

Extracting Salient Brain Patterns for Imaging-Based Classification By Fusion of Images

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Abstract—Medical image fusion aims to integrate information from multimodality medical images to obtain a more complete and accurate description to provide an easy access for image-guided medical diagnostic and treatment. Unfortunately, medical images are often corrupted by noise (during acquisition or transmission) and the noise signal is easily mistaken for a useful characterization of the image, making the fusion effect drop significantly.

Index Terms—Fusion, Computed Tomography (CT) scan, Magnetic Resonance Imaging (MRI) scan, Dyadic wavelet transform, segmentation.

I INTRODUCTION

In 21st Century, the major changes in the technology has enhanced life. They have impacted over the medical and industrial fields. The advancements has made it easier to automate, detect and rectify. To discuss about the contributions over the field of medicine, it has seen a potential rise along these twenty years. The illness, ailments and disease identification has become advanced eventually. The part of human body is subjected to the ‘test and identification’ methods. The scans had come to the rescue of identifying over the abnormalities. The scans are found namely to be Computed Tomography (CT) scan, Magnetic Resonance Imaging (MRI) scan, Positron Emission Tomography (PET) scan. They are used to provide the view of various parts of the human body. Mainly, CT scan is used for the bone structures (structural) and the MRI being used for the soft tissues (functional) parts. The diagnosis with the invent of these scans modified the perspective of identification. The images of brain can interpret how they appear. The brain is said to be the most complex part of the human being. There have been continuous researches and experiments to find the anomalies. Over the years, it is analyzed by the doctors, neurologists, radiologists, and other trained professionals visually. The success rates cannot be picked. This is might be due to various reasons such as noise, man-made error and discarded images. To the errors, noise has been misread as the one of the characteristic feature. The results are plagued with the conditions that are like to be as, error and this misinterpretation leads to the misdiagnosis. In order to better the view, fusion strategy has been implemented. Fusion in image processing, a popular technique being implemented to

combine many images into one. The fused image (after being combined) is found to elicit more information than the images that are being given to be an input. In recent years, it has become a common term in medical diagnostics and treatment.

The medical image fusion can be made over the images of the region. They are being of multiview and multimodal. The Multiview analysis are computed from the images of the same medium as it can be put to be the view of brain by CT images at various angles. Multimodal are with the images of various modes as the combination of CT and MRI scans of the brain. Multitemporal analysis are made at various set of times with intervals of time. The medical fusion images are being preferred to be the multimodal sets as it gives the better understanding of the structure and function when compared to the multiview and multitemporal analysis.

II MULTIMODAL IMAGES

The multimodal images are obtained with respect to various methods and found to be with various accuracies. They are being applied to find the local and temporal abnormalities along the regions of brain. They depict the exactness of the area. The major contributions have neural networks and wavelet transforms incorporated to train with the images that are fed into the system. A neural network resembles biological neural systems that learn tasks and perform based on the examples being fed. The wavelet transforms associate the wavelets that pick up the details from the image. The different transforms have accounted the multimodal image fusion. The common method of implementing fusion is by non-subsampled contourlet transform. However, the down- and up-sampling in contourlet transform lack shift invariance and cause ringing artifacts. This ringing artifact appears to be at the edges where there are sharp transitions. Curvelet transform uses various directions and positions at length scales. They are applied to the smooth edges. But, it does not provide a multiresolution representation of geometry.

The main problem of the multimodal image fusion is the cupping effect. This cupping effect refers to the greying of the image especially due to noise. The problem is that they affect

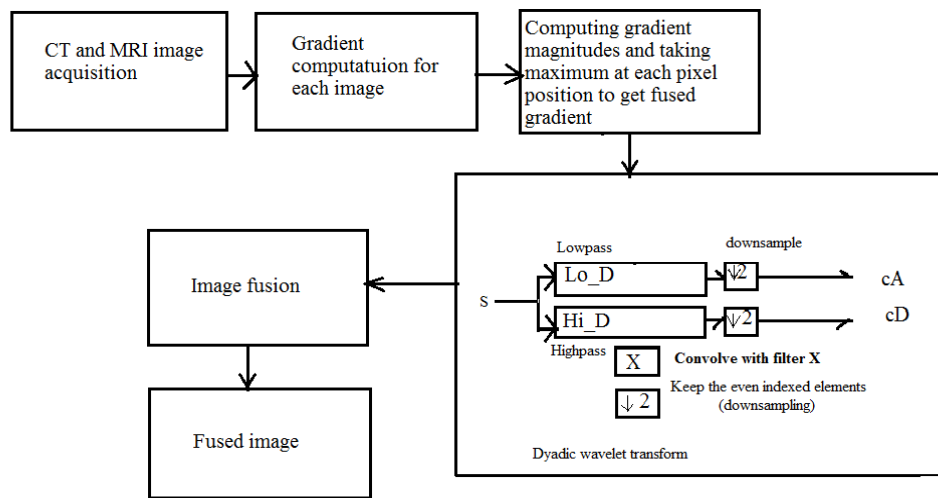


Fig.1.Block Diagram representing the fusion by Dyadic Wavelet Transform

the identification and diagnosis. In this paper the fusion of CT and MRI are being made with the dyadic wavelet transform to reduce the noise to the lesser levels. Further the presence of tumor over the region is detected. The further methods involve in treating the individual with medications if it is being identified to be positive.

III APPLICATION TRANSFORM

The dyadic wavelet transform are scale samples of the wavelet transform that are being measured in the geometric ratio 2. They use filter banks(series of filters) to segregate the frequency components. This transform does not scale time. Generally the dyadic wavelet transform f is represented as, A representation is said to be completely stable when all the Heisenberg boxes of frequency axis are covered. The dyadic wavelets are represented in the stable, possibly redundant, representation of signals to be $L^2(\mathbb{R})$. As the name suggests it is used to find two frequency components with independent of time. The computation of images are detailed in the process. Therefore the images are being taken from the various patients and are being fused. The subjective results are feature extracted in order to identify the condition of tumor over the brain.

IV PROCESSING OF IMAGES

The fusion is explained in the few steps as are termed to be,

A. CT MRI Image Acquisition

The brain images of the individuals are acquired by the former methods. They are the CT and MRI of the individual perfectly. The size of the images are taken the same. This helps in better processing of them.

B. Gradient computation of each image

An image gradient is to find the change or intensity of image. The slightest change can be found and to the computation is being made easy.

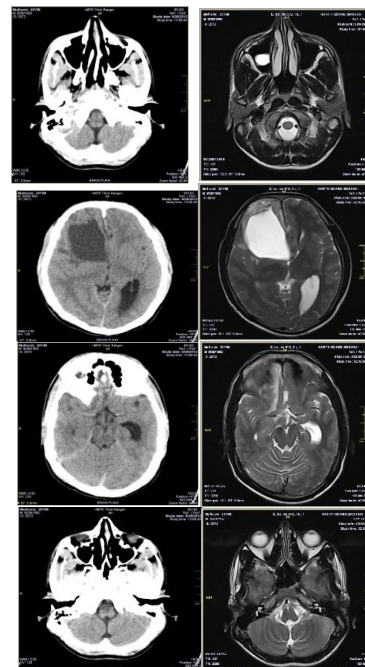


Fig.2.Collective CT&MRI images of individuals

C. Computation of gradient points and taking maximum at each pixel position

Each pixel, where the gradient is being compared over the CT and MRI images. The maximum of being taken into comparison and the pixel matrix is being constructed.

D. Down sampling and frequency components separation

The down sampling is being done to reduce the bit rates and further the higher and lower frequency components are being separated from the other. Local window is used for noise reduction and to maintain the homogeneity of the image. This is to easily access the components and to compare them.

E. Image fusion

The dyadic transform is being applied to get the fused image with which the elements are being drained into. The image is found to be in multimodular wave format. It is being tested with the other images and there are being used to make them better. The fusion is performed by extraction of local features and combining with the fuzzy logic.



Fig.3.a.CT image

Fig.3.b.MRI image

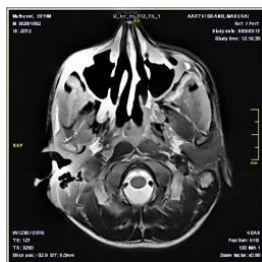


Fig.4.Result of fusion

VI SEGMENTATION

After the process of fusion, we tend to get the fused image over the acute result of the image over which further segmentation can be applied. Segmentation is applying the technique where the image is being sliced into many number of segments and are being considered to be compared and learnt. The main idea of the segmentation is that it provides a clear view of the part that is subjected to the test and identification method. Also there are several identification can be used that are applied to find the crux of the images.

The segmentation is carried out by thresholding by setting up a value to which the pixels are being corresponded to find the results of the prescribed part. Image segmentation by thresholding is a simple but powerful approach for images containing solid objects which are distinguishable from the background or other objects in terms of pixel intensity values. The various incorporations will be detecting edge, region.

VII SEGMENTATION AFTER FUSION

It is believed to be that the segmentation yields the desired results in case of identification. When the fusion is set into images, there is a better chance to obtain without errors. Still, segmentation is a tedious process in case of the medical images since the localized and the anatomical parts have to be considered and over which it has to be classified. Of tumor case, the flow of study is planned to be as,

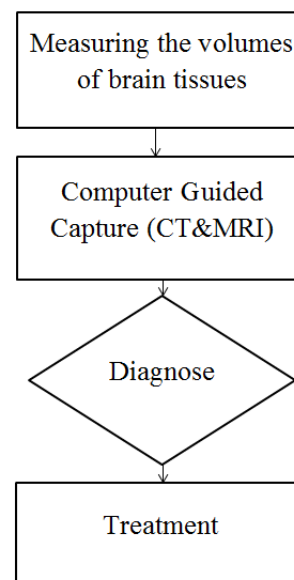


Fig.5. Flow chart of tumor identification

The flowchart where the segmentation replaces the entire column of the guided capture after which the identification is brought under one specific function. Further the computational time to diagnose is sufficiently less than to be the intended time of the actual processing.

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VII CONCLUSION AND RESULTS

The images (CT and MRI) of an individual of size 512x512 has been acquired. It has been set to the fusion by obtaining the gradient value of the pixels. The frequency components of the images are being evaluated by the additive wavelet and substitute wavelet and over being downsampled.

Finally the fusion by Dyadic Wavelet Transform has been implemented and a clear structure of brain is obtained.

This technique is further found to give a clear image of brain over which the diagnosis can be made by visual perception. The study of segmentation is still under reach for the fused image.

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