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Improved Wallis Dodging Algorithm for Large-Scale Super-Resolution Reconstruction Remote Sensing Images

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Abstract: A sub-block algorithm is usually applied in the super-resolution (SR) reconstruction of images because of limitations in computer memory. However, the sub-block SR images can hardly achieve a seamless image mosaicking because of the uneven distribution of brightness and contrast among these sub-blocks. An effectively improved weighted Wallis dodging algorithm is proposed, aiming at the characteristic that SR reconstructed images are gray images with the same size and overlapping region. This algorithm can achieve consistency of image brightness and contrast. Meanwhile, a weighted adjustment sequence is presented to avoid the spatial propagation and accumulation of errors and the loss of image information caused by excessive computation. A seam line elimination method can share the partial dislocation in the seam line to the entire overlapping region with a smooth transition effect. Subsequently, the improved method is employed to remove the uneven illumination for 900 SR reconstructed images of ZY-3. Then, the overlapping image mosaic method is adopted to accomplish a seamless image mosaic based on the optimal seam line.

Keywords: super-resolution reconstruction; large-scale image; Wallis dodging; overlapping region; optimal seam line; seam elimination

1. Introduction

Remote sensing (RS) images are increasingly being used in agriculture, mainly in the monitoring of crops, resources, and disasters. In particular, high-resolution RS images play a significant role in agriculture, aiding with the development of agricultural production and research into the fine and quantitative stage. However, high-resolution images are generally quite expensive. Super-resolution (SR) image reconstruction is a technique that recovers a high-resolution image from several low-resolution images using the non-redundant information among them [1,2]. A sub-block algorithm is usually used in the SR reconstruction of images to improve the operation efficiency and reduce the consumption of computer memory. The continuity and correlation between blocks are ignored, particularly at the block junctions. The gray-level distribution will always be discontinuous, resulting in inconsistent color of the large-scale mosaic image. In other words, the brightness and contrast distribution of images are uneven and an obvious seam line is observed [3]. Therefore, the color differences among images should be diminished before image mosaicking.