Terrain Reconstruction Algorithm Based on Epipolar Line Rectification and Dense Matching

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ABSTRACT

Terrain reconstruction aims at acquiring height maps by detecting corresponding feature points from two or more down-looking remote sensing images. This paper proposes a terrain reconstruction algorithm based on epipolar line rectification and dense matching. At first, it uses fundamental matrix to rectify stereo images to make their epipolar lines parallel and remove the disparity in vertical direction. Then, dense matching based on grid method is applied, which can provide sufficient matching points to estimate disparity of the rectified images. Finally, the heights of the matched points can be calculated according to the obtained disparity and flight parameters. Experiments show that our algorithm can generate precise and reliable height maps for well depicting terrain features.

Keywords: image matching, terrain reconstruction, epipolar line rectification, dense matching, disparity.

1. INTRODUCTION

With the development of remote sensing technology and computer science, the ground measurement systems are being transformed from traditional mapping methods to automated, non-contact digital measurement. Some new technologies for obtaining information from terrain have been developed and put into use gradually [1]. Space flight remote sensing technology provides wide range and real-time satellite images of multiple resolutions, which can meet the data requirement for acquiring information of the terrain. Besides, with the good performance on concealment and anti-jamming, it has attracted an increasing notice in engineering application.

According to optical passive measurement technology and Computer Vision, a method for gaining the geometry information of space targets and scenes is proposed in this paper. As application, we implement this method to reconstruct the 3D terrain using the multi-view sequence images acquired by Unmanned Aerial Vehicle (UAV) [2-4]. It mainly refers to epipolar line rectification, dense matching and height calculation.

2. THE TERRAIN RECONSTRUCTION ALGORITHM

In this section, we describe the basic steps of our approach. Firstly, in order to make the epipolar lines parallel, we introduce epipolar line rectification algorithm constituted of feature matching, fundamental matrix calculation and projection matrixes calculation. Then dense matching is applied to get disparity of sufficient matching points. Finally, the heights of the matching points can be calculated using the obtained disparity and flight parameters, which can be used to depict the 3D terrain features. The overall process is as Figure 1.