ABSTRACT

Image fusion based on different wavelet transform is the most commonly used image fusion method, which fuses the source pictures data in wavelet space as per some fusion rules. But, because of the uncertainties of the source images contributions to the fused image, to design a good fusion rule to incorporate however much data as could reasonably be expected into the fused picture turns into the most vital issue. On the other hand, adaptive fuzzy logic is the ideal approach to determine uncertain issues, yet it has not been utilized as a part of the outline of fusion rule. A new fusion technique based on wavelet transform and adaptive fuzzy logic is introduced in this chapter. After doing wavelet transform to source images, it computes the weight of each source images coefficients through adaptive fuzzy logic and then fuses the coefficients through weighted averaging with the processed weights to acquire a combined picture: Mutual Information, Peak Signal to Noise Ratio, and Mean Square Error as criterion.

INTRODUCTION

With the growing advancements in technology, it becomes possible to obtain information from multimodality images. However, all the geometrical and physical details in need for full assessment might not be available by analyzing the multimodality images separately. In multisensory images, there is often a trade-off between spatial and spectral resolutions resulting in information loss. Image fusion combines perfectly registered multimodality images from multiple sources to provide a high quality fused image with high spatial and spectral information. It integrates complementary information from various modalities based on specific rules to give a better visual appearance of a scene, suitable for machine pro-

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Improving Multimodality Image Fusion through Integrating AFL and Wavelet Transform

An image can be expressed either by its original spatial representation or in frequency domain. By Heisenberg’s uncertainty, information cannot be compact in both spatial and frequency domains simultaneously. This motivates the use of wavelet transform which gives a multi-resolution solution based on time-scale analysis. Each sub-band is processed at a different resolution, capturing localized time-frequency data of image to provide unique directional information useful for image representation and feature extraction across different scales.

BACKGROUND

Multimodalities data fusion has become a discipline to which more and more general formal solutions to a number of application cases are required. Several situations in image processing simultaneously require high spatial and high spectral information in a single composite image. This is important in medical diagnosis, remote sensing. However, the multimodalities are not capable of providing such information either by design or because of observational constraints. One possible solution for this is data fusion. Image fusion is the process of combining information from two or more multimodalities images of a scene into a single composite image that is more informative and is more suitable for visual perception or computer processing. The aim of multimodalities image fusion is to integrate complementary information of multi-sensor, multi-temporal and/or multitier into one new image. The goal is to reduce uncertainty and minimize redundancy in the output while maximizing relevant information particular to an specific application or task. An area based maximum selection rule, and consistency verification steps are used for feature selection. The algorithms are checked for multi sensor as well as multi focus image fusion.

In Medical Image Fusion Based on Discrete Wavelet Transform Using Java Technology (Ligia & Vaida, 2009), authors discuss the importance of information offered by the medical images for diagnosis support can be increased by combining images from different compatible medical devices. The fusion process allows combination of salient feature of these images. In this paper different techniques of image fusion, Author’s work for medical image fusion based on discrete wavelet transform and how to understand to integrate this process into a distributed application. The dedicated application considers Java technology for using its facilities as a future development, regarding a remote access mechanism. In Novel Masks for Multimodality Image Fusion using DTCWT (Shahid & Gupta, 2006), authors present an image fusion technique using the Dual tree complex wavelet transform (DTCWT). We they proposed novel masks to extract information from the decomposed structure using DTCWT. The main goal of this paper is to introduce a new approach to fuse multimodality images using dual tree complex wavelet transform. Experiment results show that the proposed fusion method based on complex wavelet transform is remarkably better than the fusion method based on classical discrete wavelet transform. This method is relevant to visual sensitivity and tested by merging multisensor, multispectral and defocussed images apart from medical images (CTand MR images). Fusion is achieved through the formation of a fused pyramid using the DTCWT coefficients from the decomposed pyramids of the source images. The fused image is obtained through conventional inverse dual tree complex wavelet transform reconstruction process. Results obtained using the proposed method show a significant reduction of distortion. In A Novel Wavelet Medical Image Fusion Method (Zhang H. et al, 2007), authors propose a novel global energy merging scheme that is a region-based analysis approach. At first, multi-resolution wavelet decomposition on each source image is performed, and then the energy of the each 3*3 matrix region is calculated. The match measure can produce using wavelet decomposition coefficient and the energy. The
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