

Public Abstract

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Ph.D.

Electrical Engineering

Development of Urban Area Geospatial Information Products from High Resolution Satellite Imagery Using Advanced Image Analysis Techniques

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There are numerous applications for urban area geospatial information products including growth assessment, emergency response and management, military combat support, and homeland security. The latest generation of commercial satellite imaging sensors have a number of characteristics (e.g. high spatial resolution, multispectral bands, and quick revisit time) that make them ideal data sources for urban area applications. The goal of this doctoral research was to develop advanced automated and semi-automated image analysis and classification techniques for the extraction of urban area geospatial information products from commercial high-resolution satellite imagery. In this research we developed two semi-automated urban land cover classification approaches, as well as fully automated techniques for road network and 2-D building footprint extraction. By utilizing fully automated feature extraction techniques for training data generation, a self-supervised urban land cover classification approach was also developed. The self-supervised classifier is significantly more accurate than traditional classification approaches, and unlike traditional approaches it is fully automated. The development of automated and semi-automated techniques for generation of urban geospatial information products is of high importance not only for the many applications where they can be used but also because the large volume of data collected by satellite sensors exceeds the human capacity of trained image specialists to analyze. In addition, many applications, especially those for the military and intelligence communities, require near real time exploitation of image data. Both the quantity of data and the speed with which that data must be analyzed illustrate the need for automated geospatial information extraction techniques.