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A New Scrutiny Method for Medical Likeness Synthesis Using Mean -Mean & Min-Max Algorithms

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ABSTRACT: The image fusion is used to merge the information from multi sensor which improves feature extraction and information analysis. In this paper we introduced new algorithms namely Min-Max, Mean-Mean, Fuzzy Logic to fuse the medical images based on multi wavelet transforms. Max-Min Algorithm and Mean-Mean Algorithms is an efficient algorithm to implement image fusion concept. Where there are two input images have been given to fuse images. This max-min algorithm will takes the maximum visible part in one image and the minimum visible part in another image to make fusion. Then it will make pre-filter operation for both these two images and then multi-wavelet decomposition will be performed based on the image fusion rules. Mean-Mean Algorithm will take the mean difference between the two input images to make fusion. An image fusion algorithm is presented based on fuzzy logic and wavelet in this paper. The goal of image fusion is to create new images that are more suitable for the purposes of human visual perception, object detection and target recognition. The use of multi-sensor data such as visible and infrared images has led to increased recognition rate in applications such as automatic target recognition.

KEYWORDS: Multiwavelet transforms Medical Image, Image Fusion, Fuzzy logic, Max-Min, Mean-Mean Algorithm

I. INTRODUCTION

Image fusion is the process of combining relevant information from two or more images into a single image. In the field of Medicine, Image fusion has become a common term used within medical diagnostics and treatment. The term is used when multiple patient images are registered and overlaid or merged to provide additional information. Fused images may be created from multiple images from the same imaging modality or by combining information from multiple modalities such as magnetic resonance image (MRI), computed tomography (CT), positron emission tomography (PET), and single photon emission computed tomography (SPECT). In radiology and radiation oncology, these images serve different purposes. For accurate diagnoses, radiologists must integrate information from multiple image formats. Image fusion deals with multi-sensors, multi-spectrum, multi-angle viewing and multi-resolutions remote sensing images from various methods, with an aiming at achieving improved image quality to better support improved image classification, monitoring and etc. Fused image will enhance reliability and speed of feature extraction, increase the usage of the data sets, and extend remote sensing images application area. There have been a lot of research efforts on image fusion, and many fusion methods have been proposed. However, these image fusion methods are not enough and cause some difficulties for image analysis and application. The advantage of wavelet transform is that it can analyze signal in time domain and frequency domain respectively and the multi-resolution analysis is similar with Human Vision System. If we fuse a high resolution panchromatic image and a multi spectral image by DWT, the fused image can conserve more spectral characteristics of the multi-spectral image. So the fusion method based on DWT is frequently used and become one of main fusion methods.

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But the DWT has two main disadvantages. Lack of shift invariance: This means that small shifts in the input signal can cause major variations in the distribution of energy between DWT coefficients at different scales. Poor directional selectivity for diagonal features, because the wavelet features are separable and real.
To overcome these problems**,** we are using a pair of MRI and CT images, their wavelet transforms based on the maximum selection rule, and the resulting fused image. The MRI image provides anatomic information while the CT image provides functional information. In the fused image, the relative position of the functional information with respect to the anatomic landmarks is clearly displayed. This information may be very useful for physicians in medical diagnosis.

II. STEPS FOR IMAGE FUSION

1. Giving input (CT and MRI Images),
2. Registering the images,
3. Decomposing the images using Multi-Wavele Wavelet Transform,
4. Applying the fusion rules,
5. Performing the fusion operation.

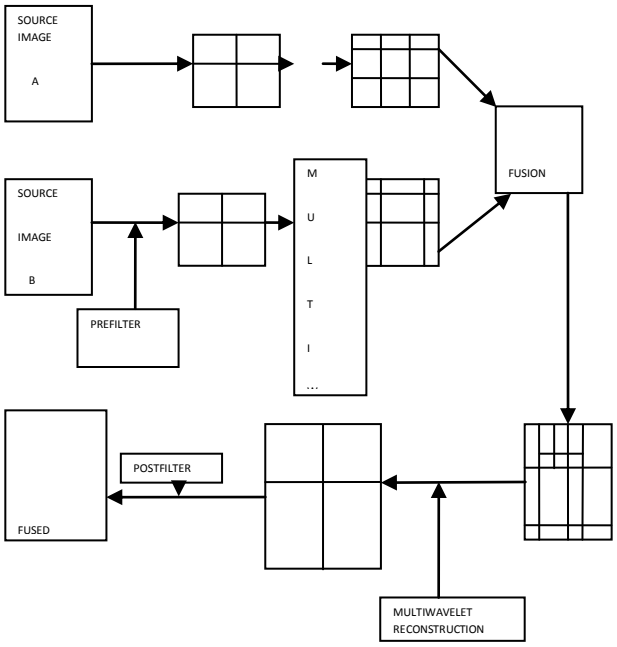

Figure 1: Fusion process

III. METHODS

3.1 Image Registration

With the availability of multi-sensor images in many fields, sensor fusion has emerged as a new and promising research area. Multi-sensor image data often present complementary information about the region surveyed, so that image fusion provides an effective method to enable comparison and analysis of such data. Image fusion aims at the integration of complementary data to enhance the information content of the imagery, i.e. make the imagery more useful to a particular application**.**

In image registration the actual input images are going to be registered to implement image fusion technique. The images can be Gray scaled image or multi colored image.

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3.2 Preprocessing

Dependent on the merging stage, multi-sensor image fusion can be performed at three different levels, namely pixel level, feature level, and decision level. In this project multi-sensor image fusion is pixel-level fusion, which denotes a fusion process generating a single image containing a more accurate description than any individual source image.

Preprocessing is a process of making images flexible to fuse. In preprocessing the images will be divided into several parts based on its property. If the image is gray scaled then it is directly goes to the image fusion. If the image is colored image then it is divided into R-plane, G-plane, B-plane then it has been synthesized into appropriate type.

3.2.1 Pixel Level

Pixel level image fusion refers to the processing and synergistic combination of information gathered by various imaging sources to provide a better understanding of a scene. We formulate the image fusion as an optimization problem and propose an information theoretic approach in a multi-scale framework to obtain its solution. [2,4]

3.2.2 Feature Level

The fusion at the feature level is to combine multiple views and modals in personal identification. A new similarity measure is proposed, which integrates multiple 2-D view features representing a visual identity of a 3-D object seen from different viewpoints and from different sensors.

3.2.3 Decision-Level

Decision-level fusion of multisensory data emphasizes fusion techniques that are suitable for non-commensurate data sampled at non-coincident points. Decision-level fusion is most convenient for such data, but it is suboptimal in principle, since targets not detected by all sensors which will not obtain the full benefits of fusion.[1]

3.3 Image Fusion

With the availability of multi-sensor data in many fields such as remote sensing, medical imaging, machine vision and military applications, sensor fusion has emerged as a new and promising research area. The current definition of sensor fusion is very broad and the fusion can take place at the signal, pixel, feature, and symbol level. In this project we address the problem of pixel-level fusion or the so-called image fusion problem. Multi-sensor data often presents complementary information about the region surveyed, so image fusion provides an effective method to enable comparison and analysis of such data. The goal of image fusion is to create new images that are more suitable for the purposes of human visual perception, object detection and target recognition. The use of multi-sensor data such as visible and infrared images has led to increased recognition rate in applications such as automatic target recognition.[5,6]

To fuse images we are going to implement three different kinds of algorithms.

1. **Max-Min**
2. **Mean - Mean**
3. **Fuzzy-Logic**

IV. ALGORITHM

4.1. Max-Min Algorithm

Max-Min Algorithm is an efficient algorithm to implement image fusion concept. Where there are two input images have been given to fuse images. This max-min algorithm will takes the maximum visible part in one image and the minimum visible part in another image to make fusion. Then it will make pre-filter operation for both these two images and then multi-wavelet decomposition will be performed based on the image fusion rules.[13]

After performing this multi-wavelet decomposition it will reconstruct the multi-wavelet fused image and then it will perform the post-filter to provide an accurate fused image.[14]

4.2. Mean-Mean Algorithm

Mean-Mean Algorithm is also an efficient algorithm to implement image fusion concept. Where there are two input images have been given to fuse images. This mean-mean algorithm will take the mean difference between the two input images to make fusion. Then it will make pre-filter operation for both these two images and then multi-wavelet decomposition will be performed based on the image fusion rules.

After performing this multi-wavelet decomposition it will reconstruct the multi-wavelet fused image and then it will perform the post-filter to provide an accurate fused image.[10,12]

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4.3. Fusion Algorithm

An image fusion algorithm is presented based on fuzzy logic and wavelet in this paper. Aiming at the visible and infrared image fusion, we analyze the pixel-level image fusion algorithms, and address an algorithm based on the discrete wavelet transform and fuzzy logic. We created two fuzzy relations, and estimated the importance of every wavelet coefficient with fuzzy reasoning. According to the importance of coefficients, the weighting average coefficients were calculated. Ultimately, we reconstructed the fused image through inverse wavelet transform. In the experimental section, we verified the effectiveness of the algorithm with two actual image data acquired from the field experiments.[7,9]

4.3.1 Uses of Fuzzy Logic

It is inherently robust since it does not require precise, noise-free inputs and can be programmed to fail safely if a feedback sensor quits or is destroyed. The output control is a smooth control function despite a wide range of input variations.

V. RESULTS

When we are using Min –Max and Mean-Mean algorithm there is a lack of clarity when we view the image, where as when we are using fuzzy logic which gives clarity of image which aids radiologist to diagnose the disease accurately. This technique gives the high quality image. In the fused image, the relative position of the functional information with respect to the anatomic landmarks is clearly displayed. This information may be very useful for physicians in medical diagnosis.

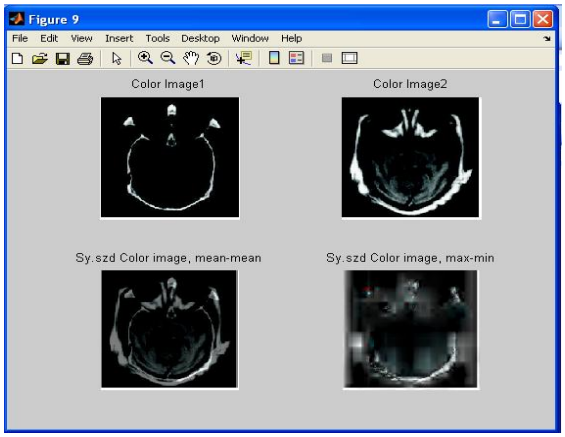

Figure 3.2 Using Max-Min and Mean Algorithm for Image Fusion

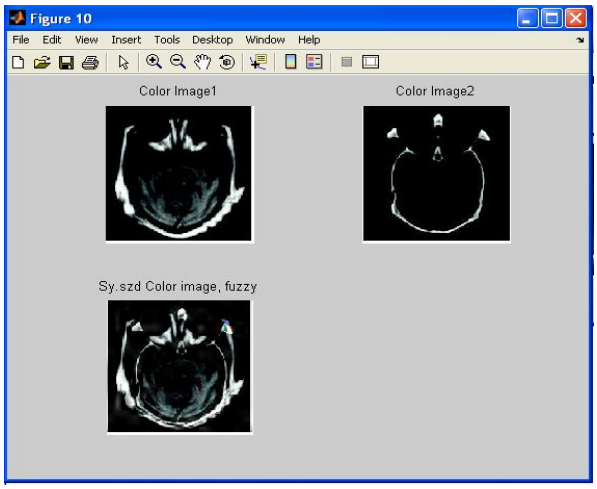

Figure 3: Using Fuzzy Logic for Image Fusion

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VI. CONCLUSION

In this paper image registration is used for transforming different sets of data into one coordinate system. In image registration the actual input images are going to be registered to implement image fusion technique. The images can be Gray scaled image or multi colored image. Preprocessing is a process of making images flexible to fuse. In preprocessing the images will be divided into several parts based on its property. If the image is gray scaled then it is directly goes to the image fusion. If the image is colored image then it is divided into R-plane, G-plane, B-plane then it has been synthesized into appropriate type. Fuzzy logic gives clarity of image which aids radiologist to diagnose the disease accurately. This technique gives the high quality image. In the fused image, the relative position of the functional information with respect to the anatomic landmarks is clearly displayed. This information may be very useful for physicians in medical diagnosis.

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