Brain Tumour Detection Using Support Vector Machine

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Abstract- *Medicinal image processing is a challenging field. Medical imaging techniques are used to image the inner portions of the human body for medical diagnosis. MRI [Magnetic Resonance Imaging] are widely used in the analysis of brain tumour. The system presents a way to detect and section the brain tumour regions using Support Vector Machine Algorithm. An exact classification of MR brain images is very important for medical investigation and interpretation. Over the last period some methods have been projected. This system presents a method to classify MR brain image as normal or abnormal. The proposed technique first working to extract features from images, to reduce the dimensions. The reduced structures were submitted to a Kernel SVM (KSVM). It is then applied to field of brain image classification and can assist the doctors to identify where a patient is normal or abnormal. All the techniques can perform proficiently analysis area in the image. Experimental results show that the Segmentation method applying on Brain Tumour MRI images which determines that the presented method distinguishes the Brain Tumour more precisely and efficiently.*

Keywords- MRI image, Pre-processing, Filter,K-mean Clustering Algorithm, SVM Algorithm, Classification.

I. INTRODUCTION

Image processing is process of mathematical operations by using any form of signal processing for which input as an image or a video. The image processing can be either a set of characteristics or parameters which are related to the image. Image processing Includes:

- Image displaying and printing
- Image editing and manipulation
- Image enhancement
- Feature detection
- Image compression

Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Image processing usually refers to digital image processing but optical, analog image processing are also possible. Closely related to image processing are computer graphics and computer vision. Computer vision, on the other hand is often considered high-level image processing out of which a machine/computer/software intends to decipher the physical contents of an image or a sequence of images (e.g., videos or 3D full-body magnetic resonance scans). Digital image processing allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing.

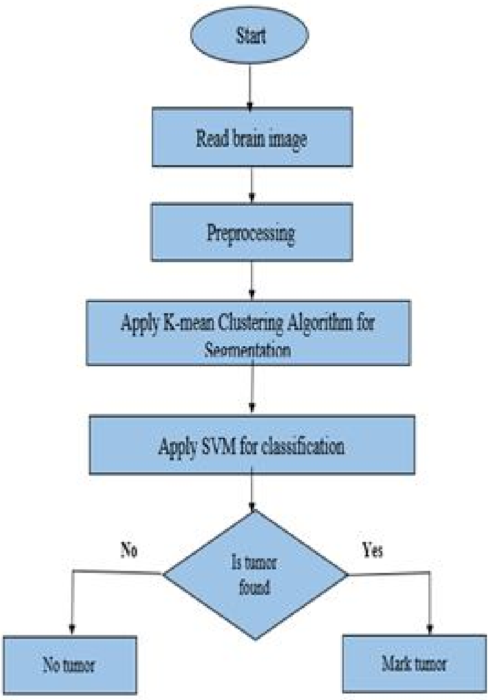
II. EXISTING SYSTEM

In this existing system the input MRI images are intended for brain tumor detection. The input images are converted into greyscale image for better segmentation. After the conversion, the images are filtered to eliminate the noise which is present in the output. The noise removal is done with the application of filter Fuzzy C-Mean (FCM) is normally used for segmentation process. FCM can be an iterative method, in which the process stops if the maxima iterations are achieved or even the iteration will be repetitive until some threshold value is reached. Now modified mean-shift is applied to detect the brain tumor. It is not just only more effective compared to various other mean-shift techniques however that it must be able to give superior segmentation.

III.PROPOSED SYSTEM

In this system Magnetic Resonance Image(MRI) is used as an input image. At first, the input image is implemented for pre-processing. In this pre-processing, the image is converted into greyscale image and then the noise is removed using filter and by setting fixed threshold value, various features can be extracted. Then pre-processed image is implemented for Segmentation. K-Means Clustering Algorithm is used for segmentation. This k-means algorithm will segment the tumour accurately even for complex shapes also. Then brain tumour is classified using Support Vector machine(SVM). Four types of kernel functions are used in the SVM for better Classification. The Support Vector Machine will classify the tumour more accurately and efficiently. The proposed technique is designed and implemented in MATLAB 2013a by using image processing tool.

Diagram:



IV. MODULES

LIST OF MODULES:

1. Pre-processing the image.
2. Segmentation using K-means Clustering Algorithm.
3. Classification using Support Vector Machine (SVM).

1. Pre-processing the Image

The Input Image is pre-processed enhance the accuracy associated with tumour detection. The actual input images are converted into grey image for better Segmentation. The images are filtered to remove the noise which is present in the image. The noise removal is done with the fuzzy Filter. The Image is set to a threshold value with maxima and the Minima value. The threshold value is set to remove the unwanted area or unwanted Region in this system. Threshold:

A parameter ε called the brightness threshold .It is chosen and applied to the image a[m,n] as follows:

$$\begin{array}{lll} \text{If } a[m,n] \geq \theta & a[m,n] = object & = 1 \\ \text{Else} & a[m,n] = background & = 0 \end{array}$$

This version of the procedure assumes the objects on a dark background. For dark objects on a light background it would use:

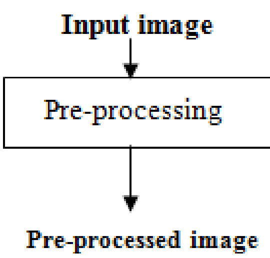
$$\begin{array}{lll} \text{If } a[m,n] < \theta & a[m,n] = object & = 1 \\ \text{Else} & a[m,n] = background & = 0 \end{array}$$

The output is the label "object" or "background" which, due to its nature, can be represented as a Boolean variable "1" or "0". Threshold methods are based on the thresholds which are normally selected from the image histogram. It is said that all pixels whose are between two values of thresholds belong to one region. The fact that thresholds are derivative from the histogram declares that these methods don't take information of that image and it experience problems to do with noise as well as with blurred boundaries in the image.

Fixed threshold: One alternate is to use a threshold that is to chosen autonomously of the image data. It deals with the dark objects and the background is very light, then constant threshold of 0 to 255 might be precise. By accuracy, the number of falsely-classified pixels should be kept to a minimum.

Block Diagram:

Input image

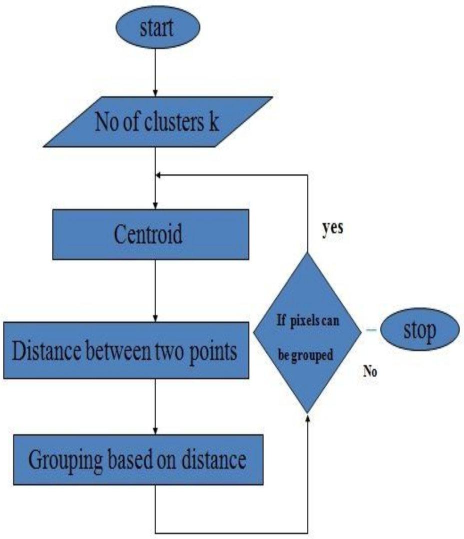


2. Segmentation using K-Means Clustering Algorithm.

K Means Clustering Algorithm:

K-means Clustering Algorithm is one of the learning algorithms that solve the clustering problem. The procedure follows a simple method to classify certain number of clusters. These centroids should be placed in a crafty way because of different location causes dissimilar result. So, it is to place them as possible faraway from each other. The next step is to take each point subordinate it to the closest centroid. When no point is pending, then the first step is completed. At this point, we need to re-calculate k new centroids from the previous step. After having these k new centroids, a new binding has to be completed between the same data set points. A loop has to be generated. As a result of this loop, the k centroids change their position step by step until no changes are done.

Flow chart for K mean algorithm:



ALGORITHM

Step 1: Read the image.

Step 2: Get number of clusters to be formed.

Step 3: Convert the colour image into grey image

Step 4: Resize the 2-D image into1-D array of length **"r×c".**
Step 5: Find the intensity of image
Range = Max intensity value - Min intensity value
Step 6: Find the centroid value
Centroid 1 = Range/Number of clusters
Centroid 2 = (2 × Centroid 1)
Step 7: Find the difference between first and various centroid values.
Step 8: Based on the minimum difference obtained, group the intensity values into the corresponding clusters.
Step 9: Redo step 1 & 2 for all other intensity values of the image.
Centroid 3 = (3 × Centroid 1)

3. Classification using SVM (Support Vector Machine):

SVM is a learning model that analyze data used classification and regression analysis. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary linear classifier (although methods such as Platt scaling exist to use SVM in a probabilistic classification setting). An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. In addition to linear classification, SVMs can efficiently perform a non-linear classification using what is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces. When data's are not labeled, learning is not possible, and an unsupervised learning approach is essential, which will find natural clustering of the data to groups, and then it is mapped to new data. The Support Vector Machine algorithm applies the statistics of support vectors, developed in the support vector machines algorithm, to categorize unlabeled data, and is one of the most widely used clustering algorithms in industrial applications. With any supervised learning model, you first train a Support Vector Machine, and then cross validate the classifier. Use the trained machine to classify (predict) new data. In addition, we use various SVM kernel functions to classify the image.

ALGORITHM FOR CLASSIFICATION

Step1: To construct an optimal hyperplane, SVM employs an iterative training algorithm, which is used to minimize an error function.
Step2: According to the form of the error function, SVM models can be classified into four distinct groups:
Step2.1: Classification SVM Type 1 (also known as C-SVM classification)
Step2.2: Classification SVM Type 2 (also known as nu-SVM classification)
Step2.3: Regression SVM Type 1 (also known as epsilon-SVM regression)
Step2.4: Regression SVM Type 2 (also known as nu-SVM regression)

1. Training an SVM Classifier:

Train and optionally cross validate, an SVM classifier using fitcsvm. The most common syntax is:
SVMModel = fitcsvm(X,Y,'KernelFunction','rbf',...
'Standardize', true,'ClassNames',{'negClass','posClass'});

2. Classifying New Data with an SVM Classifier:

Classify new data using predict. The syntax for classifying new data using a trained SVM classifier is:
[label,score] = predict(SVMModel,newX);

The resulting vector, label, represents the classification of each row in X. The first column contains the scores for the observations being classified in the negative class, and the second column contains the scores observations being classified in the positive class. To estimate posterior probabilities , first pass the trained SVM classifier to fitPosterior, which fits a score-to-posterior-probability transformation function to the scores.

The syntax is:

ScoreSVMModel = fitPosterior(SVMModel,X,Y);

The property Score Transform of the classifier contains the optimal transformation function. Pass the ScoreSVMModel to predict. rather than returning the scores, the output argument score contains the posterior probabilities of an observation being classified in the negative (column 1 of score) or positive (column 2 of score) class. Try tuning parameters of your classifier according to this scheme: Pass the data to fitcsvm, and set the name-value pair arguments 'Kernel Scale', 'auto'. The software uses a procedure to select the kernel scale. Therefore, to reproduce results, set random number seed using rng before training the classifier.

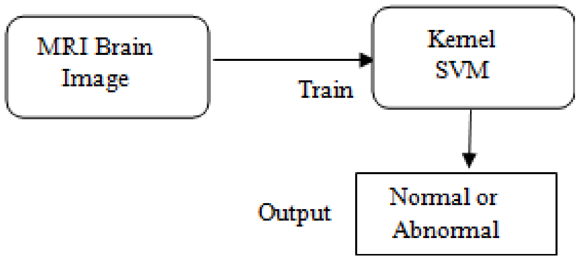
1. Cross validate the classifier by passing to cross validate.
2. Pass cross validated SVM model to kFoldLoss.
3. Retrain the SVM classifier but correct the 'Kernel Scale' and 'Box Constraint' name-value pair arguments.

Box Constraint — One strategy is to try a geometric sequence of the box constraint parameter. For example, take 11 values, from 1e-5 to 1e5 by a factor of 10. Increasing Box Constraint might decrease the number of support Vector, but also might increase training time.

Kernel Scale — One strategy is to try a geometric sequence of the RBF sigma parameter scaled at the original kernel scale. Do this by:

- Retrieve the kernel scale, e.g: ks=SVMModel.KernelParameters.Scale.
- Use new kernel scale features of the original.

FLOW DIAGRAM FOR SVM:



V. LIMITATION OF EXISTING SYSTEM

Some Complex shapes cannot be deducted more precisely in the tumour region. The deduction of tumour region takes more time in the existing system.

VI. APPLICATIONS

The System is used to detect the Brain Tumour Region accurately. The Computational Cost for Segmentation and Classification of the tumour has been reduced.

VII. CONCLUSION

In this system, a method is proposed to distinguish between normal and abnormal MRIs of the brain. The four different kernels Linear(LIN), Polygonal, Quadratic and RBF (Radial Basis Function) are used for proposed system. The system demonstrates that the kernel SVM obtained 90% classification accuracy on the 50 images, higher than the existing system, and other methods in recent literatures. It detects and Classifies the Image more efficiently than the other methods Which are recently used. The proposed technique is designed and implemented in MATLAB 2013a by using image processing tool. Algorithm used in the detecting brain tumour will give specific segmentation regions and Classify the images more accurately and efficiently.

VIII. FUTURE ENHANCEMENTS

Result shows that the proposed approach is a valuable diagnosing technique for the physicians to detect the brain tumours. But, in final segmentation, a few other tissues also segmented in addition to tumours. Therefore, in order to improve the accuracy in the segmentation, it is necessary to include additional knowledge for discarding other tissues. The system also includes additional feature information. Besides the energy, correlation, contrast and homogeneity add more information to the feature extraction in order to make the system more effective

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