

Directive Contrast Based Multimodal Medical Image Fusion in NSCT

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ABSTRACT: This paper presents the multimodal medical image fusion technique based on discrete non-sub sampled contourlet transform and pixel level fusion rule. In medical diagnosis, the edges and outlines of the interested objects is more important than other information. Therefore, edge features are worthy for investigating medical image fusion. And we know, the image with higher contrast contains more edge features. This paper proposed a new medical image fusion scheme based on discrete contourlet transformation, which is useful to provide more details about edges at curves. It is used to improve the edge information of fused image by reducing the distortion. This transformation will decompose the image into finer and coarser details and finest details will be decomposed into different resolution in different orientation. Here the pixels and decision level fusion rule will be applied selected for low frequency and high frequency and image averaging, phase congruency and directive contrast. The fused contourlet coefficients are reconstructed by inverse NS contourlet transformation. Simulating results demonstrate the effectiveness of this method compared to present image fusion schemes, especially for medical diagnosis. The aim of image fusion is to obtain useful complementary information from CT/MRI multimodality images.

KEYWORDS: Multimodal medical image fusion, non sub sampled contourlet transform, phases congruency.

I.INTRODUCTION

At present, medical imaging has more increasing attention due to its crucial role in health care. However, some different types of imaging techniques such as X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), Magnetic Resonance Angiography (MRA), etc., these methods provide limited information where some information is common, and some are unique. For example, X-ray and Computed tomography (CT) can provide dense structures like bones with minimum distortion, but it cannot detect any physiological changes and MRI images can provide normal and pathological soft tissue. Hence, the anatomical and functional properties of medical images are must to be combined for a compendious view. For this purpose, the multimodal medical image fusion has been identified as a promising solution. Multimodal medical image fusion helps in diagnosing diseases, and also it reduces the storage cost by reducing the storage to a single fused image instead of storing multiple-source images [1]. So far, many research works has been made on image fusion technique with various techniques respected to multimodal medical image fusion. Three categories are available for merging the image and they are pixel level, feature level and decision level fusion. Fusion in medical image usually employs the pixel level fusion due to the advantage of containing the original measured quantities, easy implementation and efficient computation.

The pixel level fusion is based on principal component analysis (PCA), independent component analysis (ICA), contrast pyramid (CP), gradient pyramid (GP) filtering, etc. The image features are sensitive to the human visual system which exists in different levels of scales. Hence, these are not highly suitable for medical image fusion. At present wavelet transform is the ideal method for fusion of image, but it is not good at edges and textured region and it captures only very limited directional information along vertical, horizontal and diagonal direction [2]. Multimodal decomposition called as contourlet transform, and its non subsampled version used to overcome all these disadvantages. Contourlet is a 2-D sparse representation where sparse expansion is expressed by contour segments for 2-D signals like images. So, this transform can capture 2-D geometrical structures in visual information in much more

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effective manner other than traditional multimodal methods. Here, a novel fusion framework for multimodal medical images based on non subsampled contourlet transform is proposed. The main idea is to perform NSCT on the medical images followed by the fusion of low and high frequency coefficients. The combinations of these two can preserve more details in source images and further improve the quality of fused image.

II. PREVIOUS METHOD

A new image fusion framework for multimodal medical images which relies on the NSCT domain. Two different fusion rules are proposed for combining low and high-frequency coefficients. Phase congruency is used for fusing low frequency coefficients. Phase congruency combines contrast and brightness invariant representation contained in the low frequency coefficients. NSCT domain is proposed and used to combine high-frequency coefficients.

LOW FREQUENCY ALGORITHM

The coefficients in the low-frequency sub images represent the approximation Component of the source images. The simplest way is to use the conventional averaging methods to produce the composite bands. However, it cannot give the fused low frequency component of high quality for medical image because it leads to the reduced contrast in the fused images. Therefore, a new criterion is proposed here based on the phase congruency. The complete process is described as follows. Phase congruency is a measure of feature perception in the images which provides an illumination and contrast invariant feature extraction method this approach is based on the Local Energy Model, which postulates that significant features can be found at points in an image where the Fourier components are maximally in phase. Furthermore, the angle at which phase congruency occurs signifies the feature type. The phase congruency approach to feature perception has been used for feature detection. First, logarithmic Gabor filter banks at different discrete orientations are applied to the image and the local amplitude and phase at a point are obtained.

- The phase congruency is invariant to different pixel intensity mappings. The images captured with different modalities have significantly different pixel mappings, even if the object is same. Therefore, a feature that is free from pixel mapping must be preferred.
- The phase congruency feature is invariant to illumination and contrast changes. The capturing environment of different modalities varies and resulted in the change of illumination and contrast. Therefore, multimodal fusion can be benefitted by an illumination and contrast invariant feature.
- The edges and corners in the images are identified by collecting frequency components of the image that are in phase. As we know, phase congruency gives the Fourier components that are maximally in phase. Therefore, phase congruency provides the improved localization of the image features, which lead to efficient fusion. First the features are extracted from low-frequency pca, pcb Sub-images using the phase congruency extractor denoted by and respectively. Fuse the low-frequency sub-images.

HIGH FREQUENCY ALGORITHM

The coefficients in the high-frequency sub images usually include details component of the source image. The noise is also related to high frequencies and may cause miscalculation of sharpness value and therefore affect the fusion performance. Therefore, a new method is proposed based on directive contrast. First, the directive contrast for NSCT high-frequency sub images at each scale and orientation using Equations denoted by Dca, Dcb Fuse the high-frequency sub image. The contrast feature measures the difference of the intensity value at some pixel from the neighboring pixels. Human visual system is highly sensitive to the intensity contrast rather than the intensity value. Generally, the same intensity value looks like a different intensity value depending on intensity values of neighboring pixels. Where is the local luminance and is the luminance of the local background. Generally, is regarded as local low frequency and hence, is treated as local high frequency. This definition is further extended as directive contrast for multimodal image fusion these contrast extensions take high-frequency as the pixel value in multi resolution do-main. However, considering single pixel is insufficient to determine whether the pixels are from clear parts or not. Therefore, the directive contrast is integrated with the sum modified Laplacian to get more accurate salient features.

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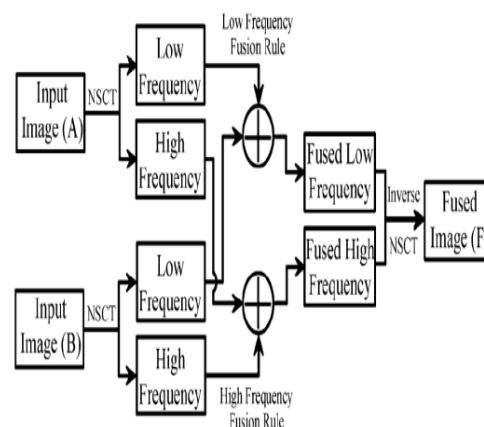


Fig.1: multimodal medical image fusion framework.

III. PROPOSED METHOD

Decomposition using NSCT

A Non-Sub sampled Contour let Transform (NSCT), based on the theory of CT, is a kind of multi scale and multi direction computation framework of the discrete images. There are two stages, non sub sampled pyramid (NSP) and non sub sampled directional filter bank (NSDFB). The former stage ensures the multi scale property by using two channel non-sub sampled filter bank, and one low-frequency image and one high frequency image can be produced at each NSP decomposition level. The subsequent NSP decomposition stages are carried out to decompose the low-frequency component available iteratively to capture the singularities in the image .At last , NSP can provide sub-images ,which consists of one low frequency and high frequency images having the same size as the source image and denotes the number of decomposition levels. The NSDFB is two channel non-sub sampled filter banks which are constructed by combining the directional fan filter banks. NSDFB allows the direction decomposition with stages in high-frequency images from NSP at each scale and produces directional sub images with the same size as the source image. Therefore, the NSDFB offers the NSCT with the multi-direction property and provides us with more precise directional details information.

Phase Congruency

The phase congruency provides a contrast and brightness invariant representation of low-frequency coefficients whereas directive contrast efficiently determines the frequency coefficients from the clear parts in the high frequency. First, logarithmic Gabor filter banks at different discrete orientations are applied to the image and the local amplitude and phase at a point are obtained. Phase congruency provides the improved localization of the image features, which lead to efficient fusion. The visual demonstrates that the proposed algorithm can enhance the details of the fused image, and can improve the visual effect with much less information distortion.

Directive contrast

The contrast feature measures the difference of the intensity value at some pixel from the neighboring pixels. The human visual system is highly sensitive to the intensity contrast rather than the intensity value itself. Generally, the

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IV. RESULTS

In this Method, Image fusion framework is proposed for multimodal medical images. In fusion, two different rules are used for getting more information from the fused image. The low frequency bands are fused by considering phase congruency where as directive contrast is adopted as the fusion measurement for high frequency bands.



Fig.2: (A) Input Image (human brain) (B) Fusion Image

Bellow figure describes the fusion of the input image. The low level segment of input image is fused together and the same is done with high level segment.

V. CONCLUSION

A novel image fusion framework is proposed for multimodal medical images, which is based on non-sub sampled contourlet transform and directive contrast. For fusion, two different rules are used by which more information can be preserved in the fused image with improved quality. The low frequency bands are fused by considering phase congruency where as directive contrast is adopted as the fusion Measurement for high-frequency bands. In this experiment, input image is fused using conventional fusion algorithms and the proposed framework and the simulation results shows that the proposed algorithm can enhance the details of the fused image, and can improve the visual effect with much less information distortion than previous methods.

REFERENCES

- [1] G.Bhatnagar, Q.M. J.Wu, and Z. Liu, "Directive Contrast Based Multimodal Medical Image Fusion in NSCT Domain," in IEEE Transactions on Multimedia, vol.15, no.5, pp.1014-1024, 2013.
- [2] F. E. Ali, I. M. El-Dokany, A. A. Saad, and F. E. Abd El-Samie, "Curvelet fusion of MR and CT images," Progr. Electromagn. Res. C, vol. 3, pp. 215-224, 2008.
- [3] A. L. da Cunha, J. Zhou, and M. N. Do, "The non-subsampled contourlet transform: Theory, design, and applications," IEEE Trans. Image Process., vol. 15, no. 10, pp. 3089-3101, Oct. 2006.
- [4] A. Toet, "Hierarchical image fusion," Mach. Vision Appl., vol. 3, no. 1, pp. 1-11, 1990.



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- [5] Q. Zhang and B. L. Guo, "Multifocus image fusion using the nonsubsampling contourlet transform," *Signal Process.*, vol. 89, no. 7, pp. 1334–1346, 2009.
- [6] A. B. Watson, "Efficiency of a model human image code," *J. Opt. Soc. Amer. A*, vol. 4, no. 12, pp. 2401–2417, 1987.
- [7] S. Yang, M. Wang, L. Jiao, R. Wu, and Z. Wang, "Image fusion based on a new contourlet packet," *Inf. Fusion*, vol. 11, no. 2, pp. 78–84, 2010.
- [8] V. S. Petrovic and C. S. Xydeas, "Gradient-based multiresolution image fusion," *IEEE Trans. Image Process.*, vol. 13, no. 2, pp. 228–237, Feb. 2004.
- [9] F. Maes, D. Vandermeulen, and P. Suetens, "Medical image registration using mutual information," *Proc. IEEE*, vol. 91, no. 10, pp. 1699–1721, Oct. 2003.
- [10] G. Bhatnagar, Q. M. J. Wu, and B. Raman, "Real time human visual system based framework for image fusion," in *Proc. Int. Conf. Signal and Image Processing*, Trois-Rivieres, Quebec, Canada, 2010, pp. 71–78.
- [11] A. Cardinali and G. P. Nason, "A statistical multiscale approach to image segmentation and fusion," in *Proc. Int. Conf. Information Fusion*, Philadelphia, PA, USA, 2005, pp. 475–482.