clustering data.

The KNN classification technique is the simplest technique conceptually and computationally that delivers good classification accuracy. By using this two-tier classification system the overall system performance and accuracy is increased over other conventional classificationtechniques.

2.2 AN OPTIMIZED METHOD FOR DETECTING BRAIN TUMOUR USING TWO-TIER CLASSIFIER WITH NEURAL NETWORK AND ADAPTIVE SEGMENTATION TECHNIQUE

The authors B.Rohini and R.saraswathi proposed an detecting brain tumour using two-tier classifier approach with ANN(Artificial Neural Network) for image classification and PSO(Particle Swarm Optimization) technique for image clustering[2].

The basic purpose of this paper is to show the tumor region. In this paper,they are implementing the system for brain tumor detection from MRI images, the malignant or benign tumor region to find by this system.

The proposed adaptive pillar K-means algorithm uses Euclidean distance to determine the distance between an object and its cluster centroid. In adaptive pillar K-means algorithm, to find out the average mean of the data point. The main advantage of Euclidean distance is reportedly faster than most other means of determining the correlation and it compares the relationship between actual ratings which means how similar ratings are for specific preferences or items. Then the segmentation process is done on the enhanced image by adaptive pillar k means.

In the proposed system,initially use two-tier classification technique to preprocess the brain MRI image to eliminate the noise and stripping the skull from the brain MRI image and the pre- processed image is segmented by adaptive pillar K-means clustering algorithm.. For tumour classification, Artificial Neural Network (ANN) classification algorithm is used.

ANN is highly efficient and effective algorithm for pattern recognition. Particle be used to optimize the image and produce accurate results. PSO has a higher optimization ability.

At finally, produce whether testing MRI is normal or abnormal and it produce an accurate results compare to existing system.

2.3 A NEW APPROACH TO IMAGE SEGMENTATION FOR BRAIN TUMOR DETECTION USING PILLAR K-MEANS ALGORITHM

The authors Hakeem Aejaz Aslam and Tirumala Ramashri proposed the adaptive pillar k-means algorithm for image segmentation [3]. Image segmentation is based on image analysis processing that aims at split an image into several regions according to a homogeneity criterion[12]. In grouping elements of high resolution images are new mechanism in segmentation method .

In this paper proposed a Fuzzy C-means technique used for classification. This technique used a number of clusters have each point, as in fuzzy logic, or other than same to just one cluster. Thus, each points on edge of cluster, it may be lesser degree in the center of cluster.

2.3.1 HISTOGRAM BASED METHODS:

Histogram-based methods are very efficient in comparison with other methods of image segmentation, and which generally require a single pass through the pixels.

A disadvantage of the method is that research histogram can be difficult to identify significant peaks and valleys in the image.

2.3.2 CLUSTERING METHOD:

Clustering can be viewed as the problem of unsupervised learning is important because it provides information about the "right" answer to any of the objects.

2.3.3 K-MEANS CLUSTERING

One of the most popular and widely studied clustering algorithms to separate the input data in the Euclidian space is the K-Means clustering.

In proposed system approach for image segmentation, while comparing with K-means clustering algorithm and Gaussian mixture model and the participation of RGB, HSV, HSL and CIELAB color spaces in this paper. Finally, thus approach can used for improving the segmentation quality and accuracy aspects of computing time.

Steps of the K-Means clustering algorithm:

1.Initialization – define the number of clusters and randomly select the position of the centers for each cluster or directly generate k seed points as cluster centers.

2. Assign each data point to the nearest cluster center.

3. Calculate the new cluster centers for clusters receiving new data points and for clusters losing data points.

4. Repeat the steps 2 and 3 until a convergence criterion is met (when there is no exchange of data points between the k clusters).

Graycomatrix using an feature extraction and its used for calculating the scaled version of the image. By default, if I is a binary image, graycomatrix scales the image, it considered two gray-levels. If I is an intensity image, graycomatrix scales the image, it considered eight gray-levels.

2.4 BRAIN TUMOR DETECTION AND CLASSIFICATION OF MR IMAGES USING TEXTURE FEATURES AND FUZZY SVM CLASSIFIER

The authors Jayachandran and Dhanasekaran proposes a hybrid algorithm for detection brain tumor in Magnetic Resonance images using Fuzzy Support Vector Machine (FSVM) classifier [4]. For successful treatment, tumor position and size are importantly classified and accuracy to measure. In generally have several algorithms for brain tumor detection and classifications in the field of medical image processing.

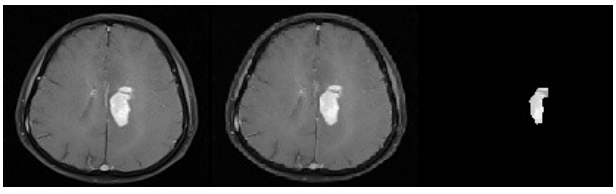

Fig. 2: (a) Original image (b) filtered image (c) segmented image

In this paper they proposed different approach consists of four stages such as: Noise reduction, Feature extraction, Feature reduction and Classification. In thisproposed a hybrid algorithm for detection brain tumor in Magnetic Resonance images using statistical features and Fuzzy Support Vector Machine (FSVM) classifier.

In the first stage anisotropic filter is applied for noise reduction and to make the image suitable for extracting features.

In the second stage, obtains the texture features related to MRI images.

In the third stage, the features of magnetic resonance images have been reduced using principles component analysis to the most essential features.

At the last stage, the Supervisor classifier based FSVM has been used to classify subjects as normal and abnormal brain MR images. Classification accuracy 95.80% has been obtained by the proposed algorithm.

2.5 AUTOMATIC CLASSIFICATION OF MR BRAIN TUMOR IMAGES USING DECISION TREE

The authors Hemarajini and Narmatha proposed an automatically classifies brain tumor using decision tree [5]. It have five different types of tumors such as glioblastoma multiforme, astrocytoma, metastatic, glioma and pituitary macro. For tumor classification used MR images and its considered an feature extraction for T1-weighted images are contrast for each axial slice through the brain.A binary decision tree is a rooted and directed tree with two types of tree vertices are such as:

A binary decision tree is a rooted and directed tree with two types of tree vertices are such as:

Terminal vertices

and

Non-terminal vertices.

2.5.1 TERMINAL VERTICES:

Terminal Vertices v has no children and is labelled by value (v) $\in$ {0, 1}.A binary decision tree for the two-bit comparator, given by the formula

$F(a1,a2,b1,b2) = (a1 \longleftrightarrow a2)(b1 \longleftrightarrow b2)$ (1)

2.5.2 NON-TERMINAL VERTICES:

Each non- terminal vertex v is a labelled by an variable vertex i.e. var(v)and has two succesors:

Low(v) similarly to the case where var(v) is assigned 0 and

High(v) similarly to the case where var(v) is assigned 1.

The proposed method has three stages. They are pre-processing, feature extraction and classification. In the first stage, the noise is removed using a wiener filter. In the second stage, six texture features are extracted using gray level co-occurrence matrix.

The features extracted are angular second moment, contrast, inverse difference moment, entrophy, correlation and variance. Finally, a decision tree classifier is used to classify the type of tumor image.

The extracted features are compared with the stored features in the knowledge base to classify the type of tumors. Thus, the proposed system has been evaluated on a dataset of 21 patients

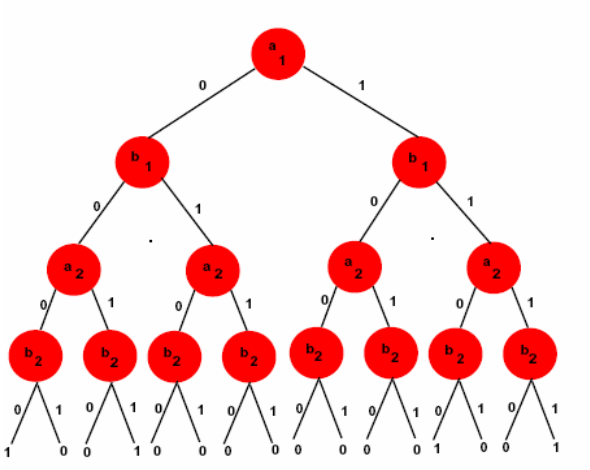

Fig.3(a) General Binary decision tree

. Then the system was found efficient in classification with a success of 98%. The proposed method has three stages. They are pre-processing, feature extraction and classification.

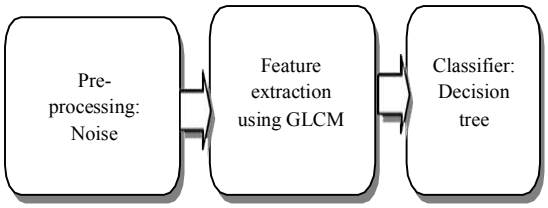

Fig.3(b) Block diagram for Decision Tree algorithm

Identifying an automatically classify the five different types of tumors like glioblastoma multiforme, astrocytoma, metastatic, glioma and pituitary macro in brain MR images using decision tree and accuracy also measured

III.METHODOLOGY AND ANALYSIS

In the proposed method of Brain tumor detection and segmentation using Adaptive pillar k-means algorithm. In proposed system of two-tier classification system, initially the brain MRI is pre-processed to eliminate the noise and stripping the skull from the brain MRI and subsequently, the pre-processed image is segmented using adaptive pillar K-means clustering algorithm. For feature extraction proposed system uses the Gray Level Co-occurrence Matrix(GLCM).

Finally, for tumour classification, Fuzzy based Support Vector Machines(FSVM) and Artificial Neural Network(ANN) classification algorithm is used.

3.1 ANN ALGORITHM:

ANN denotes an Artificial Neural Network [2]. ANN is detect complex nonlinear relationship between dependent and independent variables and includes multiple training algorithm.ANN is an adaptive system it change internal structure while it passing their information. It reach an adjusting the weight of connection. Each connection has a weight associated with it.

1. Supervised learning: This strategy involves a trainer which is smarter than the network. ANN are required the connected network unit and its difficult to extract the human knowledge, but used for an data mining.

2. Unsupervised learning: It used for not considered any any example data set with known answer.

3. Reinforcement learning: This strategy based on feedback from environment.The ability of neural network to make adjustment in structure of network.

3.2 FSVM ALGORITHM:

FSVM denotes FUZZY Based Support Vector Machines. The FSVM [4] based drop the margin value while increases their training speed, but will remove some support vector artificially. FSVM simply to manage to reduce complexity and it used for variant of the SVM algorithm of outliers and noise. In FSVMs, assigned some training examples it consists of different fuzzy –membership values based on their importance, and these values are incorporated into the SVM learning algorithm to make it less sensitive to noise.

However, like SVM algorithm and FSVMs can also suffer from the problem of class imbalance. By using this two-tier classification system the overall system performance and accuracy is increased over other conventional classification techniques. And furtherly analyses statistical measures of brain tumor.

And Fig:3.2.1 shows an flowchart of proposed method of brain tumor detection and segmentation using two-tier classifier approach.

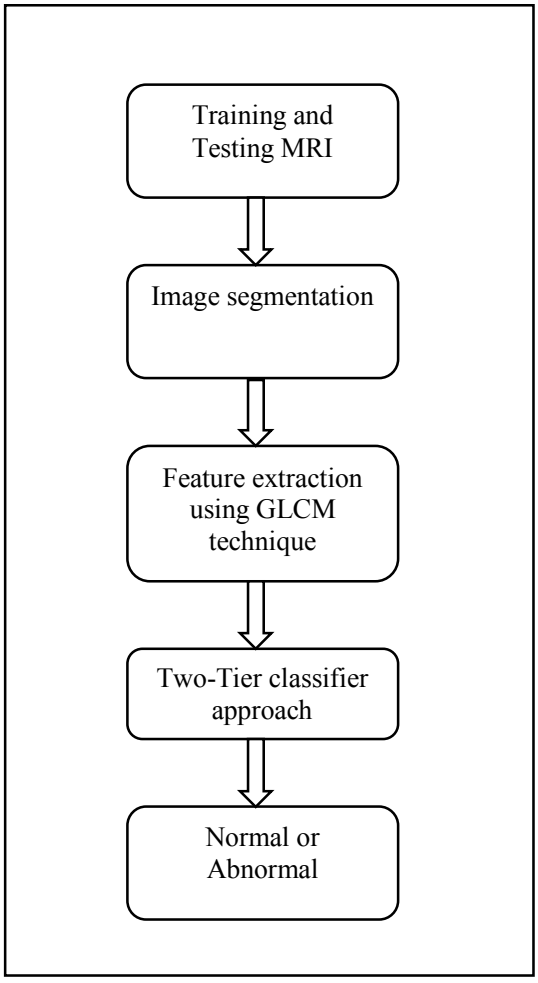

Fig.4 Flowchart for proposed work

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3.3 ADAPTIVE PILLAR K MEANS ALGORITHM:

The distance data metric of adaptive system using an authentic size of the image to perform high quality image segmentation. In performance of segmentation causes high-resolution image data points to be clustered. Thus, the K-means algorithm for clustering image data by considering that it has ability to cluster immensely collect the data andadditionally outliers' payments are using. Because, it done by efficiently. One of the local minima leads to erroneous clustering results hence K-means algorithm is arduous to reach global optimum. In image segmentation are very superior for initial clusters optimization for K-means by deploying all centroids far discretely among them in the data distribution.

In this algorithm[8][10][11], used for identifying a set of pillars. In the proposed adaptive pillar K-means algorithm we modified the pillar K-means algorithm. In the adaptive pillar K-means algorithm find out the average mean of the data point. The average mean based on initial point selection i.e centroid point can be improving performance of the clustering such as, grand mean.

It locates several pillars such as two, three, and four pillars but it pressures distributions are several different roof structures composed of discrete points.

IV.CONCLUSION

This paper proposes detection of brain tumor and image segmentation using an adaptive pillar k-means algorithm. After segmentation, the training feature extracted image using GLCM technique. In two-tier classifier approach, using ANN for classification and Fuzzy based SVM(FSVM) for clustering. The performance of two-tier classifier system in terms of statistical measures such as sensitivity, specificity and accuracy of tumor will be analyzed.

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REFERENCES

[1] V.Anitha, S.Murugavalli, Brain tumor classification using two-tier classifier with adaptive segmentation technique,IET journals,vol.10,June 2016,pp 9-17.

[2] B.Rohini, R.Saraswathi, S.Rajagopal, An optimized method for detecting brain tumor using Two-tier classifier with neural network and adaptive segmentation technique.,IJARTET.,vol.4, March 2017.

[3] Aslam, H.A., Ramashri, T., Ahsan, M.I.A. A new approach to image segmentation for brain tumor detection using pillar K-means algorithm,Int. J. Adv. Res. Comput. Commun. Eng,vol.2,March2013,pp. 1429–1436.

[4] Jayachandran A,Dhanasekaran R, Brain tumour detection and classification of MR images using texture features and fuzzy svm classifier, Res.J.Eng.Tech,June2013,pp 2264-2269.

[5]Rajini, N.H., Narmatha, T., Bhavani, R, Automatic classification of MR brain tumor images using decision tree, Special Issue of Int. J. of Computer Applications, March2012, pp. 10–13.

[6] John, P, Braintumor classification using wavelet and texture based neural network, Int. J. Sci. Eng. Res., 2012, 3, (10), pp. 1–7

[7] Anbeek, P., Vincken, K.L., Viergever, M.A, Automated MS-lesion segmentation by K-nearest neighbor classification, Midas J. MS Lesion Segmentation (MICCAI), vol.2,June2008.

[8]Clark, M.C., Hall, L.O., Goldgof, D.B., Velthuzien, R., Muztagh, F.R., Silbiger, M., Automatic tumor segmentation using knowledge based techniques, IEEE Trans. Med. Imaging,vol.17,Feb.2012,pp. 187–192.

[9] Ramteke, R.J., Monali, Y.K, Automatic medical image classification and abnormality detection using K-nearest neighbour, International Journal Advanced Computer. Res.s, vol.2,March 2012, pp. 190–196.

[10] Barakbah Ridho, A., Kiyoki, Y, A pillar algorithm for k-means optimization by distance maximization for initial centroid designation,Proc. of IEEE Symp. On Computational Intelligence and Data Mining, Feb.2011, pp. 61–68.

[11] Pal, N.R., Pal, S.K, A review on image segmentation techniques, Pattern Recognition.pp. 1277–1294.

[12]Khalid N.E.A., Ibrahim S, Haniff P.N.M.M, MRI brain abnormalities segmentation using k-nearest neighbors, IJCSE,vol.3,Feb.2011,pp 980-990.