

Chapter 26

Hybrid Multimodality Medical Image Fusion Using Various Fusion Techniques With Quantitative and Qualitative Analysis

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ABSTRACT

In this chapter, different types of image fusion techniques have been studied and evaluated in the medical applications. The ultimate goal of this proposed method is to obtain the fused image without any loss of similar information and preserve all special features present in the input medical images. This method is used to improve the fused image quality for better diagnosis of critical disease analysis. The fused hybrid multimodal medical image should convey better visual description than the individual input images. This chapter proposes the method for multimodal medical image fusion using the hybrid fusion algorithm. The computed tomography, magnetic resonance imaging, positron emission tomography, and single photon emission computed tomography are the input images used for this experimental work. In this chapter, experimental results discovered that the proposed techniques provide better visualization of fused image and gives the superior results compared to various existing traditional algorithms.

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INTRODUCTION

Image Fusion

Image fusion is a process to combine similar information present in input images using advanced fusion algorithm. The main purpose is to enhance the information present in the image by integrating the similar and dissimilar data. This leads to more accurate data and increased utility. It is also stated that fused data provides improved classification, robust operational performance, reduced ambiguity, increased confidence and improved reliability. Image fusion is generally applied to digital imagery for the following applications that are valuable in human life.

- Geographical change detection
- Deforestation monitoring
- Glacier monitoring
- Hazards monitoring
- Military target detection
- Border security surveillance
- Early detection of medical symptoms like a cancer
- Urban mapping
- Replace defective data
- Object identification and classification

Multimodal Image Fusion

Multimodal image fusion produces a better visible image by combining two or more images from heterogeneous sources. The fused images can decrease the ambiguity related to a single image. The resultant fused images are used in military and security applications, such as weapon detection, target detection, object tracking, night vision, etc. The multi-sensor data in many fields, such as medical imaging, remote sensing, machine vision, sensor fusion has emerged as a novel and robust research area. It is possible to have several images of the same scene providing different information although the scene is the same. This is because each image has been captured with a different sensor. If we are able to merge the heterogeneous information that is collected from different image sensors, we can obtain a new and improved image which is called a multimodal fusion image. Naturally the image fusion combines most similar information present in input images and achieved a new fused image. Hence, the fused image has better quality than any of the input images. Target detection, urban mapping, medical imaging and remote sensing are some applications multimodal image fusion technique.

Importance and Significance of the Multimodal Medical Image Fusion

Multimodal medical image fusion technique is one of the recent research topics in the medical imaging field. This technique performed to reduce the redundancy in clinical applicability and to increase the relevant information present in the images. The multimodal medical images can be particular organ focused by the different types of modalities which include CT, MRI, PET and SPECT images. In this research work the Neurocysticercosis (NCC) affected multimodality medical images of same patient are

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