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DeVisOR - Detection and Visualization of Unexploded Ordnance Risks*

Sebastian Zambanini, Fabian Hollaus, and Robert Sablatnig

Computer Vision Lab, Institute of Computer-Aided Automation, TU Wien, Austria
{*zamba,holl,sab*}*@caa.tuwien.ac.at*

The project 'Detection and Visualization of Unexploded Ordnance Risks' (DeVisOR) is devoted to the analysis of historical aerial images. These images are currently investigated by experts in order to detect UneXploded Ordnances (UXO) [3]. For this purpose, the aerial images have to be georeferenced first which is accomplished by a manual registration of the images onto modern satellite images by means of a professional GIS software tool. Afterwards, the experts detect suspicious image regions by looking for characteristic shapes or patterns. Additionally, images captured at different time instances are compared in order to detect changes of the scene, which might stem from bombs or other events related to military operations.
A problem of this current practice is that its manual steps are tedious and taxing. Thus, analysis takes a long time and intense reviewing is necessary. An automated analysis could obviously solve the tasks faster and less tiresome. The DeVisOR project aims at developing tools that support the work of the experts by making use of methods originated from the fields of computer vision and visual analytics. The main computer vision tasks can be grouped into two categories: automated image registration and object detection.

Image Registration

This task is concerned with the automatic georeferencing of the historical aerial images. By taking modern satellite image as reference, this task can be approached as a classical image registration problem [5], as illustrated in Figure 1. The main challenge are the strong changes in image content caused by the age differences of around 70 years between the old and new images that hinder the reliable identification of correspondences, especially in non-urban areas. Additionally, the historical images are partially in a poor condition, meaning they are affected by over- or underexposure, uneven illumination, low spatial resolution, blurring, sensor noise or cloud coverage. Consequently, a straightforward solution based on standard algorithms using keypoint matching [4] and robust transformation estimators [2] does not exist.

Object Detection

The second task is dedicated to the automated detection of military objects (e.g. bomb craters or trenches) and assignment of prediction probabilities to the objects found. The task is hindered by the low quality of the images investigated and their high variety. Due to the absence of large amounts of training data, we are planning to implement and evaluate semi-supervised and active learning procedures [1], which will also make use of techniques stemming from the field of visual analytics.

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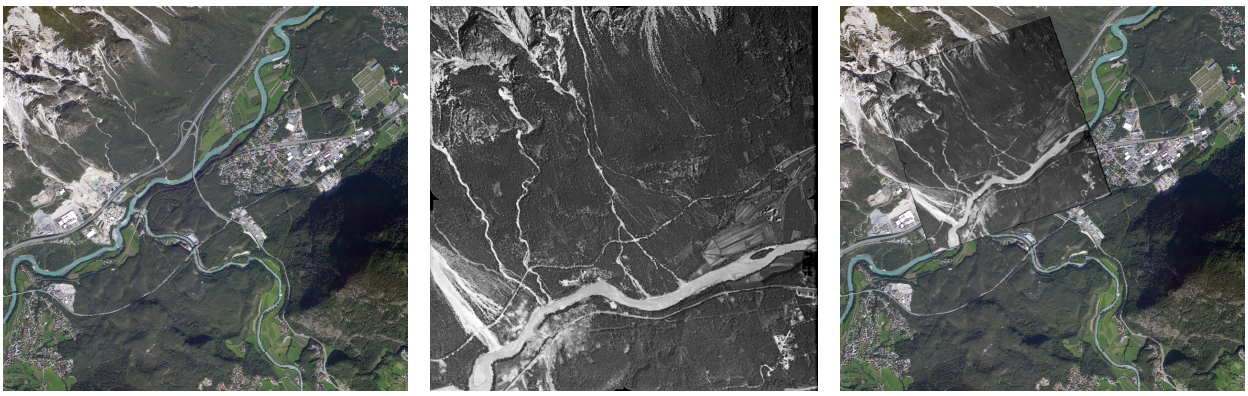

Reference satellite image (Ötztal region).

Historical aerial photo from May 1945.

Result of manual georeferencing.

Reference satellite image (Vienna, 21st district).

Historical aerial photo from November 1943.

Result of manual georeferencing.

Figure 1: Two examples illustrating the process of manually georeferencing historical aerial photos by image registration.[1]

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