

# USE OF AUTOMATIC COLLECTION OF GROUND CONTROL POINTS FOR ORIENTATION OF ARCHIVAL AERIAL IMAGERY USING EXISTING DATA SETS

## Abstract

The diploma thesis is focused on the automated searching of ground control points (GCPs) for processing archival aerial images (AAIs) and creating orthomosaics. The study evaluates selected computer vision operators (SIFT, SURF, ORB and image correlation) and various approaches for identifying and subsequently matching identical points between the reference dataset (current orthophoto) and AAIs. Thanks to AAIs georeferences, the searching area in AAI is known for finding the corresponding point to the reference one (from current orthophoto). Unfortunately, the georeferencing of AAIs provided by the Czech Office for Surveying, Mapping, and Cadastre (ČÚZK) was methodologically incorrect (very bad accuracy) and it had to be corrected before automated GCPs searching. The topic was supported by ČÚZK and datasets (current orthophoto, AAIs, ZABAGED vector data) were provided for processing purposes free of charge (beyond the standard student license).

Based on operator testing, a fully automated methodology was developed in Python, relying on image correlation. The input includes AAIs, current orthophoto and a road network, with road intersections as reliable and time invariant points. The procedure also includes filtering poorly matched points using the robust RANSAC algorithm combined with DLT transformation. The output consists of files containing GCPs that can be imported into standard photogrammetric and GIS tools.

The result is seamless orthomosaics for the Milovice and Kobylí areas, each captured at two different time slices (1930s and 1980s). The orthophoto processing used automatically detected GCPs and the MicMac software. In MicMac, standard steps for orthophoto processing were performed, including computation of internal and external orientation, bundle adjustment, digital surface model (DSM) generation, and final orthomosaic production. The accuracy of the outputs was evaluated using control points and the root mean square error (RMSE).

Keywords: automatic collection of ground control points, time series, image orientation, archival aerial imagery, orthophoto, DTM, RANSAC