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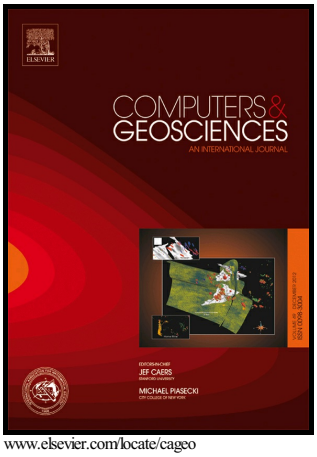

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A novel orthoimage mosaic method using the weighted A* algorithm for UAV imagery

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Abstact-A weighted A* algorithm is proposed to select optimal seam-lines in orthoimage mosaic for UAV (Unmanned Aircraft Vehicle) imagery. The whole workflow includes four steps: the initial seam-line network is firstly generated by standard Voronoi Diagram algorithm; an edge diagram is then detected based on DSM (Digital Surface Model) data; the vertices (conjunction nodes) of initial network are relocated since some of them are on the high objects (buildings, trees and other artificial structures); and, the initial seam-lines are finally refined using the weighted A* algorithm based on the edge diagram and the relocated vertices. The method was tested with two real UAV datasets. Preliminary results show that the proposed method produces acceptable mosaic images in both the urban and mountainous areas, and is better than the result of the state-of-the-art methods on the datasets.

Index term **-** Orthoimage mosaic, Weighted A* algorithm, Voronoi Diagram, digital surface model, edge diagram.

I. INTRODUCTION

Nowadays, the UAV images are widely used in digital mapping especially for those areas that are unreachable, for example, the desert, mountains and other dangerous locations. In the UAV mapping process, the source images are firstly rectified to orthoimages based on the corresponding DSM (Digital Surface Model) or DEM (Digital Elevation Model) data, and then these orthoimages are stitched together, forming a large orthoimage. There are, however, seam-lines in the big orthoimage due to the inconsistencies between adjacent small orthoimages in both geometric and radiometric perspectives. The geometric inconsistency is mainly caused by the object's height and the different viewing angles while the radiometric inconformity is affected by the viewing and illumination angles, and different imaging time. A lot of research works have been done to resolve these problems. The research undertaken may be classified into two categories: image-based and ground-based methods. Image-based methods only use the color information to guide the seam-line to avoid areas with large intensity contrast, and make sure that the color difference on the seam-line is minimized. On the other hand, the ground-based methods use the ground information such as DSM, DEM, OESM (Orthoimage Elevation Synchronous Model), LiDAR (Light Detection and Ranging) point cloud and others, to guide the seam-line to avoid high objects (for instance buildings and trees) on the ground.

Image-based methods do not need any ground information, and the only input required is the orthoimage. The color information is used to determine an optimal seam-line which has minimal difference between the adjacent orthoimages [1] [3-6] [8] [10-11] [13-15] [17-19]. Generally, a cost function is used to represent the difference, and the main objective is to find the optimal seam-line which has the minimal cost. Based on this theory, twin snakes algorithm [6], Dijkstra's algorithm[3] [14-15] [25] [26], the A* algorithm [20], morphological algorithm [13] and other