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# A study for seeking an optimal minimum cover triplet sets for SfM

## Proposal for a Master thesis topic (EN)

In photogrammetry and computer vision, when given a set of images captured from different viewpoints, a key task is to estimate the exterior orientation or pose parameters (i.e., rotation and translation parameters with respect to an overall 3D coordinate system) together with a sparse 3D point cloud, i.e., structure from motion (SfM). The so called incremental SfM has received a notable amount of attention, demonstrated e.g. by the success of the software packages Bundler, VisualSFM, and COLMAP. The general idea is that one good initial image pair which normally has enough correspondences with reasonable large intersection angle is firstly selected to do stereo reconstruction. Additional images are sequentially chosen based on some criteria to extend the photogrammetric block, and bundle adjustment is repetitively used to refine the results. As it is demonstrated, this approach is impeded by a long computational time and artefacts such as visual drift. To overcome these drawbacks, many researchers presented the so called global solutions. Global SfM is typically separated into two steps, global rotation averaging and global translation estimation. The exterior orientation parameters of all available images are first simultaneously estimated, followed by only one final bundle adjustment.
Typically, there are lots of redundant overlapping image pairs which can contribute to relative orientations existing and these two types of SfM take the correspondences of overlapping image pairs and corresponding relative orientations as input, however, many of these inputs are actually incorrect, e.g. due to repetitive structures, poor textures etc., and these incorrect relative orientations can negatively influence the results of SfM.
In this topic, we would like to first study the qualities of a triplet which can indicate if the corresponding triplet is good or not, then a minimum cover triplet set which not only has all available images included, but also, makes this triplet set be optimal with respect to each triplet's qualities. The goal is to study the quality of a triplet and find a time-efficient way to generate such an optimal minimum cover triplet sets.

This thesis will be supervised by Xin Wang, M.Sc.

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12. December 2019

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