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ESRI India

ArcIndia News

ESRI India Magazine

January - March 2010 Vol : 4 Issue : 1

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Using Information from Imagery in GIS

Introduction

Today people rely on GIS for information needed for decision making. Information from GIS is used for a wide variety of applications from urban planning to agriculture to medicine. It is increasingly important that government organizations and commercial companies making decisions use accurate and up-to-date information. In many instances, aerial or satellite imagery can provide a current source of data for a geographic area of interest, which helps to ensure accurate and reliable GIS-based decisions.

There are many situations, such as natural disasters and other large scale emergency response events, which require up-to-date information to enable quick response times. In these situations the most current information is invaluable to rescue efforts on the ground. A traditional GIS may often not contain the timely information required for this type of situation. Satellite and airborne imagery, which was once considered a simple backdrop to maps, is now readily available, more affordable and a great source of valuable data to add more timely information to GIS applications.

To date, using the important information that could be found in imagery was a challenge for GIS professionals. Standard image processing and analysis methods and software were difficult to use, time consuming and required a background in image science to use effectively and accurately. Advances in image processing and analysis such as easy to use, automated workflows found in ITT's ENVI EX, now allow GIS professionals to quickly and easily get accurate and timely information from imagery to easily added to a GIS. .

Applications for Geospatial Information from Imagery

In addition to emergency response situations, a growing application of information from geospatial imagery is as a data source to populate, update and assess the quality of GIS databases. Map-accurate orthophotos or satellite images are being used to collect (digitize) features such as road centerlines, land use areas, building footprints and utility infrastructure. The availability of up-to-date imagery makes it easy to identify areas of development that may not yet be captured in the GIS database. Additionally, automated image processing methods tailored for feature extraction, such as the ENVI EX feature extraction workflow, can be used to reduce the effort of often tedious, manual digitizing processes.

Other applications of image analysis include using an image's spectral content – the images varying wavelengths – to assess land use and to map land cover; to measure, monitor and assess environmental conditions; to assess the condition of pavement and other public works assets;

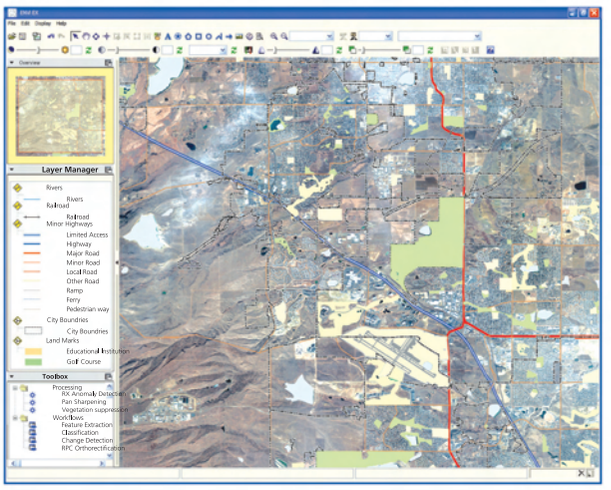

Figure 1: New image processing technology allows GIS users to easily integrate information from geospatial imagery with vector layers, as seen above in a screenshot from ENVI EX, an image processing software package designed specifically for GIS users.

and to identify building materials. Detecting change that has occurred in an area is also possible when imagery is collected over time. Gaining knowledge from analyzing imagery and data can be achieved with ENVI EX, and can be a valuable addition to many GIS-based processes including land development models and forecasts, planning exercises and environmental impact assessments.

Streamlined GIS and Imagery Integration

In order to realize the benefits of using imagery as a source of geospatial information, GIS professionals need a solution that easily integrates the information contained in imagery into GIS workflows. ENVI EX, a new software

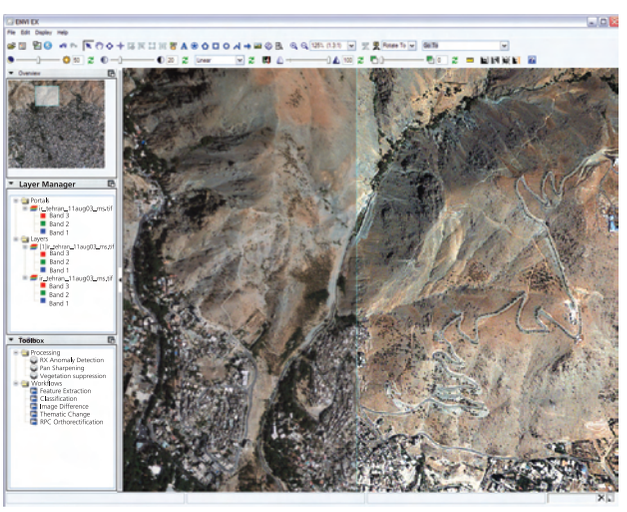

Figure 2: Example of a sharpened image in ENVI Ex. The display on the left is the original multispectral image. The display on the right contains the sharpened image result. Data courtesy of DigitalGlobe.

product from ITT, provides a complete suite of tools based on proven scientific methods to help GIS professionals view, manipulate, process and analyze imagery.

Advanced Image Viewing and Manipulation Capabilities

ENVI EX was specifically designed for GIS professionals. The desktop toolbox and layer manager in ENVI EX allow users to visualize imagery and data, and to create representations that are clear and easily interpreted. Advanced manipulation tools allow users to stretch, sharpen, blend, rotate, adjust brightness, transparency and contrast, create histograms and add annotations to imagery.

The ENVI EX portal view allows users to display an image or a layer in ESRI's ArcGIS, select an area of interest, and quickly visualize the selected area using manipulation tools. ENVI EX also gives users access to vector editing tools to "clean up" visualizations and make features more true to life.

Image Processing and Analysis Tools for GIS Professionals

ENVI EX provides support for a variety of GIS image processing tasks, using all types of widely available satellite and airborne imagery. ENVI includes new, easy to use workflows for standard image processing and analysis tasks including change detection, image classification, orthorectification and feature extraction. The software also includes robust vector support to compliment GIS systems, including tools for the conversion and editing of common vector data formats, full geodatabase support, and the ability to drag and drop layer files between ENVI and ArcGIS. All results from ENVI EX processing and analysis can be saved to the geodatabase or can be output directly using the ArcGIS map and printing dialogs.

The tight integration of ENVI EX with ArcGIS allows users to easily exchange data files and layer files between the two software tools by selecting an image in ArcGIS and dragging and dropping it into ENVI EX. Users can also view and interact with ArcGIS layers in ENVI EX while viewing vector information with the same symbology, styling and rendering as ArcGIS. A typical work project now facilitated by the integration of ENVI EX and ArcGIS may include performing image processing tasks in ENVI EX, making changes to the parameters on the fly, and viewing the changes as the user moves between ENVI and ArcGIS.

Automatically Extract Features of Interest

New technology advancement, available in ENVI EX, now allows GIS professionals to quickly and accurately locate, extract and identify features of interest in imagery. Manually locating and digitizing features is often tedious and time consuming, especially over large coverage areas. In addition, limited spectral content may make standard pixel- based extraction approaches inaccurate..

The ENVI EX feature extraction workflow allows GIS professionals to automatically extract spatial objects from imagery and reduce the time spent on manual processes. The ENVI EX feature extraction can be used to extract a wide variety of features such as vehicles, buildings, roads, bridges, rivers, lakes and fields, and is optimized for extracting information from high-resolution panchromatic and multispectral imagery based on spatial, spectral and texture characteristics. The ENVI EX feature extraction workflow uses an object-based approach that can be used on high spatial resolution imagery with limited or no spectral content.

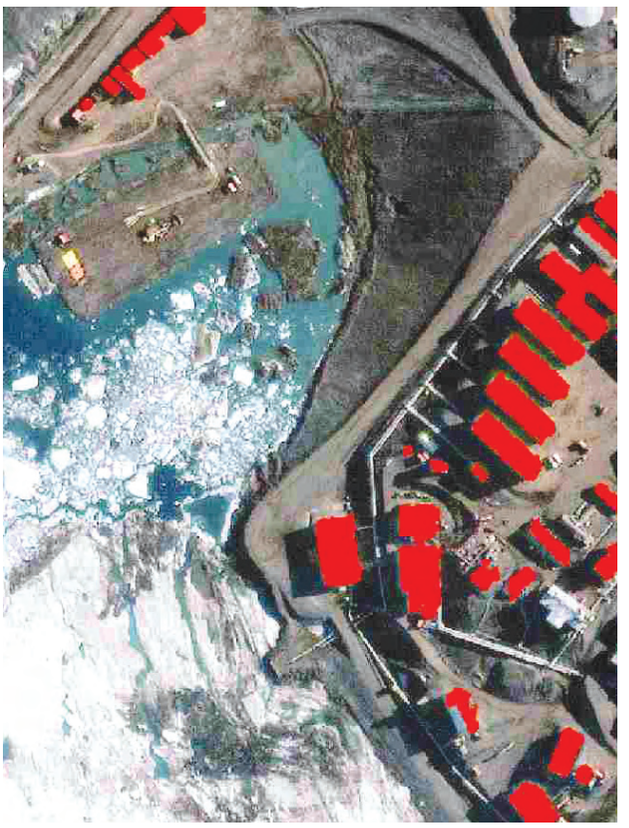

Figure 3: Example of feature extraction performend in ENVI EX. Red regions are a building footprint layer extracted from the underlying multispectral image. Data courtesy of DigitalGlobe.

Conclusion

GIS professionals worldwide are beginning to understand the importance and benefits of extracting geospatial information from imagery to complement and enhance GIS applications. The growing availability of imagery and recent advances in image processing and analysis technologies, such as ENVI EX are making it easier for GIS professionals to get important information from imagery for a wide variety of applications.

As the need for adding more timely and accurate information grows, so too does the need for solutions that make it easier to get information quickly and easily. ENVI EX, designed for for GIS professionals, delivers accurate results based on a solid scientific foundation and provides step-by-step workflows that quickly and easily guide users through advanced image processing tasks, regardless of experience level. ENVI EX is also fully integrated with ArcGIS to allow information from imagery to be seamlessly integrated with the GIS

For more information on ENVI visit www.ittvis.com/ENVI or email Rolf Schaeppi at rschaeppi@ittvis.com.