

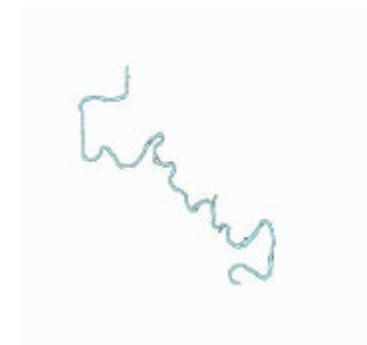
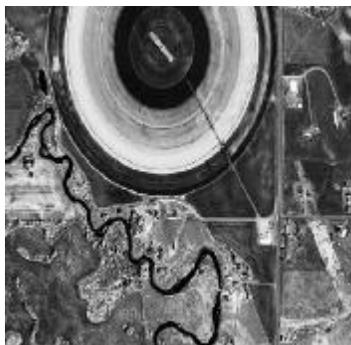


# NASA Office of Technology Transfer

## John C. Stennis Space Center

### Feature Analyst: A Key To The Geographic Information System Industry

*A state-of-the-art machine learning feature extraction software*



*The extraction process using a river as an example*

A state-of-the-art machine learning feature extraction software developed by Visual Learning Systems, Inc. (VLS) of Missoula, MT, under the NASA Small Business Innovation Program at Stennis Space Center, Feature Analyst is a software extension for leading commercial-off-the-shelf (COTS) GIS and image processing software, such as ArcGIS and ERDAS Imagine which automate the geospatial feature extraction process from digital imagery. Feature Analyst reduces labor costs, improves accuracy and is simple to use.

Geospatial features, such as streets, buildings, landmarks and vegetation are used in the GIS industry to produce maps and perform spatial analyses for urban planning, transportation analyses, defense, telecommunications and many other applications. The Feature Analyst technology speeds up this feature extraction process using VLS's proprietary machine-learning algorithms. This innovative technique cuts labor costs on digitizing projects by 80 percent or more while fitting into the existing commercial GIS software workflow process. As an assisted target recognition/assisted feature extraction (ATR/AFE) toolkit, the Feature Analyst will increase the efficiency of GIS database by a factor of 50 to 200 times over traditional heads-up digitizing methods with an accuracy that surpasses expert heads-up digitizing.

Feature Analyst was developed to assist NASA's critical need to accelerate and automate the identification and classification of features in digital satellite imagery to support its Earth Science Enterprise mission. This need is paralleled by demands in the emerging commercial remote sensing sector, which is a strategic concern for NASA's Earth Science Enterprise.

#### **HOT** Points

- **“Smart” bridge between image processing and analysis tools**
- **Automates extraction process**
- **Reduces labor costs**
- **Increases accuracy**
- **Easy to use**
- **Compatible with commercial-off-the-shelf (COTS) products ArcGis and ERDAS Imagine**
- **Broad application within GIS industry**

Commercial applications of NASA's Earth Science data as well as the viability of the remote sensing industry depend on the development of new Information Technology tools that accelerate the analysis of remotely sensed images to support geospatial data models for land-cover and land-use change. Feature Analyst, developed as a "plug and play" machine learning toolkit, provides a "smart" bridge between image processing and GIS spatial analysis tools.

### Target Markets

Primary markets for the Feature Analyst software include the U.S. Department of Defense and Homeland Security Operations, NASA and National Imagery and Mapping Agency. These agencies require timely, accurate and relevant GIS data to support intelligence and emergency planning operations. Other vertical markets include: civil government, transportation, forestry, environmental and agriculture. Revenue generating opportunities for VLS include software sales, custom computer programming, and consulting services. The simplicity of the Feature Analyst interface and the tight integration of the technology into the GIS workflow expand the opportunities for high-resolution imagery to serve as the primary source of features for GIS databases.

These "niche" markets are large consumers of geospatial products and services that will be early adopters of the 1-meter resolution spatial accuracy requirements for future GIS databases. VLS has conducted market research that shows, based on the proposed Feature Analyst extension for ESRI's Arc 8 technology alone, the market for the proposed Feature Analyst software will garner between \$25 million and \$50 million annually in 10 years.

### The Future of Feature Analyst

Visual Learning Systems and NIMA recently conducted a detailed quantitative analysis of the Feature Analyst based on written test procedures provided in the NIMA Automated Feature Extraction Algorithm Validation Program. The evaluation minimally included a sensitivity analysis, an accuracy analysis and a timing analysis. Personnel involved in the testing included cartographers from NIMA Operations in St. Louis, MO, research personnel from NIMA Reston, VA, and researchers from the Army Topographic Engineering Center located in Arlington, VA.

The performance evaluation consisted of a series of tests in which the cartographers extracted a variety of geospatial features using both the Feature Analyst and manual methods. Objective data was collected on the timing and relative accuracy of the extraction of vegetation and double-line drains. The accuracy of the Feature Analyst software was superior to hand digitizing in all instances.

Based on these results, VLS has reinvested \$150,000 for continued development of the product and entered into a business partnership with the Environmental Systems Research Institute (ESRI) of Redlands, CA-the world's leading developer of GIS software products. The optimum goal is for Feature Analyst to be the featured extraction software of choice by all remote sensing and GIS personnel.

Future enhancements VLS plans to make to the software include:

- A change-detection module for detecting changes over time. There is currently no real change-detection software available and is a natural extension to the Feature Analyst workflow;
- Georegistration of old vector layers to new imagery in GIS databases. Called Machine Learning, this is a natural solution to an important problem;
- Incorporation of 3-D info into the feature extraction process so that it fully uses information available in stereo imagery.

### Why SBIR

"The SBIR Program is a highly-competitive program that is widely recognized as selecting the best-in-breed of innovative small businesses poised to solve federal government technology problems and develop new commercial products around those concepts. Visual Learning Systems, Inc. is a performance driven organization that thrives on competition, innovation, and challenges," said Stuart Blundell, Chief Operating Officer, Visual Learning Systems, Inc. "The SBIR Program was a natural outlet for VLS to pursue federal grant opportunities to drive the Feature Analyst technology into the commercial GIS market."

SBIR is a highly competitive multi-phase program that provides small U.S. businesses with federal funds reserved for conducting serious research and development. Phase I is the start-up segment with awards up to \$70,000; if chosen, Phase II awardees are granted up to \$600,000 to conduct research and development for two years. The SBIR Program at Stennis Space Center is managed through the Office of Technology Transfer. For more information regarding the NASA Small Business Innovation Research Program contact the Office of Technology Transfer at Stennis Space Center.

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