Abstract

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. This paper discusses the implementation of three categories of image fusion algorithms – the basic fusion algorithms, the pyramid based algorithms and the basic DWT algorithms, developed as an Image Fusion Toolkit - ImFus, using Visual C++ 6.0. The objective of the paper is to assess the wide range of algorithms together, which is not found in the literature. The fused images were assessed using Structural Similarity Image Metric (SSIM) [10], Laplacian Mean Squared Error along with seven other simple image quality metrics that helped us measure the various image features; which were also implemented as part of the toolkit. The readings produced by the image quality metrics, based on the image quality of the fused images, were used to assess the algorithms. We used Pareto Optimization method to
figure out the algorithm that consistently had the image quality metrics produce the best readings. An assessment of the quality of the fused images was additionally performed with the help of ten respondents based on their visual perception, to verify the results produced by the metric based assessment. Coincidentally, both the assessment methods matched in their raking of the algorithms. The Pareto Optimization method picked DWT with Haar fusion method as the one with the best image quality metrics readings. The result here was substantiated by the visual perception based method where it was inferred that fused images produced by DWT with Haar fusion method was marked the best 63.33% of times which was far better than any other algorithm. Both the methods also matched in assessing Morphological Pyramid method as producing fused images of inferior quality.

Reference

- The Online Resource for Research in Image Fusion www.imagefusion.org
(ISIF), 644-648
- Z. Xue, R. S. Blum and Y. Li, "Fusion of visual and IR images for concealed weapon detection," invited paper at International Conference on Information Fusion, Annapolis, Maryland, July 2002. 123
- “Principal Component Analysis”,
http://www.cse.unr.edu/~bebis/MathMethods/PCA/lecture.pdf

**Index Terms**

Computer Science

Signal Processing
**Key words**

- Image Fusion
- Principal Component Analysis
- Pyramid Methods
- Discrete Wavelet Transform
- Image Quality Metrics
- Pareto Optimality