Medical Image Fusion Based On Lifting Wavelet Transform and Neuro Fuzzy

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Abstract- Multimodal medical image fusion algorithm based on multi-resolution transform and neuro fuzzy is presented in this paper. Imaging modalities like CT (computer tomography), MRI (Magnetic resonance image) are complementary on reflecting human information. Based on the wavelet transform the fusion of the CT, MRI image comes true. The main aim of our project is to improve image content by fusing images so as to provide better information to the doctor and the clinical treatment. In this paper proposes a image fusion based on lifting wavelet transform and neuro fuzzy. Initially the registered CT & MRI images are decomposed using lifting wavelet transform. The wavelet co-efficient are fused by fuzzy algorithm. Then inverse lifting wavelet transform is applied to fused coefficient to get the fused image. The ILWT is used to recover the samples or information. The performance of this algorithm is measured by mean, standard deviation and spatial frequency.

***Index Terms*- Medical Image Fusion, Neuro Fuzzy, Lifting Wavelet Transform CT, MRI, and Multimodality.**

I. INTRODUCTION

Medical image fusion is one of the techniques that encompassed from image fusion, where as image fusion is used to complementary information as well as redundant information from the imaging data. One of the main advantages of image fusion is improved reliability and capability. The multimodality imaging plays a vital role in the clinical treatment. While fusing the CT and MRI images it could generate the new image with more accuracy. So as to provide better information to the doctor and the clinical treatment. Different image fusion techniques can provide scans with complementary as well as occasionally redundant information. The combination of images can lead to the additional clinical information not in the separate images. Moreover it is difficult to simulate or characterized by extreme precision or incisiveness on involving surgery. When algorithms are image processing is put on merely. So, they provide much solution to the medical diagnostic and image fusion has been proposed today. Wavelet theory employs the spatial resolution and spectral characteristics.LWT maintains the edge information about the image and it occupies less memory. [1][2] This paper proposes a new image fusion using LWT and fuzzy. Registered CT & MRI images of the same person and same spatial part are used for fusion. First the images are decomposed by LWT. The lifting wavelet coefficients are then fused by applying neuro fuzzy fusion rule. Membership functions are used for fusing the coefficient. Then the inverse lifting wavelet transform is applied to the fused coefficient to get the fused image.

This paper regulate behind as follows. The lifting wavelet theory is given in section II. Section III discuss about neuro fuzzy. The proposed algorithm is given in section IV. Section V concludes the paper.

II. LIFTING WAVELET THEORY

Lifting wavelet theory is a new approach for constructing wavelet, which is also called as second generation wavelet. The main aim of LWT is transform the signal that is coarser signal sn-1 into a detailed signal dn-1. Hence, LWT is an efficient method for calculating the filtering operations. Furthermore wavelet theory has been taken into as one special type of decomposition.[6] After one level of decomposition there will be split into four frequency bands.

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That is LL (low-low), LH (low-high), HH (high-high), and HL (high-low). The next level decomposition is just applied to the LL band of the current decomposition stage. Constructing wavelet using lifting scheme can be divided into 3steps 1) split 2) predict 3) update

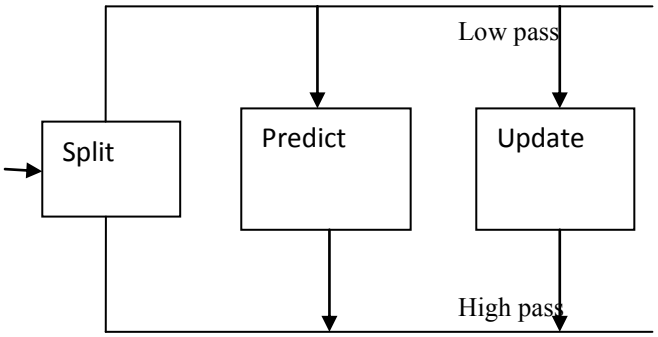

Fig.1 Block Diagram for Lifting Scheme

Split: The data has some correlation structure and to obtain a more compact representation split into two smaller subsets that is even indexed samples (Sn), odd indexed samples (sn+1)

Predict: Use the odd subset (Sn+1) to predict even subset (Sn) based on the correlation present in the original data.

dn-1=odd-p (even)

Update: maintain the global properties of the original set in the subsets need to be maintained. This is performed by introducing update stage.

$Sn-1=even_{j,i}+u(dn-1)$

III. NEURO FUZZY

Neuro fuzzy refers to the combination of artificial intelligence and it is used for fusing the images. The fuzzy systems are employed to tune the membership functions. Directly the linguistic labels are encoded with the fuzzy logic system and provide expert knowledge of the system. It takes larger time to design and tune the membership functions which quantitatively define these linguistic labels. Advantage of neural network is adaptivity. Neural networks are easily identifying the patterns. Neural network learning techniques can emulate this process and consequently reduce development time and cost while improving performance. [4][3] To avoid the problem of knowledge acquisition, neural networks are extended to automatically extract fuzzy rules from numerical data.

A Membership Function

The membership function is the kernel part of fuzzy set. The fuzzy set is also referred to as membership function. Although fuzzy is defined as fuzzy set. The function is used to companion of high level membership function of each element to the domain of particular fuzzy set. Membership function of fuzzy sets can be in different shapes or types in the domain over the sets are defined.

B ANFIS

ANFIS is called as Artificial Neuro-Fuzzy Inference System. It is a type of adaptive networks that is used for functionally equivalent to fuzzy inference systems. ANFIS gives Sugeno-type fuzzy inference systems which use a hybrid learning algorithm to identify parameters of Sugeno-type fuzzy inference Systems. It gives the combination of least-squares method and the back propagation gradient descent method for training FIS membership function parameters to emulate a given training data set. Anfis can also be invoked using an optional argument for model validation. The type of model validation that takes place with this option is a checking for model over fitting, and the argument is a data set called the checking data set.

IV. Proposed Method

Registered MRI and CT medical images of the same person and same spatial part are to be fused. The first step in this scheme is to compute a multi-resolution representation. This is done using lifting Wavelet Transform. The second step is to fuse the lifting wavelet coefficients using neuro-fuzzy. Then ILWT is performed to obtain the fused image.

A Algorithm

1. Read the first image (CT) in variable M1 and find its size.

2. Read the second image (MRI) in variable M2 and find its size.

3. Decompose both the image using lifting Wavelet Transform.

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4. Make a neuro-fuzzy structure using genfis1 and

Anfis command with the specified membership function type and number.

5. Convert the vector form to matrix form and form

the fused coefficients.

6. Then apply Inverse LWT to get the fused image.

7. Finally calculate Mean, Standard deviation, Spatial Frequency.

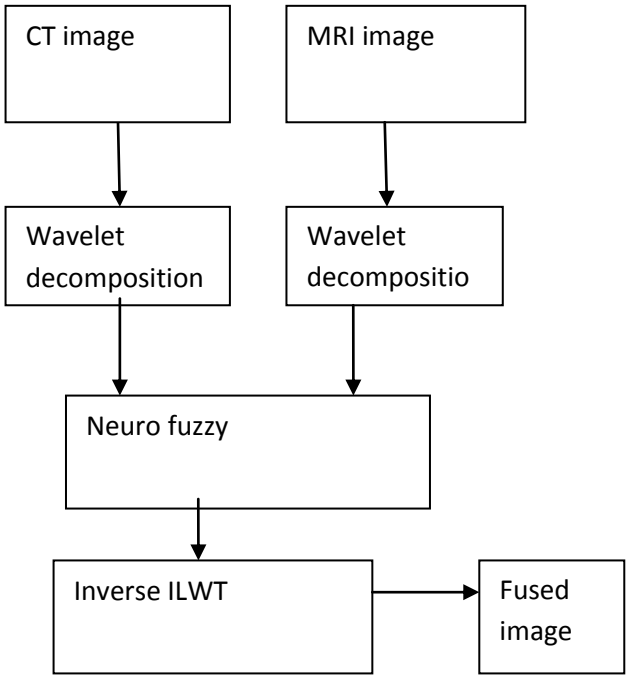

Fig 2 Fusion rule using LWT

V. Conclusion

In this paper, a new fusion rule is proposed using lifting Wavelet Transform and neuro-fuzzy. The advantage of lifting Wavelet Transform is to clearly identifying the details information in an Image. Membership function used for the fusion is generalized bell shaped built-in Membership Function. The algorithm performed better with the fusion rule using lifting wavelet transform and neuro- fuzzy. Measuring attributes like mean, Standard deviation and Spatial Frequency are used. Mean value and Standard deviation value is high for the proposed method, indicating that the fused image contains fairly good amount of information present in the input images. Low value of Spatial Frequency indicates that the fused image is symmetric with respect to the input images.

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