

# LEAST SQUARES MULTIPLE IMAGES MATCHING FOR LARGE COVERAGE AERIAL IMAGES AND SMALL COVERAGE UAV IMAGES

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## **Abstract:**

Unmanned aerial vehicle (UAV) is widely used to acquire high resolution imagery at multiple viewing angles. The benefit of multi-view stereo images is to provide better intersection geometry. To compare the UAV and traditional aerial photogrammetry, UAV derives 3D structure from different view angles but traditional aerial photogrammetry usually takes photo at vertical view. Besides, large-format aerial camera acquires large coverage at high altitude and UAV usually acquires high spatial resolution image in a small coverage. The integration of these two platforms may improve the viewing geometry. However, there are some difficulties to integrate aerial and UAV images as these two platforms have different image scales, view angles, occlusions and illuminations. In this study, we propose a robust image matching method for aerial and UAV images based on least squares matching. The multi-view least squares matching (MVLSM) combines multi-view geometry and least squares matching method to determine the tie points. The initial matching integrates scale-invariant feature transform (SIFT), normalized cross correlation (NCC) and geometric constraint to obtain initial parameters such as tie points, affine transformation parameters and image scales. Then, we apply the MVLSM to minimize the grayvalue difference between multi-view images in precise matching. The test images are UltraCam aerial image and Sensefly eBee UAV images. The test area is located at National Chiao Tung University, Taiwan. The MVLSM may improve the matching accuracy at sub-pixels level. Compare with other matching algorithm, MVLSM will improve the matching accuracy. Additionally, integration of different platforms will also improve the precision of object space. In summary, the MVLSM is a robust image matching method for different platforms. Moreover, the integration of the aerial and UAV images matching strategy will be beneficial to the data fusion, data analysis and other applications.