Benign and Malignant Tumour Identification by Fusion Technique using SVM Model

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Abstract— Medical image fusion plays a vital role in the medical field to diagnose brain tumors which be classified as benign or malignant. It is a procedure of amalgamate multiple image of the same scene into a single fused image to reduce unreliability and minimizing errors while extracting all the useful information from the source image. SVM is used to fuse two brain images with different visions. Concluding fused image will be more informative than the source images. The texture and wavelet feature are extracted from the fused image. SVM classifier classifies brain tumors based on trained and tested features. Apparently proposed method achieved 80.48% sensitivity, 99.9% specificity and 99.96% accuracy. Experimental results obtained from the fusion process demonstrate that the use of proposed image fusion approach shows better performance while compared with conventional fusion methodologies.

Keywords: SVM, Fusion, Brain Tumor, Benign And Malignant Images

I. Introduction

Medical image processing has developed as one of the critical factors in regular clinical applications, such as disease diagnosis and treatment planning. Owing to the technical limitations, the quality of medical images is usually unsatisfactory, degrading the accuracy of human interpretation and further medical image analysis, thereby, requiring the quality of these images to be enhanced. One approach to enhance the image quality is by image denoising. Several denoising approaches, like adaptive filters, wavelet-based methods, etc. were proposed. Another efficient technique is by image fusion which enhances the image quality by combining various images into a single fused image, Thus resulting image is referred as fused image. A fusion process is nothing but a combination of salient information to synthesize an image with more information than individual image and the synthesized image is more suitable for visual perception. Image fusion is a process of combining multiple input images of the same scene into a single fused image, which preserves full content information, and also retaining the important features from each of the original images. The fused image should have more convenient information compared to the sole image. Radiologists mostly prefer both MR and CT image side by side, when both images are available. This provides them all the available image information, but its accessibility is limited to a visual correlation between the two images. Both CT and MR images can be employed as it is difficult to determine whether the narrowing of a spinal canal is caused by a tissue or bone. Both the CT and MR modalities provide complementarily information. To properly visualize the related bone and soft tissue structures, the images must be mentally aligned and fused together. This process leads to more precise data interpretation and feasibility. In fundamental multi-modal image fusion methodologies, the source image is just overlaid by assigning them to different color channels. In color image fusion, this overlay approach is used to expand the amount of information over a single image, but it does not affect the image contrast or distinguish the image features. So in this paper, a novel region-based image fusion algorithm is proposed for multi-focus and Multimodal images which also overcomes the limitations of different approaches

II. Literature review

1) Fusion of hyper-spectral data is presented by means of splits up the hyper-spectral bands into subgroups, prior to principal components' transformation (PCT). The center of attraction is partitioning with three subgroups suitable for RGB representation. One of them comprises matched-filtering based on the spectral characteristics of various materials and is very promising for classification purposes. The classification performance of the proposed partitioning approaches by using the k-algorithm.
2) A novel region-based image fusion method using the high boost filtering using the discrete wavelet transform. This method is used to extract regions from input registered source images which are then compared with different fusion rules. The proposed method is applied to numerous registered images of various categories of multi-focus and multimodality images and results are compared using standard reference-based and non-reference based image fusion parameters.
3) Text Fusion in Medical Images using Fuzzy Logic based Matrix Scanning Algorithm. In this work area of interest is going to be found for the particular image and will fuse the related document in the NAOI (no area of interest) of the image, till yet many techniques to fuse text data in the medical images one of forming them is to fuse data at the border of the images and build the particular and predefined border space. It brings forward an algorithm called a fuzzy logic-based matrix scanning algorithm in which we will first find out the area of interest, and after that we find noisy pixels of the image to insert data in that noisy portions to save the border size. Our employed technique is LSB to store text data in pixels. MATLAB is used for carrying out implementation on our proposed work.
4) Directive Contrast Based Multimodal Medical Image Fusion in non-sub-sampled contour-let transform (NSCT) Domain. The main objective is to capture the most applicable details from sources into a single output, which plays a crucial role in medical diagnosis. In this work, a novel fusion framework is advocated for

Multimodal medical images based on (NSCT) method. Apparently origin medical images are first transformed by (NSCT) followed by incorporated low- and high-frequency components. Two unlike fusion rules based on phase congruency and directive contrast is proposed and utilized in a manner to fuse low- and high-frequency coefficients. Eventually, the fused image is constructed with the help of the inverse (NSCT) attached with all nearby complex and compounded coefficients. Assessment results and the comparative study show that the proposed fusion framework comes up with an effective way to enable a more precise analysis of multi-modality images. Additionally, the applicability of the presented framework is carried out by the three clinical examples of persons affected with Alzheimer's, sub-acute stroke and recurrent tumor.

5) Comparative analysis of medical Images fusion. This research investigates different medical image fusion approaches, and their differences to find out which fusion method gives finer results based on the performance parameters. At this moment medical images of magnetic resonance imaging (MRI) and computed tomography (CT) images are fused to establish a new image. Here a new fused image enhances the information content for diagnosis. Combining images of MRI and CT delivers more information to doctors, and the clinical treatment planning system. MRI provides better information on soft tissues, whereas, CT provides better information on denser tissues. Amalgamate these two images gives more information than a single input image. From this paper, wavelet transform, principal component analysis (PCA) and Fuzzy Logic techniques are employed for fusing these two images and results are compared. Fusion performance is assessed based on root-mean-square error (RMSE), peak signal-to-noise ratio (PSNR) and Entropy (H).

III. METHODOLOGY

A. *Preprocessing*

Preprocessing the input image.

B. *Image Enhancement*

By denoising the image using the algorithm called median Filter. A median filter is used for denoising the image, an important step for Image Enhancement. Noise depletion is a typical pre-processing step to refine the results of later processing.

It preserves edges while removing the noise. The main concept of the median filter is to pass through the signal entry by entry, replacing each entry with the median of neighboring entries.

C. *Features Extraction*

Extracting morphological features by using the k-means clustering algorithms, it’s one of the simplest unsupervised learning algorithms that solve the well-known clustering problems. The procedure follows a simple and easy way to classify given data set through a certain number of clusters. The main intention is to explain k centers, one for each cluster. These centers should be placed in a hasty manner because of different locations causes different results. So, the desirable choice is to place them possible distance from each other, succeeding a step each point is taken belonging to a given data set and connect it to the nearest center.

D. *Thresholding*

It is the simplest method of image segmentation from a grayscale image to binary images. In this paper multilevel thresholding is used which is a process that segments a gray level image into a number of different regions. This process determines more than one threshold for the given image and bifurcates the image into certain brightness regions, which correlates to one background and several objects. The technique works very well for objects with colored or fused backgrounds on which bi-level thresholding is unsuccessful to produce satisfactory outcomes.

E. *Segmentation*

Image segmentation is a process of splitting the given image into several non-overlapping regions. Segmentation depicts the image into sets of pixels that are more crucial and easier for investigation. It is used probably to locate the boundaries of objects in an image and the consequent segments collectively cover the complete image. Besides nearby regions are different with respect to same characteristics. Then segmentation process will be carried out for further performance of image to identify the tumor is benign and malignant.

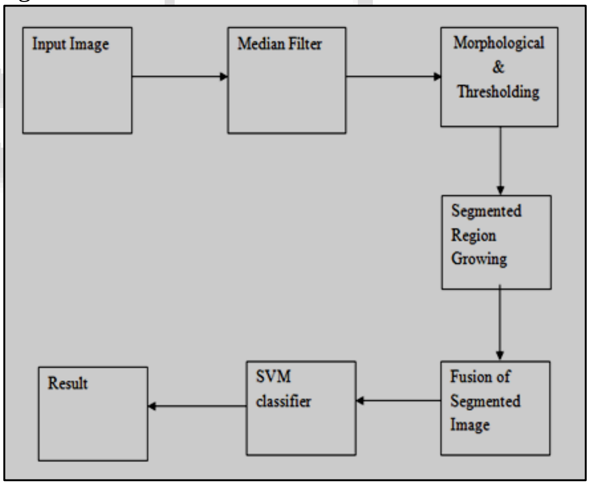

Fig. 1: Block Diagram of the Brain tumor Detection

F. *Support Vector Machine (SVM)*

Classifier is used for classification as well as in the regression condition. SVM Classifies the tumor is benign or malignant. In this algorithm, we plot each data item as a point in n-dimensional space, where n is a number of features with the value of each feature being the value of a particular coordinate. Subsequently, classification is carried out by finding the hyper-plane that transforms the two classes very well.

IV. EXPERIMENTAL RESULTS

MATLAB has been used for implementing the algorithms and for creating a graphical user interface respectively. In this part, we are going to visualize the classification results by investigating on different images of MRI, PET and CT. All the images are harmonious with each other. MRI gives more information about soft tissue whereas CT talks about bone and hard tissues and PET about working. After performing a fusion of MRI images in MATLAB the location of a brain tumor is being identified. With the help of SVM, we can identify the tumor whether in benign or malignant stages. The preprocessed images are free from unwanted noise and will be easy to detect for the radiologists. Hence proposed method achieved 80% sensitivity, 99.9% specificity and 99.69% accuracy which is better than the existing conventional methods

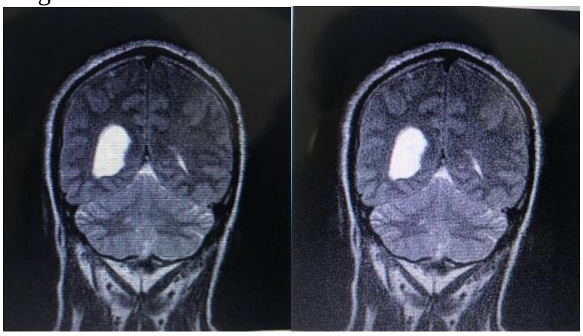

Fig. 2: Two Different Images of Brain

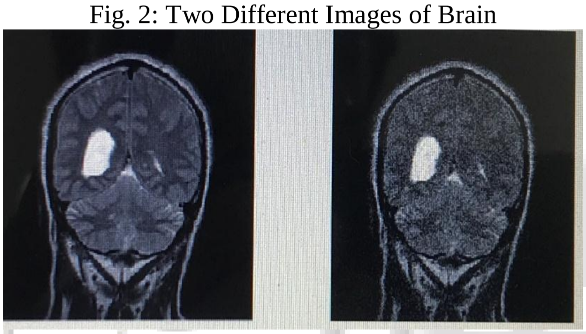

Fig. 2.1: Fusion of Images

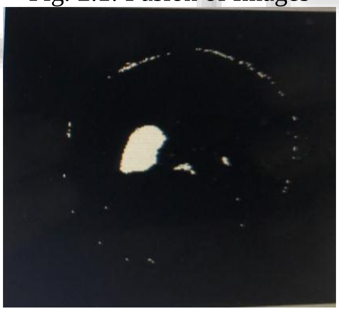

Fig. 2.2: Detection of Benign tumor type I

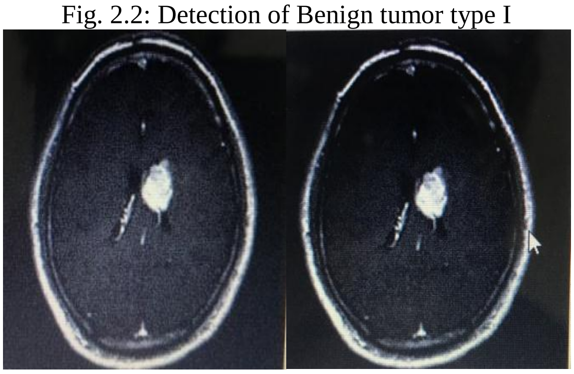

Fig. 2.3: MRI Images of brain

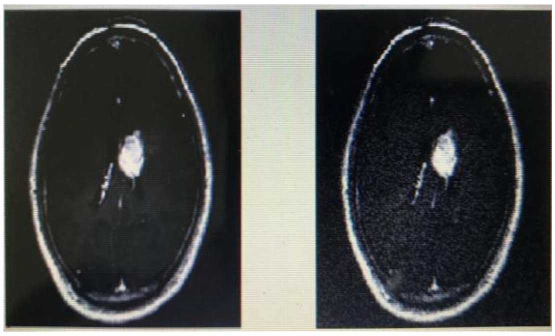

Fig. 2.4: Fusion of Images

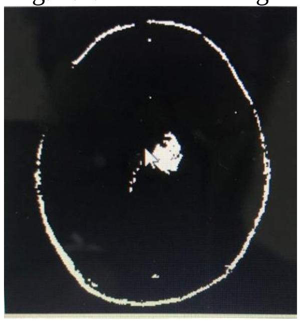

Fig. 2.5: Detection of Benign tumor type II

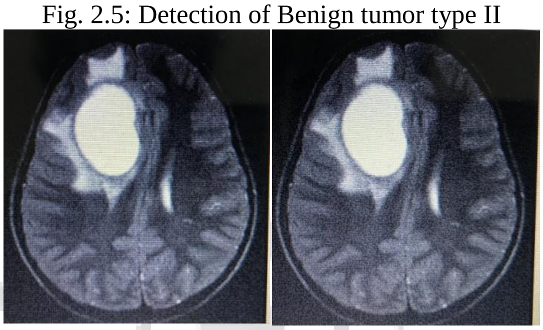

Fig. 2.6: Images of Malignant tumor

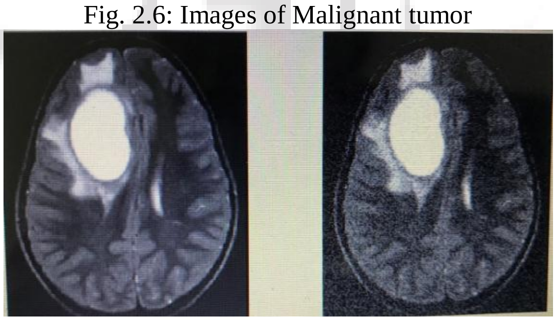

Fig. 2.7: Fusion of Images

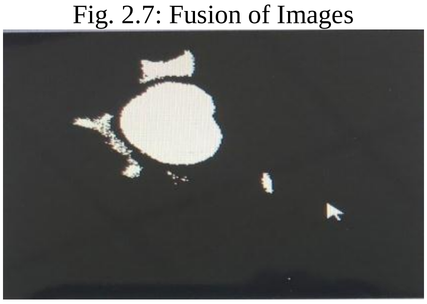

Fig. 2.8: Detection of Malignant tumor

V. CONCLUSION

Medical image fusion combines different modality of medical images to produce a high quality fused image with spatial and spectral information. The fused image with more information improved the performance of image analysis algorithms used in different medical diagnosis applications. SVM is used in this paper for brain image fusion and K-Clustering features are extracted from the brain image. The brain tumor region is segmented using the extracted features and the adaptive SVM classifier helps to identify whether the tumor is benign or malignant. Thus, it helps the physician and radiologist for brain tumor diagnosis for human surgery.

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