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Wavelet Based Feature Extraction for Brain Tumour Diagnosis– A Survey

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Abstract— The brain tumour is one of the major causes among human. To detect the brain tumour in earlier stages is performed by MRI. The detection of the tumour method follows pre-processing, feature extraction, and classification. In pre-processing remove the noise by Gaussian filters from the original images and enhance the image. And the enhanced image is used to extract the feature by symlet wavelet. The classification is performed by support vector machine (SVM).
Keywords ---Brain Tumour, MRI, Pre-processing, Feature extraction, Classification.

I. INTRODUCTION

Brain tumour is the most frequently diagnosed tumour and the leading cause of tumour death among Human's. The mortality rate is decreased by increasing the tumour diagnosis. Nowadays, automatic brain tumour detection in MRI images is very important in many diagnostic and therapeutic application [1]. For automatic brain tumour detection , different algorithms are presented that each step on this process has its suitable methods. One of the most powerful methods for feature extraction is Wavelet transform (DWT) [1-2]. So the early detection of brain tumour has increased the survival rate. MRI is the effective technique to detect the brain tumour. MRI is an efficient tool to detect the brain tumour at early stage. The earlier detection of brain tumour provides the better treatment. The proposed method consist of three major steps: The first step is pre-processing used to remove the noise from the MRI image. Second step is feature extraction using symlet wavelet. Third step is classification using the support vector machine (SVM).Classify the MRI as malignant, normal and benign. In the soft tissues of the human body MRI provides complete detail about abnormalities/ disorders, but identification of these are very difficult by X-rays and CT scan etc. There are lots of techniques available for feature extraction from MRI but wavelet transform is the best method for feature extraction. Images of real things normally do not contains regions of uniform intensities. Let us take an example, image of a cloth, that is not uniform but having different intensities which form certain repeated patterns called visual texture. Image texture, defined as a set of metrics calculated in image processing designed to quantify the perceived texture of an image. Image Texture gives us information about the spatial arrangement of colour or intensities in an image or selected region of an image[3]. Wavelet method gives local frequency information and detail coefficients of the image at various levels. This paper is organized as follows section 2 provides methods and techniques; section 3 provides overview of previous work, and section 4 conclusion.

II. METHODLOGY

The overview of the proposed method is follows the figure1. The methodology deals with medical image processing. Further process is done by using Matlab coding. The MRI images are collected then deals with the part of various steps such as enhancement, segmentation, feature extraction and classification. Discrete Wavelet Transform represents the data into a set of high pass (detail) and low pass (approximate) coefficients. Image is first divided into blocks of 32×32. Then each block is passed through two filters: in this the first level, decomposition is explained to breakdown the input data into an approximation and detail coefficients[4], detail coefficients and approximate coefficients are separated as LL, HL, LH and HH coefficients. After that all the coefficients are discarded, except the LL coefficients. LL coefficient transformed into the second level. In MR imaging process the existence noise due to magnetic field, patient motion and other effects, must be eliminated using pre-processing methods. The pre-processing is used to eliminate any interfere in the image to identify the tumour. It is significantly increasing the reliability, robustness of the image. It is used to remove the noise and enhance the image using Gaussian filter. To reduce the work area only to the relevant region that exactly contains the brain. It acquisition the image from the database as the input image.

A. Gaussian Filter

Gaussian filter is used to remove the noise from the image and its impulse response is Gaussian function. So the noise added and removed from the input image. It is a class of linear smoothening filters with the weight chosen according to the shape of Gaussian

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function. Gaussian kernel is mainly used for smoothening purpose. It is used to removing noise from the normal distribution. The filter window is symmetric is center in the time domain in the noncasual filters. It makes Gaussian filter as unrealized. This is generally no consequences for application where the bandwidth is much larger than the signal. Gaussian functions have five properties that make them useful. These properties of Gaussian filter smoothing filters are effective low-pass filters from the view of both the spatial and frequency domains are efficient.

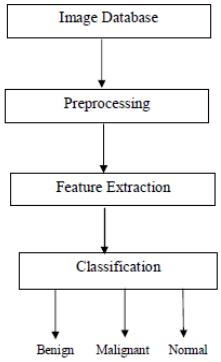


Figure 1 The overview of the proposed method

I. PRE-PROCESSING

B. Feature Extraction

The features are extracted from the MRI using symlet wavelet. It is used to extract the textural patterns of the MRI to identify the suspicious region of masses. The wavelet is used to analyze different frequencies of an image using different scales. This approach is enabling of both local and global features are present in the image. The feature extraction is used to measure the properties from the enhanced image are Area, Origin, major axis length, minor axis length, eccentricity, orientation, filled area, extreme, solidity, equivdiameter. The area is the scalar value; it computes the actual number of pixels in the region. Then the origin is the vector and it computes the centre of the mass region. Symlet wavelet is used to extract the feature from the enhanced image. Symlet wavelet is a family of wavelets. It is a modified version of Daubechies wavelet with increased symmetry. Symlet is a quasisymmetric extension of the Daubechies wavelet. The properties of two wavelets are similar. There are 7 different functions from sym2 to sym8.

C. Classification

Title Classification is used to classify the tumour as normal, benign, malignant it helps to predict the feature using support vector machine (SVM).The extracted feature image is will be input to the classification system. Classification process is dividing into training phase and testing phase. In the training phase known data are given and the classifier is trained, and the testing phase unknown data are given and the classification is performed using trained classifier [5].Classifications have the assignment to an unknown pattern of a predefined class, according to the pattern presented in the form of a feature vector.

D. Support Vector Machine

The Support Vector Machine (SVM) is a supervised learning model with associated learning algorithm that analyzes data and recognize pattern.In other words, given labeled training data the algorithm outputs an optimal hyper plane which categorizes new examples. It searches for a separating hyper plane to separates positive and negative from each other with maximum margin. So the distance between the decision surface[14].SVM classifier is designed tosolve a binary classification problemby finding the class boundary the hyper plane maximizing the margin in the given trainingdata.SVM is used Kernel functions can be used to solve the nonlinear boundary problems. The optimal hyper plane is for linear and the extend to patterns are non linear. The transformation of original data into new space is separable in kernel function.

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III. OVERVIEW OF THE PREVIOUS WORK

TABLE I

PREVIOUS WORK

Methods	Remarks
Discrete and Stationery Wavelet Transform, Median filter, and average filter [6].	To detect the brain tumour in the ultra sound image by enhancing image and reduce the speckle noise.
Filtering, Top hat operation, DWT, Thresholding, SVM classifier [7].	Used to detect the masses in the brain by various techniques of image enhancement, segmentation, feature extraction, and classify the tissue as normal or abnormal. It is achieved 88.75% accuracy.
Sym 5[8].	tumour in the ultra
Symlet and Wiener filter[9]	Used to give the result of compression and denoising of natural image and it is measured by the CR and PSNR value.
Wavelet, Extreme Learning Machine[10].	Used to detect different micro calcification in normal tissues and avoid local minima problem.
Dyadic wavelet, Fuzzy shell clustering[11].	To detect the Micro Calcification in early stage by multi resolution analysis
Wavelet, Median filter[12].	To analyzing and identifying strong variations in intensities within the mammographic data.
Haralick features, SVM[13].	To detect the micro calcification by coding consists in assigning to each pixel a code and not a gray level

IV. CONCLUSIONS

In this paper method to detect the brain tumour by using MRI image. The detailed explanation about various techniques used to detect the brain tumour. The information of the paper deal with pre-processing used to enhance the image, feature extraction to extract the suspicious region, and classification to classify normal and abnormal tissue are studied and explained.

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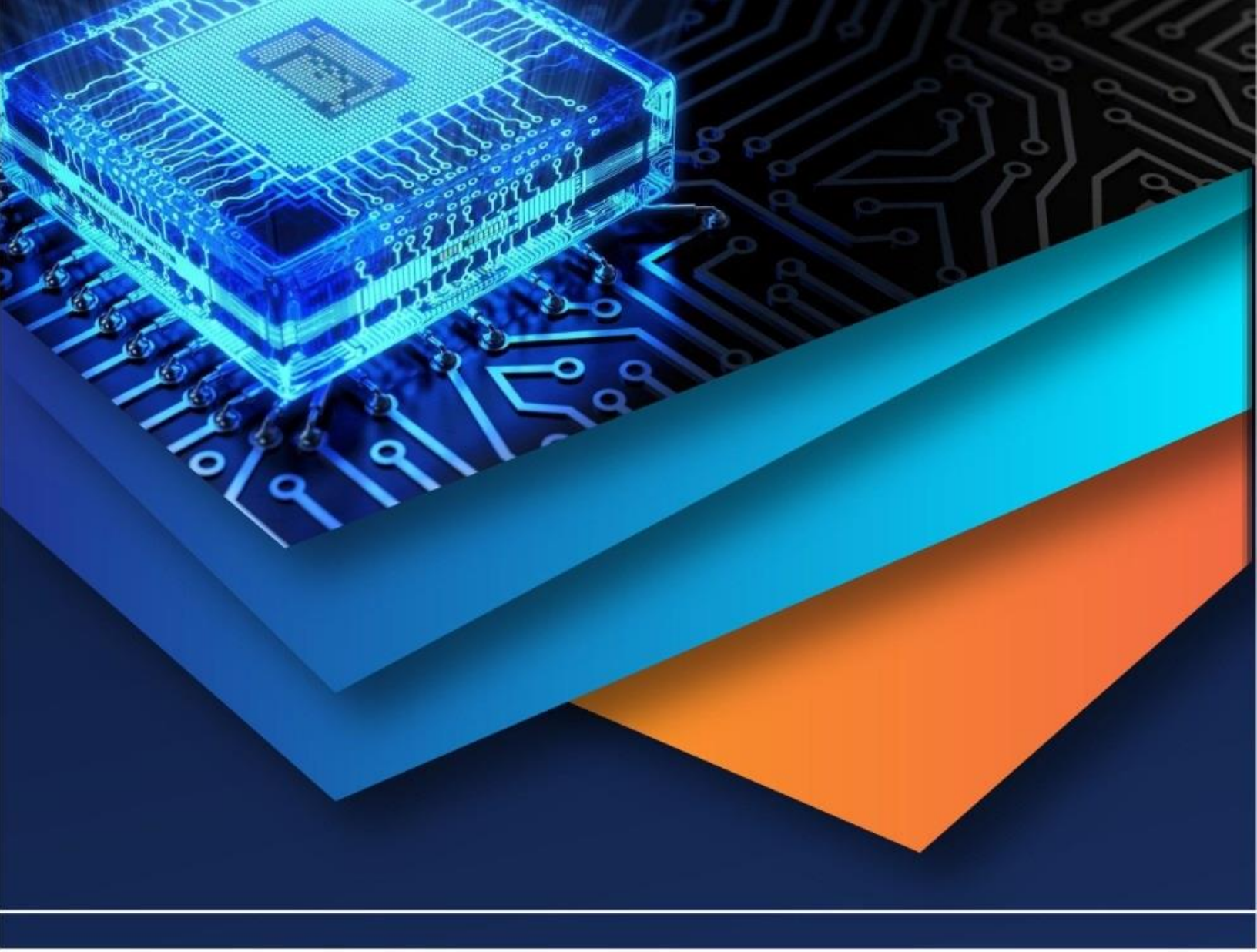
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