Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 131 (2018) 273–281

Procedia Computer Science

www.elsevier.com/locate/procedia

8th International Congress of Information and Communication Technology (ICICT-2018)

A Block Image Fusion Algorithm Based on Algebraic Multi-grid Method

Huang Ying [a,b], Xie Rong [a] *

[a] School of Software Engineering, Chongqing University of Posts and Telecommunications, Chongqing, 400065,China
[b] Chongqing Engineering Research Center for Software Quality Assurance Testing and Evaluation, Chongqing, 400065,China

Abstract

In this paper, a block image fusion algorithm based on algebraic multi-grid (AMG-Block) method is proposed. The main novelty of this idea is that the algebraic multi-grids method has good abilities to extract the structure information of images, which overcomes difficulties faced by the existing fusion methods. At first the rough grid data of the image is extracted and reconstructed. Because the mean square error between clear image and reconstructed image is bigger than the mean square error between fuzzy image and its reconstructed image, this characteristic can be used to judge the sharpness of the image. Then the sliding window tactics is used to make the effect better, and the decision map is obtained. At last the final decision map is generated and rectified with the assist of the surrounding pixels. Experimental results demonstrate that the proposed method can obtain better fusion performance on the part of both visual quality and objective evaluation.

Keywords: Image fusion, Algebraic multi-grid, Sliding window;

1. Introdution

Image fusion is an image processing technology, which uses multiple source images from different sources in the same scene to obtain a more accurate information of this scene. This technology has a wide range of applications in image, which has been applied in remote sensing[1], infrared and visible image[2], multi-focus image[3], medical image[4] and so on. Through the years, a variety of image fusion methods have been proposed, these methods can be sketchily classified into two categories: spatial domain methods and transform domain methods. The most classic

* Corresponding author. Tel.:13618343778.
*E-mail address:*1070447797@qq.com.

10.1016/j.procs.2018.04.214

transform domain methods are based on multi-scale transform theories, some representative examples include wavelet transform method[5], the multi-scale transform and sparse method[6, 7]. The spatial domain methods include image fusion based on matting method, gradient-directed multi-exposure image fusion method.

The concept of algebraic multi-grid method (AMG) is first proposed by [8]. In the AMG method, coarse grids and fine grids are introduced and the coarse grids can be used to extract the structures of the image. The AMG method allows for solving the problems on unstructured grids and it is more easily extended to the field of image processing including image reconstruction, image denoising and image fusion.

The process of using the AMG method to reconstructed image is made up of the following three steps.

Step 1: For each source image M , apply the AMG method to extract n-layer rough grids $\Omega_1\Omega_2\cdots\Omega_n$.

Step 2: For each rough grid layer, initialize empty image which have the same size of the source image $M_1M_2\cdots M_n$. Each position equal to 1 in $\Omega_1\Omega_2\cdots\Omega_n$ indicates the corresponding pixel exists in the source image or else it is set to 0.

Step 3: Interpolate values with the pixel which is equal to 1 to get the final image $M_1^{'}M_2^{'}\cdots M_n^{'}$.

Fig. 1 shows the Clock source image and the first coarse grid using AMG method.

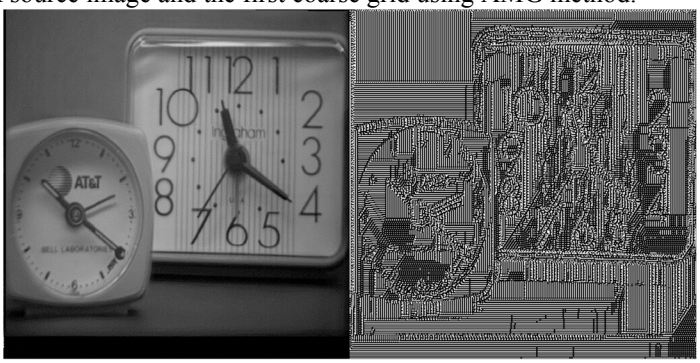

Fig. 1. Clock source image and first coarse grid.

The rest of this paper is organized as follows. In Section 2, the proposed AMG-Block image fusion method is provided in detail. And the experimental results are presented in Section 3. Finally Section 4 concludes the pape.

2. Experimental and computational details

2.1. AMG-Block Algorithm

According to the analysis, the sharpness of the image is better reflected with the mean square error between the source image and the reconstructed image using the AMG method. The advantage of this feature is applied in the image fusion. In this paper, we apply sliding windows accurately judging the mean square error between the source image and the reconstructed image, and the decision map is generated. Then the decision map is blocked, each pixel which the source is incorrect is rectified. Finally, the final decision map is generated which is rectified with the assist of the surrounding pixels. The final decision map is applied image fusion. Fig. 2 shows the illustration of the AMG-Block algorithm.