Identifying Urban Forest Canopy in Downtown Sacramento Using Feature Analyst and QuickBird Satellite Imagery

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Background

High resolution imagery (satellite and airborne) is becoming more readily available and being used by many organizations for use with other spatial data, web mapping applications, and maps. One of the areas that many organizations have not taken advantage of is deriving useful spatial information from high resolution imagery. Typically, deriving spatial data from high resolution imagery requires an analyst to manually digitize (sometimes called heads up digitizing) features by visually interpreting the feature of interest and then using a cursor on a computer screen to draw a point, line, or polygon representing the extent of the feature. In addition, the analyst must also fill in an attribute table so that the feature can be uniquely identified.

This procedure can be very time consuming and tedious to the analyst performing the digitizing task. In the last several years commercially available software has entered the market to provide as set of tools that an analyst can use to semi-automate the categorization or identification of specific geographic features within high resolution imagery.

Traditionally, digital image processing techniques involve an analyst to create "spectral signatures" (sample areas for different geographic land cover types) that are then used in an automated image classifier to categorize the various land cover types throughout the entire image. The sample areas often contain only spectral information of homogeneous areas and not information related to the shape, texture, or size of the sample feature. These techniques work well if the imagery is medium or large resolution (i.e. pixel size is > 5 m). When attempting to apply these same techniques to high resolution imagery, spectrally homogeneous areas for a given geographic feature are difficult to find. Because of the quantity of detail inherent in high resolution imagery attempting to categorize or identify features purely on spectral content, often times automated classifiers will detect many features that do not match the feature of interest. For example, identifying forest types involve sampling different kinds of tree plant communities. In some cases, different species may be able to be sampled if their geographic extent is large enough to sample. In course resolution imagery, this is not too difficult to achieve. However, if the same kind of forest plant communities are to be identified in high resolution imagery, then problems arise because forest communities often get confused with other non-forest types such as grasses, shrubs, and other features that may have the same color and tone (for example cars, building with green roofs, pavement

markings, etc). Color infrared high resolution imagery could also be used, but typically color infrared imagery is more expensive to collect and many organizations (especially local and small non-profit) do not have a need for color infrared image data unless their focus is on wildlife or natural resource projects.

The digital image processing tools that are now commercially available are able make it possible for the analyst to create digital image protocols to semi-automatically categorize and identify specific land cover types (trees, grasses, shrubs, pavement, etc) or specific features (buildings, man holes, airplanes, cars, etc) within high resolution imagery.

In this project one of the commercially available high resolution digital image processing packages (Visual Learning Systems' Feature Analyst) was used to identify and categorize forest cover within an urban setting. This project summarizes the methods and processes used to complete the urban forest classification using Feature Analyst and it describes the time required to process the entire image.

Purpose

The purpose of this project was to develop a real world project using high resolution imagery for the Remote Sensing and Digital Image Processing course at American River College. This course spends about 25% of the class reviewing and applying high resolution image processing techniques and issues. The course uses Visual Learning Systems' Feature Analyst software for this portion of the course.

As a result these methods demonstrate a viable alternative to manually digitizing forested areas throughout an urban setting. In addition, the final urban forest canopy data could be used by organizations that are interested in the full extent of urban forest, running carbon offset models in urban environments, and identifying areas that are well shaded or are suitable sites for solar panels to name a few.

Imagery

Quickbird July 18, 2006 TIF file. Full resolution (0.6m, 2 ft), RGB bands, approximately 5300x5300 pixels.

Software