Detection of Brain Tumour by Image Fusion using SVM Classifier

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Abstract
Tumor is defined as the abnormal increases of the tissues. Brain Tumor is an abnormal mass of tissue in which cells get increase in size and multiply uncontrollably apparently unchecked by the mechanisms that control normal cells. The proposed system is going to detect this brain tumor of a particular person. That is done by fusion of output of segmented image and input image. Image fusion is a process of combining complementary information from two images of the same patient into an image. The resultant image consists of more informative the usual images alone. The images are pre-processed for feature extraction and data analysis of image is done based on Histogram feature for localizing the tumor. The morphological operations like dilation and erosion are applied on the image for image segmentation using SVM classifier. After this step the output image obtained after segmentation is fused with the input image for knowing the exact position of the tumor in the brain. This technique is used for detection of Brain Tumor.
Keywords: convolution filter, svm classifier segmentation, image selection.

1. Introduction

Pre-processing is the method of removing noise and other disorders in image for obtaining characteristics of the image. The image is converted to grayscale image which is different from binary image. The blurriness present in the image is removed by smoothening. The grayscale image when filtering ought to be increased for higher recognition of text. Morphology could be a broad set of image process operations that method pictures supported shapes. In a morphological operation, the worth of every picture element within the output image is predicated on a comparison of the corresponding picture element within the input image with its neighbours. By selecting the dimensions and form of the neighborhood, the construction of morphological operation that's sensitive to specific shapes within the input image is done. The most basic morphological operations are dilation and erosion. The amount of pixels side or aloof from the objects in a picture depends on the dimensions and form of the structuring part accustomed method the image. When edge detection in complex body part pictures, edges are expanded to find the sting regions victimization morphological operation. The dilation method is performed by laying the structuring component B on the image A and slippy it across the image. In computer vision, image segmentation is the process of splitting a digital image into many segments. The aim of segmentation is to simplify and/or change the delineation of an image into something that is more meaningful and simple to analyze. After segmentation the image obtained as a output is fused with input image, this gives exact location of the tumor.

Rest of the paper is organized as follows: Image segmentation is explained in Section2II. Section 3 explains the image fusion. Section4 explains about the proposed system. Experimental results and performance evaluations are explained in Section 5. Finally the conclusion of work is given in Section 6.

2. IMAGE SEGMENTATION

Image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is the problem of partitioning an image into meaningful parts, often consisting of an object and background. Image segmentation is typically used to locate objects and boundaries in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics. The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic. When applied to a stack of images, typical in medical imaging, the resulting contours after image segmentation can be used to create 3D reconstructions with the help of interpolation algorithms like marching cubes**.**SVM classifier is used for segmentation process.

SVM (support vector machine) based classifier, which is very competitive within the existing classification methods in many areas and relatively easy to use. It performs classification using linear decision hyper planes in the feature space. During training, the values which extracted (features) are calculated to separate the training data with different labels. If the training data are not linearly separable, the function is used to transform the data into a new space. The data have to linearly separable in the new vector space. SVMs scale well for very large training sets and perform well with accurate results cost effectively. The complexity for training increases with the number of training samples.

3. IMAGE FUSION

Image fusion is the process of combining two or more images of same scene into a single fused image which is more informative than the single images. Image fusion plays a wider spatial and temporal coverage. This decreases uncertainty, improves reliability, and increases robustness of system performance. The fused image should contain all relevant information of the source images. Fused image should not contain additional noise or irrelevant data that is not in source images. Here image fusion is used to finalize the exact location of the tumor from the body part. Here only one image is taken as input. The output of the segmentation which is only the tumor part is fused with the input image to get exact location of tumor.

4. PROPOSED SYSTEM

In this paper, only one image is considered as an input. The fused image should contain all features of the source image. Once the image is segmented using SVM classifier, the output is fused with input image to combine the information of the images.

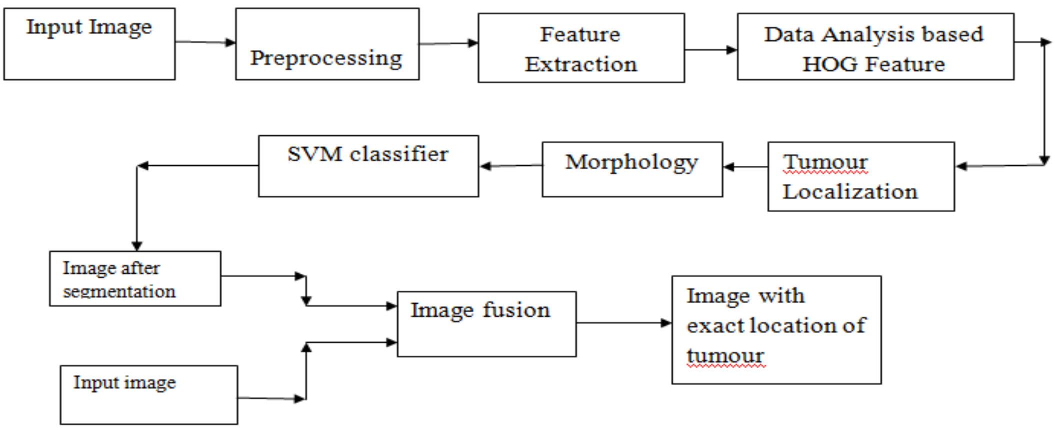

Fig 1.Flow chart of proposed system

4.1 IMAGE CONVERSION

In this module, we load the images from the local directory. Here the images refer to the datasets of images at different conditions. The images are read using mat lab commands like imread & resized as per the requirement. It is then converted to gray for further processing.

4.2 PREPROCESSING OF IMAGE

Pre-processing refers to removal of any noise & other disturbances in the image so that the image is ready for feature extraction. Here greyscale images are distinct from one-bit black-and-white images, which in the context of computer imaging are images with only the two colours, black, and white (also called bi-level or binary images). Smoothing is performed to remove blurriness in the image The edges should be marked where the gradients of the image has large magnitudes. Noise in image is random (not present in the object imaged) variation of brightness or colour information in images, and is usually an aspect of electronic noise. It can be produced by the sensor and circuitry of a scanner or digital camera. Noise is reduced by use of certain filters. Here we use median filter for removing noise content in images.

The Grayscale image after filtering should be enhanced for better recognition of text. So we adopt a method called Contrast-limited adaptive histogram equalization (CLAHE). It enhances the contrast of the grayscale image by transforming the values using contrast-limited adaptive histogram equalization (CLAHE) .CLAHE operates on small regions in the image, called tiles, rather than entire image. Each tile contrast is enhanced, so that the histogram of the output region approximately matches the histogram specified by the 'Distributed' parameters. The neighboring tiles are then combined using bilinear interpolation to eliminate artificially induced boundaries. The contrast, especially in homogeneous areas, can be limited to avoid amplifying any noise that might be present in the image.

J = adapthisteq (I,param1,val1,param2,val2...)

4.3 FEATURE EXTRACTION

Feature extraction gives the details about the pre-processed image like color, intensity, contrast and details about the pixels. When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a features vector). This process is called feature extraction. The extracted features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data. Feature extraction involves reducing the amount of resources required to describe a large set of data. When performing analysis of complex data one of the major problems stems from the number of variables involved. Analysis with a large number of variables generally requires a large amount of memory and computation power, also it may cause classification algorithm to over fit to training samples and generalize poorly to new samples. Feature extraction is a general term for methods of constructing combinations of the variables to get around these problems while still describing the data with sufficient accuracy. One very important area of application is image processing, in which algorithms are used to detect and isolate various desired portions or shapes (features) of a digitized image or video stream. It is particularly important in the area of optical character recognition like: Edge detection, Corner detection, Blob detection, Ridge detection, Scale-invariant feature transform, changing intensity, autocorrelation.

4.4 DATA ANALYSIS BASED HOG FEATURE

This information is used in the HOG for data analysis. Histogram is made for all the pixels in the image depending on peaks and valleys. Histogram-based methods are very efficient compared to other image segmentation methods because they typically require only one pass through the pixels. In this technique, a histogram is computed from all of the pixels in the image, and the peaks and valleys in the histogram are used to locate the clusters in the image. Color or intensity can be used as the measure. A refinement of this technique is to recursively apply the histogram-seeking method to clusters in the image in order to divide them into smaller clusters.

4.5 TUMOUR LOCALIZATION

Tumour localization is done based upon histogram features. Tumour detection undergoes Edge Detection for detecting the boundary of the tumour. The edges identified by edge detection are often disconnected. To segment an object from an image however, one needs closed region boundaries. The desired edges are the boundaries between such objects or spatial-taxons. Spatial-taxon is information granules consisting of a crisp pixel region, stationed at abstraction levels within hierarchical nested scene architecture. Edge detection methods can be applied to the spatial-taxon region, in the same manner they would be applied to a silhouette. This method is particularly useful when the disconnected edge is part of an illusory contour. Segmentation methods can also be applied to edges obtained from edge detectors.

4.6 MORPHOLOGY

Morphology is a broad set of image processing operations that process images based on shapes. Morphological operations apply a structuring element to an input image, creating an output image of the same size.

In a morphological operation, the value of each pixel in the output image is based on a comparison of the corresponding pixel in the input image with its neighbours. By choosing the size and shape of the neighborhood, you can construct a morphological operation that is sensitive to specific shapes in the input image.

The most basic morphological operations are dilation and erosion. Dilation adds pixels to the boundaries of objects in an image, while erosion removes pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the structuring element used to process the image. After edge detection in fundus images, edges are dilated to locate the edge regions using morphological operation.

4.7 SEGMENTATION BY SVM CLASSIFIER

Partitions an image into distinct regions containing each pixel with similar attributes. To be meaningful and useful for image analysis and interpretation, the regions should strongly relate to depicted objects or features of interest. Meaningful segmentation is the first step from low-level image processing transforming a greyscale or colour image into one or more other images to high-level image description in terms of features, objects, and scenes. The success of image analysis depends on reliability of segmentation, but an accurate partitioning of an image is generally a very challenging problem. Segmentation techniques are either contextual or non-contextual. The latter take no account of spatial relationships between features in an image and group pixels together on the basis of some global attribute, e.g. grey level or colour. Contextual techniques additionally exploit these relationships, e.g. group together pixels with similar grey levels and close spatial locations.

4.8 SEGMENTATION BY SVM CLASSIFIER

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4.9 SEGMENTATION BY SVM CLASSIFIER

Image fusion is the process of combining complementary information from multimodality images of the same patient into an image. Hence the resultant image consists of more informative than the individual images alone. It is the process of combining two or more images of a scene into a single fused image which is more suitable for visual perception or computer processing. The benefits of using image fusion are wider spatial and temporal coverage with decreased uncertainty, improved reliability and increased robustness of system performance. There are two basic requirements for image fusion. First, fused image should possess all possible information contained in the source images. Second, fusion process should not introduce any artifact or noise in the fused image.

5. EXPERIMENTAL RESULTS

This section gives the visual and quantitative representation of the proposed system. Experiments have been performed over a single image such as MRI, CT or PET. All these images are complementary in nature. MRI images gives more information about the soft tissue where as CT images gives information about to bone and hard tissues and PET images gives information about functionalities.

The fused output after segmentation of image is shown in the Fig5-1.Fusion of images gives the exact location of tumour.

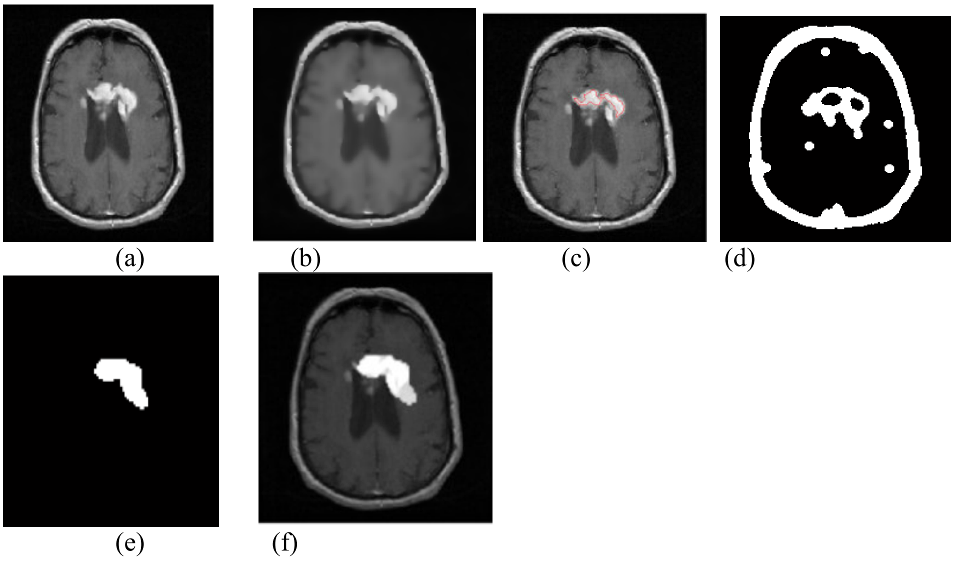

Fig 5-1: (a) Source image(MRI) , (b) Image after preprocessing (c) Image with Tumor Localization (d) Image after Morphological operations (e) Segmented image using SVM classifier (f) Fused image with proposed system.

The source images can be any type of images like MRI, CT or PET. The preprocessed images are free of noise and other unwanted information. Histogram based method ,the histograms are computed for all the pixels in the image ,and the peaks and valleys in the histogram are used to locate the clusters in the image. Tumor Localization is done based on Edge detection technique. The edges identified by edge detection are often disconnected. To segment an object from an image however, one needs closed region boundaries. The desired edges are the boundaries between such objects or spatial-taxons. Spatial-taxons are information granules consisting of a crisp pixel region, stationed at abstraction levels within hierarchical nested scene architecture. This method is particularly useful when the disconnected edge is part of an illusory contour. Morphology contains two types of operations: Dilation and Erosion. Dilation allows objects to expand, thus potentially filling in small holes and connecting disjoint objects. The dilation process is performed by laying the structuring element B on the image A and sliding it across the image. A structuring element is simply a binary image (or mask) that allows us to define arbitrary neighbourhood structures. If the origin of the structuring element coincides with a 'white' pixel in the image, there is no change; move to the next pixel. If the origin of the structuring element coincides with a 'black' in the image, make black all pixels from the image covered by the structuring element. Erosion shrinks objects by etching away (eroding) their boundaries. The erosion process is similar to dilation, but we turn pixels to 'white', not 'black'. In the opening ,It consists of an erosion followed by a dilation and can be used to eliminate all pixels in regions that are too small to contain the structuring element ,It is applied to remove objects that are thinner than the LP symbols. In the closing, it consists of a dilation followed by erosion and can be used to fill noisy holes and small gaps and to connect broken symbols. Morphology gives the black and white image which is then used for segmentation process. The fused image gives the exact information about the tumour position than the input image.

6. Conclusion

The medical image fusion plays a significant role in medical diagnostics. An interesting source of images is the medical field. Here, imaging modalities such as CT (Computed Tomography), MRI (Magnetic Resonance Imaging), PET (Positron Emission Tomography) etc. generate a huge amount of image information. Not only does the size and resolution of the images grow with improved technology, also the number of dimensions increase. Developing algorithms for medical image analysis requires thorough validation studies to make the results usable in practice. This adds another dimension to the research process which involves communication between two different worlds - the patient-centered medical world, and the computer centred technical world. The symbioses between these worlds are rare to find and it requires significant efforts from both sides to join on a common goal.

In this paper, SVM classifier for segmentation is proposed and then the images are fused. Here the proposed method process regions than pixels. It overcomes the drawbacks of pixel level image fusion methods such as sensitivity to noise and blurring effects. The proposed system is Sensitivity to noise, blurring effects and miss registration. Due to the SVM Classifier usage the starting stage of brain tumor will be find out. SVM Classifier has a regularization parameter, which makes the user think about avoiding over-fitting. Method uses the kernel trick, so you can build in expert knowledge about the problem via engineering the kernel. SVM is defined by a convex optimization problems (no local minima) for which there are efficient methods (e.g. SMO). It is an approximation to a bound on the test error rate, and there is a substantial body of theory behind it which suggests it should be a good idea.

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