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SEGMENTATION AND CLASSIFICATION OF MR BRAIN IMAGE BY MODIFIED ADAPTIVE MEAN SHIFT ALGORITHM

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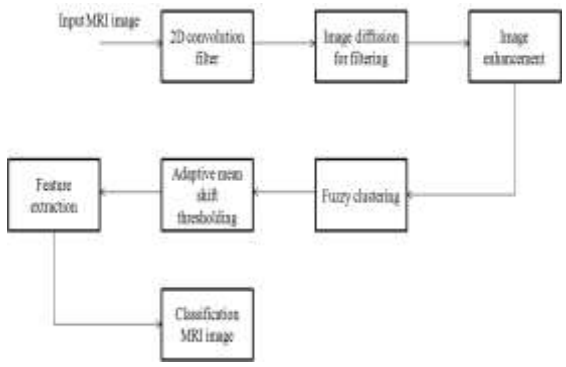
Abstract—Brain is the majestic part of the human body.Tumour is the irregular growth of tissue in the brain which affects the healthy tissues when it is not treated properly.This paper presents a method of automatic segmentation of MR brain using modified Adaptive Mean Shift algorithm(AMS)[10]. In this paper the existing adaptive mean shift algorithm is newly modified by Fuzzy C Means(FCM)[7] clustering technique where automatic centroid value is calculated to ensure that the method obtains accurate segmentation details as well as spatial consistency.The features are extracted using 2 dimensional Discrete Wavelet Transform(DWT) and Gray Level Co-occurance Matrix(GLCM)[6].The feature extracted image is classified using Zernike Moment Classifier(ZMC)[1].The MR image of maximum accuracy is calculated using confusion matrix.

Keywords—Brain, MRI, MAMS, FCM, DWT,GLCM and Zernike moment.

I. INTRODUCTION

A very commonly occuring disease is tumour in previous algorithm there is no proper accuracy in detecting the tumour area in the brain.In the modified AMS[10] algorithm the tumour area is clearly shown with high accuracy.It is very helpful in the bio-medical field the interior blood vessels affected by tumour is clearly shown.Initially the denoising process is done using Anisotropic Diffusion Filter(ADF) where the unwanted noises are removed.The denoised image is enhanced using Adaptive Mean Adjustment(AMA)[2].The brightness is improved using Contrast Limited Adaptive Histogram Equillization(CLAHE) algorithm without over amplifying the image.The tumour in the brain is segmented using modified (AMS)[10].The process of segmentation is equal to clustering and thresholding. The fuzzy C means clustering[8] technique is used to group the abnormal pixels in the image.The otsu thresholding technique is used to convert gray level image to binary image.The features are extracted using 2D DWT and the features are trained and tested using GLCM[6] where 21 features are obtained.The output of the feature extraction is given to the classifier where the image is partioned into multiple segments using Zernike Moment Classifier(ZMC)[1].The desired accuracy is achieved using confusion matrix.

II. BLOCK DIAGRAM



III. IMAGE DENOISING

The image restoration is the process of removing the noise content present in the image initially. The restoration is performed by reversing the process that blurred the image.The image is restored using Anisotropic diffusion filter.Anisotropic diffusion filter is also known as perona malik diffusion filter.It aims at reducing the image noise without removing significant parts of the image content.It remove the noise from the digital images without blurring edges. The simplest and best method used for smoothing images is to apply a linear diffusion process. It uses convolution between image matrix and square kernel matrix.The size of the kernel is calculated using the given formula

$a(x,y)= 1/(2\pi\sigma*\sigma)\exp\{-(x*x+y*Y)/2\sigma*\sigma\}$

anisotropic diffusion equation

$$\boldsymbol{I},= div\,(\,c\,(\,x\,,y,t\,)\nabla l\,)\;=\;\boldsymbol{c}(\boldsymbol{x},y.r)\Delta l\;+\;\nabla c\,\nabla I$$

Where, it is indicate with *div* the divergence operator, and with ∇ and Δrespectively the gradient and Laplacian operators, with respect to the space variables. It reduces to the isotropic heat diffusion equation $\boldsymbol{I_t}$= **c** Δ***I***if *c(x* , y, *t)* is a constant. Suppose that at the time (scale) *t*, it is known the locations of the region boundaries appropriate for that scale. It would want to encourage smoothing *within* a region in preference to smoothing *across* the boundaries. This could be achieved by setting the conduction coefficient to be 1 in the interior of each region and 0 at the boundaries.

The noises are completely eliminated in the restoration process.

IV. IMAGE ENHANCEMENT

Image enhancement is the process of adjusting digital image so that the results are most suitable for display.It is used to improve the quality of the imageThe **Adaptive Mean Adjustment**[2] is used to enhance the image.Adaptive Mean Adjustment[2] is a computer image processing technique used to improve contrast in images. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore

suitable for improving the local contrast of an image. However, adaptive histogram equalization (AHE) has a tendency to over-amplify noise in relatively homogeneous regions of an image. A variant of adaptive histogram equalization called **Contrast Limited Adaptive Histogram Equalization** (CLAHE)[2] is a spatial domain image enhancement technique. It modifies the distribution of the pixels to become more evenly spread out over the available pixel range. In histogram processing, a histogram displays the distribution of the pixel intensity values. Dark image will have low pixel values whereas a bright image will have high pixel values.

CLAHE[2] formula is given by,

CLAHE = X(I,j)-Xmin(I,j)/Xmax(I,j)-Xmin(I,j)

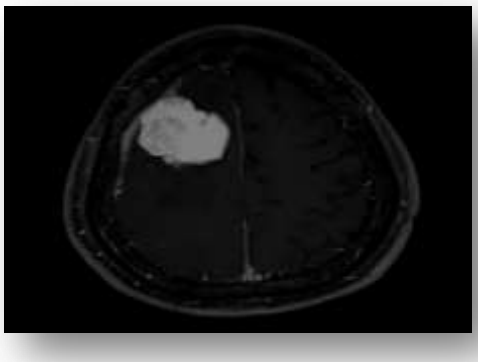
Where ,X is the image,Xmin-Minima of the image,Xmax-maxima of the image.

V. Image Segmentation

After enhancing the tumour is detected in the image using modified Adaptive Mean Shift(AMS) [10] segmentation technique.Segmentation is the is the process of splitting a digital image into multiple segments.It is used to locate objects and boundaries in the image.So the tumour affected area is clearly shown.The segmented image is clustered and the gray scale image is converted into binary image using thresholding.The soft clustering technique fuzzy C means(FCM)[7] clustering is used.In FCM[7] each pixel of the image belongs to more than one cluster.In the clustering process the tumour is grouped accurately.To improve the accuracy in the image the otsu thresholding method is used to automatically perform clustering-based image thresholding or reduction of a graylevel image to a binary image.

VI. Feature Extraction

Feature extraction is compact representation of the image.It involves in reducing the amount of resources required to describe a large set of data.Low level feature extraction involves automatic extraction of features from an image without doing any processing method.The high level feature extraction technique is used to investigate the characteristic of narrow and broad weed by implementing the 2 dimensional discrete wavelet transform (2D-DWT) as the processing method.The wavelet type used for feature extraction is haar wavelet.The GLCM[6] features are used to represent the spatial relationship of the pixel.The 21 features such as Autocorrelation, Contrast, Correlation, Cluster Prominence, Cluster Shade, Dissimilarity Energy, Entropy, Homogeneity, Maximum probability , Sum of squares, Sum average, Sum variance, Sum entropy, Difference variance, Difference entropy, Information measure of correlation, information measure of correlation, Inverse difference normalized is extracted using GLCM[6].



VII. Image Classification

The image classification is the process of partitioning a digital image into multiple segments.The main goal of the segmentation is to simplify or change the image to desired format.More precisely ,image segmentation is the process of assigning a label to every pixel in an image such that pixel with each label share certain characteristics.The classification is done using **Zernike Moment Classifier**(**ZMC)**[1].In general, moments describe numeric quantities at some distance from a reference point or axis.Zernike moment[1] represent the properties of an image without redundancy or overlap of information between the moments.Zernike is defined on a unit disk.So,for an image ,the disk takes its centre at centroid of the image with radius being minimal.It provides high accuracy,orthogonal,less information redundancy.Zernike moments[1] have rotational invariance and can be made scale and translational invariant suitable for many applications.The extracted features are classified using ZMC[1] and the output is supressed using PCA(Principal Component Analysis) 21 features are calculated for each image. Extracted feature set is applied to PCA. PCA is used to reduce the feature set which is extracted from images. The reduced features are submitted to a classifier for training and testing. Therefore this method will decrease the computation time and complexity. The classification process is divided into two parts i.e. the training and the testing part. Firstly, in the training part known data are given to the classifier for training. Secondly, in the testing part, unknown data are given to the classifier and the classification is performed after training part. The accuracy rate and error rate of the classification depends on the efficiency of the training.The tumour area is detected accurately with the accuracy of 96.5% in this work.

VIII. CONCLUSION

From the study done and the results obtained in this proposed modified AMS[10] the accuracy of 96.5% is achieved and the noise contents are totally eliminated the tumour and even the interior parts affected is clearly obtained.

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