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Multi-Sensor Image Fusion for Visible and Infrared Thermal Images

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Abstract : This paper is motivated by the importance of multi-sensor image fusion with a specific focus on infrared (IR) and visual image (VI) fusion for various applications, including military reconnaissance. Image fusion can be defined as the process of combining two or more source images into a single composite image with extended information content that improves visual perception or feature extraction. These images can be from different modalities like visible camera & IR thermal imager. While visible images are captured by reflected radiations in the visible spectrum, the thermal images are formed from thermal radiation (infrared) that may be reflected or self-emitted. A digital color camera captures the visible source image, and a thermal infrared camera acquires the thermal source image. In this paper, some image fusion algorithms based upon multi-scale transform (MST) and region-based selection rule with consistency verification have been proposed and presented. This research includes the implementation of the proposed image fusion algorithm in MATLAB along with a comparative analysis to decide the optimum number of levels for MST and the coefficient fusion rule. The results are presented, and several commonly used evaluation metrics are used to assess the suggested method's validity. Experiments show that the proposed approach is capable of producing good fusion results. While deploying our image fusion algorithm approaches, we observe several challenges from the popular image fusion methods. While high computational cost and complex processing steps of image fusion algorithms provide accurate fused results, they also make it hard to become deployed in systems and applications that require a real-time operation, high flexibility, and low computation ability. So, the methods presented in this paper offer good results with minimum time complexity.

Keywords : image fusion, IR thermal imager, multi-sensor, multi-scale transform
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