OPTIMIZATION OF STRUCTURE-FROM-MOTION ORIENTATION FOR TOPOGRAPHICAL MAPPING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Under - Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

In the realm of producing topographic maps through photogrammetry, precision and accuracy have always played crucial roles in assessing the quality of the process. However, when employing Structure-from-Motion (SfM) photogrammetry processing, the generated tie points often contained persistent noise, even after the orientation and adjustment steps, ultimately resulting in lower precision of both tie points and image orientation parameters. This posed significant challenges in achieving the level of accuracy required for reliable topographic mapping. One of the primary issues observed in SfM-based photogrammetry was the presence of noise in the tie points, leading to suboptimal results. Surprisingly, it was noted that simply increasing the number of tie points did not necessarily improve the precision and accuracy of the generated topographic maps. In fact, it had been observed that having more tie points in the photogrammetry process could lead to increased error and processing time. This phenomenon was attributed to the presence of noisy tie points, which adversely affected the adjustment steps. Fortunately, Agisoft Metashape, a widely used photogrammetry software, offered a solution in the form of the Gradual Selection tools. These tools provided an effective means of enhancing the quality of generated tie points by progressively eliminating the noise. However, while these tools were available, no specific guidelines were provided for their optimal utilization. To address this issue, a comprehensive study was conducted to evaluate the effect of point filtering procedures on topographic mapping. The study encompassed various aspects, including the reduction of the number of images, reconstruction uncertainty, projection accuracy, and reprojection errors. Additionally, the proposed procedure was rigorously compared to previous studies to determine the optimal configuration for achieving precise photogrammetric processing through noise filtering. Remarkably, the study's results indicated that precision and accuracy were slightly better when using a smaller number of tie points compared to a larger number. Moreover, the use of a reduced number of tie points significantly decreased the processing time, making the photogrammetry process more efficient without compromising on the quality of the final output. By leveraging these findings, photogrammetry practitioners and researchers could enhance their workflows by applying the Gradual Selection tools in Agisoft Metashape with optimal configurations. This approach would ensure better precision and accuracy in topographic mapping, leading to more reliable results and ultimately contributing to advancements in various fields such as geology, environmental monitoring, and urban planning.

Keywords: Sturcture-from-Motion, tie points, Gradual Selection, Agisoft Metashape

TABLE OF CONTENTS