

ACQUISITION AND APPLICATION OF LOW-COST HIGH RESOLUTION AERIAL PHOTOGRAPHY IN URBAN ENVIRONMENTS

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Urban areas are characterized by complex spatial properties in all three dimensions. Spectrally they also show a large variation in the physical-chemical parameters of their materials. Nowadays, the rapid urban developments result in dynamic changes of the spatial structure. These changes have to be analyzed at their appropriate scale. This research deals with the acquisition and processing of remote sensing data with a high spatial and spectral resolution, which can be applied at the required spatial, spectral and time scale. Another important aspect of this work was to increase the cost effectiveness, compared to traditional acquisition systems.

An in-house developed data acquisition system allows for the collection of high resolution imagery at the moment when it is required. A DuncanTech MS3100 small format aerial camera captures color infrared (CIR) images (1320x1040 pixel), and a Trimble system (PhaseOne P65+ back, Schneider 47 mm lens) provides RGB and CIR data. Using the FLIR ThermaCAM P65 from our partner, thermal characteristics of the surface can be recorded. The data collection unit with the power supply and navigation system are built in a Cessna C-172 airplane. High spectral imagery was collected and preprocessed by our partner using an AISA Dual hyperspectral sensor from our study areas.

The Trimble data collection was supported by special planning and navigation software (AeroTopoL), which automatically recorded the image acquisition position and heading values. Since this system was not available for the small format CIR and thermal (TIR) data acquisition, it was necessary to apply a time synchronization to derive the precise image center point coordinates. Ortho rectification of the single images was only partly successful due to lack of omega, phi and kappa values and inaccurate X,Y,Z coordinates of the plane position. During the mosaicing of the images histogram matching had to be applied. The RGB, CIR and TIR images cover the complete city. The more expensive hyperspectral data were acquired from a select area only, which represents all of the main types of urban morphology (city center, high rise apartment district and garden city).

Our goal was to use the data in a wide range of applications. Using segment based classification on data with a high spatial resolution, not only spectral but spatial information can be extracted as well. With this method land cover maps from different study areas were created. For the same purpose hyperspectral images were classified using traditional pixel-based methods. A city wide surface temperature map, created from the TIR images, was used for urban climate research and to evaluate the effectiveness of insulation programs for high rise apartment buildings. Very high resolution (10 cm) RGB digital aerial photographs will be used for city management purposes (maintenance of green areas, inventory of street furniture etcetera).

The poster will show the main components of the acquisition systems, the data processing workflow and some current and future applications.