International Journal of Innovative Computing, Information and Control
Volume **7**, Number **7(A)**, July **2011**

ICIC International ©2011 ISSN 1349-4198
pp. **3583–3596**

BLOCK-BASED PIXEL LEVEL MULTI-FOCUS IMAGE FUSION USING PARTICLE SWARM OPTIMIZATION

Abdul Basit Siddiqui[1], M. Arfan Jaffar[2], Ayyaz Hussain[3] and Anwar M. Mirza[4]

[1]Department of Computer Science
National University of Computer and Emerging Sciences
A.K Brohi Road, Islamabad 44000, Pakistan
basit.siddiqui@nu.edu.pk

[2]Department of Mechatronics
Gwangju Institute of Science and Technology
Gwangju, South Korea
arfanjaffar@gist.ac.kr

[3]Department of Computer Science
International Islamic University
Islamabad, Islamabad, Pakistan
ayyaz.hussain@iiu.edu.pk

[4]Department of Computer Engineering
College of Computer and Information Sciences
King Saud University
ammirza@ksu.edu.sa

Received November 2009; revised March 2010

Abstract. *For accurate image segmentation, edge detection and stereo matching, it is significant that all the objects in the image under processing must be in focus. However, due to limited depth of field of optical lenses particularly which have greater focal length, it is not always possible. In such cases, image fusion is performed to obtain an everywhere-in focus image. In this paper, we have proposed a highly precise method for multi-focus image fusion. We have proposed a method based on Particle Swarm Optimization (PSO) to find out the optimal size of blocks to be fused. Detailed experimentation is performed using different quantitative measures for different set of multi-focus images. We have compared the results of proposed technique with different existing image fusion techniques such as DWT, aDWT, PCA and Laplacian Pyramid based image fusion. Experimental results show that the proposed method outperforms the traditional approach both visually and quantitatively*
Keywords: Fusion, PSO, Optimal block

1. **Introduction.** Image fusion is a sub-field of image processing in which more than one images of the same scene are combined and a resultant image is created which offers more details and resolves the ambiguities in the input images. In multi-sensor image fusion, the images of the same scene come from different sensors of different resolution. In multi-focus image fusion, the images of the same scene from the same sensor are combined to create an image in which all the objects are in focus. The process of image fusion takes place either in spatial domain or in transformed domain. In spatial domain, the pixel values are directly incorporated in fusion process whereas in transformed domain, the input images are first transformed using wavelet decomposition or pyramid decomposition to exploit the information at different scales or multi-resolutions. An image often contains physically