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Investigation on the Automatic Geo-Referencing of Archaeological UAV Photographs by Correlation with Pre-Existing Ortho-Photos

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Abstract. We present a method for the automatic geo-referencing of archaeological photographs captured aboard unmanned aerial vehicles (UAVs), termed UPs. We do so by help of pre-existing ortho-photo maps (OPMs) and digital surface models (DSMs). Typically, these pre-existing data sets are based on data that were captured at a widely different point in time. This renders the detection (and hence the matching) of homologous feature points in the UPs and OPMs infeasible mainly due to temporal variations of vegetation and illumination. Facing this difficulty, we opt for the normalized cross correlation coefficient of perspectively transformed image patches as the measure of image similarity. Applying a threshold to this measure, we detect candidates for homologous image points, resulting in a distinctive, but computationally intensive method. In order to lower computation times, we reduce the dimensionality and extents of the search space by making use of a priori knowledge of the data sets. By assigning terrain heights interpolated in the DSM to the image points found in the OPM, we generate control points. We introduce respective observations into a bundle block, from which gross errors i.e. false matches are eliminated during its robust adjustment. A test of our approach on a UAV image data set demonstrates its potential and raises hope to successfully process large image archives.

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