Image Deblurring Using DCT Based Fusion Techniques- A Survey

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Abstract

The image fusion is becoming one of the hottest techniques in image processing. Many image fusion methods have been developed in a number of applications. The main objective of image fusion is to combine information from multiple images of the same scene in order to deliver only the useful information. The discrete cosine transforms (DCT) based methods of image fusion are more suitable and time-saving in real-time systems using DCT based standards of still image or video. In this paper a survey is conducted for fusion of multi-focus images based on variance calculated in DCT domain. The overall **objective is to find the gaps in existing literature.**

1. Introduction

Image fusion [1] – [14] is the process of combining relevant information from two or more images into a single image. The resulting image will be more informative than any of the input images .Image fusion is process of combining information of interest in two or more images of same scene into a single highly informative image, information of interest depends upon area consideration. It extract all the information from source images. Image fusion is useful technique for merging similar sensor and multi-sensor images to enhance the information.

The objective of image fusion is to combine information from multiple images of the same scene in order to deliver only the useful information. The discrete cosine transforms (DCT) [4] based methods of image fusion are more suitable and time-saving in real-time systems using DCT based standards of still image or video. In this paper an efficient approach for fusion of multi-focus images based on variance calculated in DCT domain is presented. The experimental results on several images show the efficiency improvement of our method both in quality and complexity reduction in comparison with several recent proposed techniques.

In all sensor networks, every sensor can apperceive environment, produce and transfer data. Visual Sensor Networks (VSN) [1] is the term used in the literature to refer to a system with a large number of cameras, geographically spread resources and many monitoring points. In VSN, sensors are cameras which can record either still images or video sequences. Therefore, the processing of output information is related to image processing and machine vision subjects.

A distinguished feature of visual sensors or cameras is the great amount of generated data. This characteristic makes necessary more local processing to deliver only the useful information represented in a conceptualized level .

Image fusion is generally defined as the process of combining multiple source images into a smaller set of images, usually a single one, which contains a more accurate description of the scene than any of the individual source images. The aim of image fusion, besides reducing the amount of data in network transmissions, is to create new images that are more suitable for the purposes of human or machine perception, and for further image-processing.

Due to the limited depth of focus in optical lenses, only objects at one particular depth in the scene are in focus and those in front of or behind the focus plane will be blurred. In VSN we have the opportunity of extending the depth of focuses using more than one camera.

One goal of fusion software is to align anatomical and functional images and allow improved spatial localization of abnormalities. Image fusion takes place at three different levels i.e. pixel, feature and decision.

Image fusion methods can be broadly classified into two that is special domain fusion and transform domain fusion. Averaging, Brovery method, Principal Component Analysis (PCA) [1], based methods are special domain methods. But special domain methods produce special distortion in the fused image .This problem can be solved by transform domain approach. The multi-resolution analysis has become a very useful tool for analyzing images.

The discrete wavelet transform [3] has become a very useful tool for fusion. The images used in image fusion should already be registered. Pixel level fusion technique is used to increase the special resolution of the multi-spectral image.

Application of image fusion include improving geometric correction, enhancing certain features not visible in either of the single data alone, change detection using temporal data sets and enhancing provide a complete information for diagnosis. Image fusion is a concept of combining multiple images into composite products, through which more information than that of individual input images can be revealed.

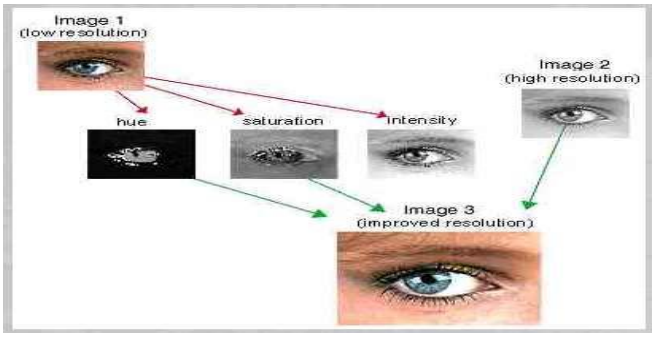

Figure 1.1 Image fusion process

Figure 1 is demonstrating the complete process of the image fusion with respect to resolution concept. It is clearly shown that the saturation of low intensity image is add up with the saturation of high intensity image.

2. Literature survey

Patil, U et al. (2011) [1] has demonstrated that the image fusion algorithm using hierarchical PCA. Image fusion is a process of combining two or more images (which are registered) of the same scene to get the more informative image. Hierarchical multiscale and multiresolution image processing techniques, pyramid decomposition are the basis for the majority of image fusion algorithms. Principal component analysis (PCA) is a well-known scheme for feature extraction and dimension reduction and is used for image fusion.

Qiang Wang et al. (2004) [2] has discussed that the image fusion is becoming one of the hottest techniques in image processing. Many image fusion methods have been developed in a number of applications. They mainly discuss the structures of image fusion process, which is classified as hierarchical fusion structure, overall fusion structure, and arbitrary fusion structure. And the effects of such image fusion structures on the performances of image fusion are analyzed.

Sruthy, S et al. (2013) [3] has shown that the image fusion is the process of combining information of two or more images into a single image which can retain all important features of the all original images. Here the input to fusion involves set of images taken from different modalities of the same scene. Output is a better quality image; which depends on a particular application. The objective of fusion is to generate an image which describes a scene better or even higher than any single image with respect to some relevant properties providing an informative image.

Desale, R.P et al. (2013) [4] has shown that the image fusion is a process of combining the relevant information from a set of images, into a single image, wherein the resultant fused image will be more informative and complete than any of the input images. Desale, R.P et al. (2013) [4] has given that the Formulation, Process Flow Diagrams and algorithms of PCA (principal Component Analysis), DCT (Discrete Cosine Transform) and DWT (Discrete Wavelet Transform) based image fusion techniques. The results are also presented in table & picture format for comparative analysis of above techniques. The PCA & DCT are conventional fusion techniques with many drawbacks, whereas DWT based techniques are more favorable as they provides better results for image fusion.

Prakash, C et al. (2012) [5] has suggested that the image fusion is basically a process where multiple images (more than one) are combined to form a single resultant fused image. This fused image is more productive as compared to its original input images. The fusion technique in medical images is useful for resourceful disease diagnosis purpose.

Aribi, W et al. (2012) [6] has discussed that the quality of the medical image can be evaluated by several subjective techniques. However, the objective technical assessments of the quality of medical imaging have been recently proposed. The fusion of information from different imaging modalities allows a more accurate analysis. The developed new techniques based on the multiresolution fusion. MRI and PET images have been fused with eight multi resolution techniques.

Haozheng Ren et al. (2011) [7] has explained that the image fusion is one of the important embranchments of data fusion. Its purpose is to synthesis multi-image information in one scene to one image which is more suitable to human vision and computer vision or more adapt to further image processing, such as target identification. Discussion was carried on the image fusion method based on wavelet transformation. Firstly, the article gives the basic concept of multi-focus image fusion.

Yijian Pei et al. (2010) [8] has proposed an improved discrete wavelet framework based image fusion algorithm, after studying the principles and characteristics of the discrete wavelet framework. The improvement is the careful consideration of the high frequency subband image region characteristic. The algorithms can efficiently synthesis the useful information of the each source image retrieved from the multi sensor. The multi focus image fusion experiment and medical image fusion experiment can verify that our proposed algorithm has the effectiveness in the image fusion. It studies the quality assessment of the image fusion, and summarize and quantitatively analysis the performance of algorithms proposed.

Mohamed, M.A. et al.(2011) [9] has proved that the mage fusion is a process which combines the data from two or more source images from the same scene to generate one single image containing more precise

details of the scene than any of the source images. Among many image fusion methods like averaging, principle component analysis and various types of Pyramid Transforms, Discrete cosine transform, Discrete Wavelet Transform special frequency and ANN and they are the most common approaches.

Sruthy, S et al. (2013) [10] has studied that the image fusion is the process of combining information of two or more images into a single image which can retain all important features of the all original images. Here the input to fusion involves set of images taken from different modalities of the same scene. Output is a better quality image; which depends on a particular application. The objective of fusion is to generate an image which describes a scene better or even higher than any single image with respect to some relevant properties providing an informative image.

Anita, S.John Nisha et al. (2013) [11] has shown that the most of the existing fusion techniques such as Principal Component Analysis (PCA), Intensity-Hue-Saturation (IHS), Wavelet Transform (WT) yields color distortion in other words it is also known as spectral distortion problem. When the high resolution panchromatic image unite with low resolution multispectral image results in fused image of high spatial resolution multispectral image. The above said fusion techniques require additional transformation to increase spatial information and also decrease spectral distortion in fused image.

Dong-Chen He et al. (2004) [12] has demonstrated that the main objective of image fusion is to create a new image regrouping the complementary information of the original images. The challenge is thus to fuse these two types of images by forming new images integrating both the spectral aspects of the low resolution images and the spatial aspects of the high resolution images. The most commonly used image fusion techniques are: Principal Components Analysis (PCA), Intensity-Hue-Saturation Transformation (IHS), High Pass Filter (HPF) and Wavelet Transformation (WT). The PCA and IHS, are simple to use but they are highly criticized because the resulting image does not preserve faithfully the colors found in the original images.

Haghighat, M.B.A et al. (2010) [13] has discussed that the objective of image fusion is to combine information from multiple images of the same scene in order to deliver only the useful information. The discrete cosine transform (DCT) based methods ofimage fusion are more suitable and time-saving in real-time systems using DCT based standards of still image or video. An efficient approach for fusion of multi-focus images based on variance calculated in DCT domain is presented. The experimental results on several images show the efficiency improvement of our method both in quality and complexity reduction in comparison with several recent proposed techniques.

Lavanya, A. et al. (2011) [14] has worked for multisensory and suggested that the image fusion is the process of combining relevant information from high spatial resolution image and high spectral resolution image. They proposesed a new image fusion method based on wavelet combined IHS and PCA transformations for remotely sensed lunar image data in order to extract features accurately. Different fusion techniques have been used in the past separately for spatial and spectral quality image enhancement.

New image fusion technique used was based on (1) Intensity Hue Saturation (IHS) combined wavelet transformation and (2) Principal Component Analysis (PCA) combined wavelet transformation. Results indicate that the fused lunar image shows good spatial fidelity and the spectral resolution of the fused product was preserved after image data fusion.

3. Gaps in Literature

By conducting the literature survey it is found that image fusion may introduces some artefacts on output image so it is required to have filtering and image restoration approaches.

But it is found that most of researchers has neglected one of the following or both:

1. No appropriate filter is used to remove noise from fused images.
2. No restoration technique is applied on image fusion algorithm.

4. Conclusion

After conducting the literature survey on various new image fusion techniques proposed by different researchers. It is concluded that the image fusion is the process of combining information of two or more images into a single image which can retain all important features of the all original images. It is found that DCT based image fusion produce high quality results. But it found that most of researchers has neglected image filtering and restoration which is must need of the image fusion as it may introduces some artefacts. So in near future work will be extended to achieve a new integrated algorithm which will integrate filtering with DCT based technique.

Referrences

[1] Patil, Ujwala, and Uma Mudengudi. "Image fusion using hierarchical PCA." InImage Information Processing (ICIIP), 2011 International Conference on, pp. 1-6. IEEE, 2011.

[2] Wang, Qiang, and Yi Shen. "The effects of fusion structures on image fusion performances." In Instrumentation and Measurement Technology Conference, 2004. IMTC 04. Proceedings of the 21st IEEE, vol. 1, pp. 468-471. IEEE, 2004.
[3] Sruthy, S., Latha Parameswaran, and Ajeesh P. Sasi. "Image Fusion Technique using DT-CWT." 2013.
[4] Desale, Rajenda Pandit, and Sarita V. Verma. "Study and analysis of PCA, DCT & DWT based image fusion techniques." In Signal Processing Image Processing & Pattern Recognition (ICSIPR), 2013 International Conference on, pp. 66-69. IEEE, 2013
[5] Prakash, Chandra, S. Rajkumar, and P. V. S. S. R. Mouli. "Medical image fusion based on redundancy DWT and Mamdani type min-sum mean-of-max techniques with quantitative analysis." In Recent Advances in Computing and Software Systems (RACSS), 2012 International Conference on, pp. 54-59. IEEE, 2012.
[6] Aribi, Walid, Ali Khalfallah, Med Salim Bouhlel, and Noomene Elkadri. "Evaluation of image fusion techniques in nuclear medicine." In Sciences of Electronics, Technologies of Information and Telecommunications (SETIT), 2012 6th International Conference on, pp. 875-880. IEEE, 2012.
[7] Ren, Haozheng, Yihua Lan, and Yong Zhang. "Research of multi-focus image fusion based on M-band multi-wavelet transformation." In Advanced Computational Intelligence (IWACI), 2011 Fourth International Workshop on, pp. 395-398. IEEE, 2011.
[8] Pei, Yijian, Huayu Zhou, Jiang Yu, and Guanghui Cai. "The improved wavelet transform based image fusion algorithm and the quality assessment." In Image and Signal Processing (CISP), 2010 3rd International Congress on, vol. 1, pp. 219-223. IEEE, 2010.
[9] Mohamed, M. A., and B. M. El-Den. "Implementation of image fusion techniques for multi-focus images using FPGA." In Radio Science Conference (NRSC), 2011 28th National, pp. 1-11. IEEE, 2011.
[10] Sruthy, S., Latha Parameswaran, and Ajeesh P. Sasi. "Image Fusion Technique using DT-CWT."
[11] Li, Hui, B. S. Manjunath, and Sanjit K. Mitra. "Multisensor image fusion using the wavelet transform." Graphical models and image processing 57, no. 3 (1995): 235-245.
[12] He, D-C., Li Wang, and Massalabi Amani. "A new technique for multi-resolution image fusion." In Geoscience and Remote Sensing Symposium, 2004. IGARSS'04. Proceedings. 2004 IEEE International, vol. 7, pp. 4901-4904. IEEE, 2004.
[13] Haghighat, Mohammad Bagher Akbari, Ali Aghagolzadeh, and Hadi Seyedarabi. "Real-time fusion of multi-focus images for visual sensor networks." In Machine Vision and Image Processing (MVIP), 2010 6th Iranian, pp. 1-6. IEEE, 2010.
[14] Lavanya, A., K. Vani, S. Sanjeevi, and R. S. Kumar. "Image fusion of the multi-sensor lunar image data using wavelet combined transformation." In Recent Trends in Information Technology (ICRTIT), 2011 International Conference on, pp. 920-925. IEEE, 2011.