Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 4, Issue. 5, May 2015, pg.192 – 197

RESEARCH ARTICLE

A Study on Image Fusion Techniques for Medical Image Enhancement

Ritu
Student, M.Tech, Dept. Of Computer Sc., ITM University, Gurgaon, Haryana

Dr. Akansha Singh
Associate Professor, Dept. Of Computer Sc., ITM University, Gurgaon, Haryana

Abstract: The effectiveness of medical image processing depends on input image. But these images are captured from complex sources because of which there are chances of feature distortion over the image. Because of this, there is requirement of some such mechanism that can improve the medical image feature in case of partial distortion. In this paper, a study based work is defined to refine the images using fusion approach. The paper has discussed the medical image processing along with associated issues. The paper has also explored various methods of image fusion to improve the medical images.

Keywords: Medical Image, Fusion, DWT, Tumor Detection

I. INTRODUCTION

Medical Image processing is one of the critical image processing application area that is requires more accuracy than any other image processing approach. The major applications of medical image processing are to detect the disease by performing the image analysis. These diseases are also specific to the captured image. The study of medical image processing can be defined under different aspects. One of such aspect is the human body organ by which the processing approach is associated. These associated medical image processing includes the detection of tumors in lung, brain, liver images. The identification of cuts, scars or infection area on skin or face images. This application area also includes the identification as well as classification of the disease or the tumor in medical image.

Another application area associated with medical image processing is information security. The information security is here attained by using the medical images as the cover image for watermarking or the steganography processes. These approaches are basically used to hide some valuable information in it. As the medical images are high intensity images because of this it is used to store the important information contents in it. To mark the medical image respective to the person identity or hospital identity, some observing symbol can be hide behind the image. This processing of hiding the symbol object behind the medical image is terms as watermarking process. Watermarking is one of the major application area for medical image processing.

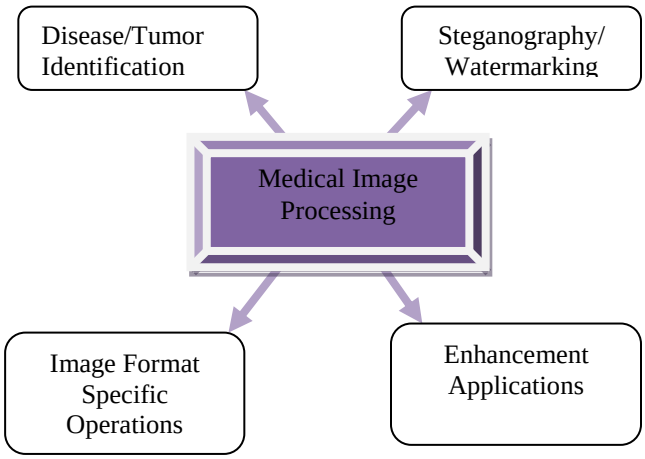

Figure 1 : Medical Image Processing

Another criticality of medical image processing is the separate work definition based on the image format. It is not necessary that the algorithmic approach defined for one image format will work for the other format. There are number of specialized image formats available for medical images such as DICOM images, PGM images, CT images etc. While defining any algorithmic solution it is required to test it for each medical image. There is the requirement of some algorithmic changes based on the format.

The accuracy of the work depends on effective images that can explore the image features in better way without hiding some part of information. If the image features are not fully visible, reliable and robust outcome cannot be derived. But the extraction of medical images is generally done from specialized scanners. But there can occur some problem over the image during the extraction process. Because of this, there is the requirement of some effective mechanism to repair the image. This is another application of medical image processing in which the medical images are reconstructed so that the destroyed image features will be resettled. This improvement to the images can be done using some contrast balancing, brightness balancing and image impainting approaches. The presented work is also focused on the same problem. In this work, an exploration is given to image improvement using image fusion approach.

A) Image Fusion

Image fusion is an approach to generate a perfect image by combining two or more partially perfect images. The fusion can be performed on multiple images extracted images at different time instances. These images are extracted for same object under some variation. This variation can be in terms of different viewpoints or different sensor positions. But all the images having some kind of distortion on incompleteness under different vectors. These vectors can be unequal brightness, unequal contrast as well as partial information representation. There are two type of fusion approaches called pixel level fusion and area level fusion. The pixel level fusion is performed on individual pixel of multiple images under intensity analysis to identify the most effective image pixel. In same way, the region level fusion is performed on same areas of different images to reconstruct the repaired image region. The effective pixel or region selection is here performed under different parameters. These parameters includes MSE analysis, Entrophy value analysis etc.

In this paper, a study oriented work is defined to reconstruct the medical images using fusion process. The paper has explained different approaches associated on fusion process. In this section, a study on the fusion process as well as associated processes is defined. In section II, the work defined by the earlier researchers is discussed. In section III, the study on different associated approaches is defined. In section IV, the conclusion obtained from the work is defined.

II. RELATED WORK

Lot of work is already defined on medical image processing and image enhancement by using different approaches. Researchers also defined work on fusion based approaches to repair medical images. In this section, some of the work defined by earlier researchers is discussed. A. Soma Sekhar[1] has defined a work on image fusion for MR and CT scan images. Author uses the wavelet based approach to repair these images. The work is here performed using multi resolution fusion algorithm that is based on the pixel level as well as region level fusion process. The pixel and region level selection is here performed under visibility analysis. This analysis vector was obtained statistically and the integration of the work is here performed with wavelet integrated approach. The work is here defined to improve the fusion process to generate the smoother and effective image. G.K. Matsopoulos[2] has defined a mathematical filter based work to generate new image under fusion process performed on MRI and CT scan images. Author defined work for brain images to combine the anatomical and pathological structured analysis to generate the repaired image. The processing is here defined at single scale level. The structured featured image is here generated under fusion process. Yuinei Miao[3] has presented a semantic analysis integrated conceptual model to improve the image features and to reconstruct the image. The work is here defined as a model to match the semantic features under descriptions to generate the repaired image. The work is here performed at content level analysis to repair and reconstruct the result image. Li Jin[4] has presented a edge region based analysis under clustering approach for image reconstruction. The work is here presented on clear region and edge segmentation approach to generate a repaired image by combining the image features. The work is here defined to generate a combined featured image.

Yi Shen[5] has defined an adaptive weighted approach for fusion process under local priority analysis for CT and MRI images. The local priority is here observed under the specification of complementation of image regeneration under the brightness analysis and feature fused analysis so that more effective feature settlement will be done. The work is here defined for regeneration of image. Yong Chai[6] has defined novel rule to apply the weighted fusion process on different image regions. The work is here defined under distance level analysis under different frequency bands. The coefficient analysis is here performed at high performance generation. Cheng Shangli[7] has presented a work on medical image processing using wavelet approach. Author defined a weighted analysis approach using wavelet decomposition for CT images. Author defined the medical image fusion under the specification under pathological change analysis. Author defined the work to analyze the images under pathological features for reconstruction of image.

Xiaoyang Huang[8] has presented work on image registration and data fusion under contrast level analysis applied on multiple CT images. The contrast analysis is here applied at different phases for image reconstruction. Author defined the data fusion process under the dataset evaluation so that the mutual information analysis can be obtained. Author defined the frequency analysis based adaptive process for image regeneration. Damon Hyde[9] has presented a multimodel architecture for image fusion for CT images. Author defined the structural analysis and anatomic information analysis applied on tomography of images. Author defined an inverse problem based parameterized approach to perform anatomical image segmentation. Author performed the statistical interpretation based work for image reconstruction. Author defined the structure analysis based image regeneration. F. E. Ali[10] has presented a work on curvelet transformation approach for medical images. In fusion process, multiple images can be fused to regenerate the medical image. The fusion is here performed to handle the various issues using wavelet approach. Yong Yang[11] has defined the effective approach to apply fusion on medical images. The fusion is here applied using wavelet approach. Author has defined the characteristics analysis approach for improving the image characteristics with coefficient analysis. Author analyze these multiple images under low frequency band to apply the maximum selection rule. The coefficient of the frequency band is here generated laplacian operator for regeneration of result image. Kiran Parmar[12] has defined an analysis on CT images using wavelet decomposition approach. The work is here performed to select the effective image area on multiple images. The analysis is here performed to observe the image quality and to regenerate the image based on it. Maria C Carminati[13] has defined a framework to repair the medical images using two level image fusion. The fusion is here performed under gradient analysis and feature analysis approach.

III. FUSION APPROACHES

As discussed earlier, image fusion is about to generate a perfect image by combining two or more imperfect images. The presented work is about to study the available algorithmic approaches to repair the medical images using fusion process. In this section, some of the existing image fusion approaches are defined and explored.

A) Minimum Intensity Selection Approach

This is one of the simplest fusion approach in which the selection is based on the analysis on intensity value of each pixel for multiple images and the pixel with minimum intensity will be selected as the result image pixel. The pixel position on these images will be same and fused under the specification of corresponding position so that the fusion to the pixel values will be performed. The least intensity value is selected to generate the new pixel value that can discard the remaining intensity value of other images. The algorithmic approach is shown in table 1.

Table 1 : Algorithm

1.	Get the N number of Imperfect Images as input to the system.
2.	Compare the intensity value of these N images for corresponding pixel position
3.	Identify the selection matrix based on comparative analysis
4.	Generate the multiplicate matrix based on image matrix and selection matrix
5.	Generate the corresponding negated selection matrix as the resultant matrix
6.	Process all pixels in same way to generate result image

B) Pyramidal Fusion Method

The pyramid level transformation is required to perform the fusion for images under transform domain. Author defined an efficient method to build the same pyramid for transformation. Author defined a work on low pass and band pass approaches for representing the pattern at different scales. The Gaussian pyramid is here defined to unite the sequence of images so that low pass filtration is performed. The fusion at the pyramid transform is here obtained at the preceding level so that the higher level concentration will be obtained with spatial frequencies. Author defined the fused image based transformation so that the inverse pyramid transform will be obtained.

This algorithmic approach is divided in three main stages called decomposition stage, formation of image under decomposition and recomposition of image. The first stage is basically defined where the pyramids are generated at each level of fusion process. The degree of fusion and number of pyramids builds are correlated. The fusion level is here defined under the image size specification. The decomposition is here performed at two level filtration so that the input image get convolved and will be combined for the formation of the pyramid at the level from filtered. There are number of associated approach for the formation. At the final stage the reformation is performed to generate the fuse image. This process is also defined by merging the associated pyramids. The associated set for pyramid level fusion is defined here in figure 2.

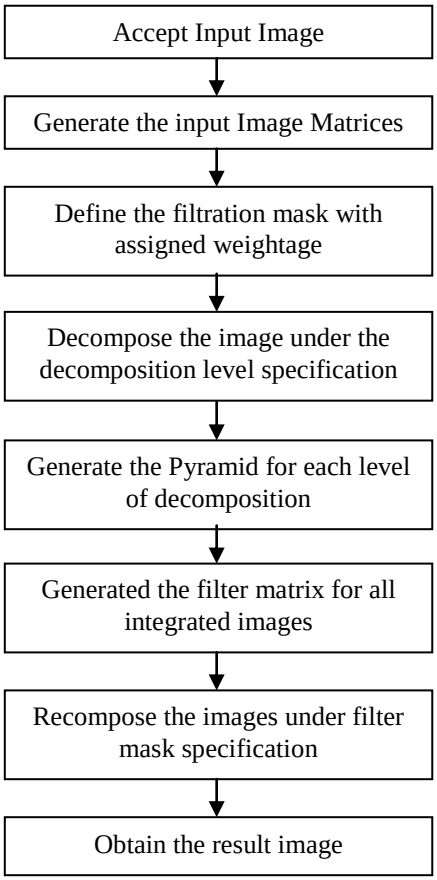

Figure 2 : Algorithmic Flow

C) DWT

DWT is considered as the wavelet transformation approach that itself represents the decomposition mechanism applied on input value pair and applying the various band based operations on it. DWT is considered as the frequency content based operational analysis to examine the scale values under temporal analysis. The property based composition is here performed under frequency analysis to regenerate the output. One of the common DWT form of Haar Wavelet that itself defined the countable orthonormal system under the space specification with real line. It is described as the scaling function under the specification so that the fusion image will be generated from the image effectively.

IV. CONCLUSION

In this paper, a study on different fusion processes is shown for real time images. The paper has discussed, the type of fusion under the feature vector analysis as well describe the challenging areas of image fusion. Later on the research methodology of some of the most effective fusion algorithms is defined in this paper.

REFERENCES

[1] A. Soma Sekhar," A NOVEL APPROACH OF IMAGE FUSION ON MR AND CT IMAGES USING WAVELET TRANSFORMS", 978-1-4244-8679-3/11 ©2011 IEEE

[2] G.K. Matsopoulos," Multiresolution morphological fusion of MR and CT images of the human brain", IEE Proc.-Vis. Image Signal Process, 1994

[3] Yuinei Miao," A'Conceptual Model Integrating Semantic Content lnto CT Image Fusion", 0-7803-S404-0/04@2004 IEEE.

[4] Li Jin," Multi-region Segmentation of CT Images Based on Information Fusion", ICIEA 2006 0-7803-9514-X/06©2006 IEEE

[5] Yi Shen," An Adaptive Pixel-weighted Image Fusion Algorithm Based on Local Priority for CT and MRI Images", IMTC 2006 – Instrumentation and Measurement Technology Conference 0-7803-9360-0/06©2006 IEEE

[6] Yong Chai," CT and MRI Image Fusion Based on Contourlet Using a Novel Rule", 978-1-4244-1748-3/08 © 2008 IEEE

[7] CHENG Shangli," Medical Image of PET/CT Weighted Fusion Based on Wavelet Transform", 978-1-4244-1748-3/08 © 2008 IEEE

[8] Xiaoyang Huang," Image Registration and Data Fusion for Different Phases of Contrast Enhanced Liver CT Data", 978-1-4244-1748-3/08 © 2008 IEEE

[9] Damon Hyde," NEW TECHNIQUES FOR DATA FUSION IN MULTIMODAL FMT-CT IMAGING", ISBI 2008 978-1-4244-2003-2/08©2008 IEEE

[10] F. E. Ali," Fusion of MR and CT Images Using The Curvelet Transform", 25th NATIONAL RADIO SCIENCE CONFERENCE (NRSC 2008)

[11] Yong Yang," Fusion of CT & MR Images with a Novel Method Based on Wavelet Transform", 978-1-4244-2902-8/09 ©2009 IEEE

[12] Kiran Parmar," Analysis of CT and MRI Image Fusion using Wavelet Transform", 2012 International Conference on Communication Systems and Network Technologies 978-0-7695-4692-6/12 © 2012 IEEE

[13] Maria C Carminati," A Framework for CT and MR Image Fusion in Cardiac Resynchronization Therapy".

