

plication programs for depicting NASA orbital missions on personal computers running the Windows XP, Mac OSX, and Linux operating systems.

GoView enables seamless rendering of Cartesian coordinate spaces with programmable graphics hardware, whereas prior programs for depicting spacecraft trajectories variously require non-Cartesian coordinates and/or are not compatible with programmable hardware. GoView incorporates an algorithm for

nonlinear interpolation between arbitrary reference frames, whereas the prior programs are restricted to special classes of inertial and non-inertial reference frames. Finally, whereas the prior programs present complex user interfaces requiring hours of training, the GoView interface provides guidance, enabling use without any training.

This work was done by Paul R. Upchurch of Caltech for NASA's Jet Propulsion Laboratory. In accordance with Public Law 96-517,

the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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Refer to NPO-45274, volume and number of this NASA Tech Briefs issue, and the page number.

Alert Notification System Router

Goddard Space Flight Center, Greenbelt, Maryland

The Alert Notification System Router (ANSR) software provides satellite operators with notifications of key events through pagers, cell phones, and e-mail. Written in Java, this application is specifically designed to meet the mission-critical standards for mission operations while operating on a variety of hardware environments.

ANSR is a software component that runs inside the Mission Operations Center (MOC). It connects to the mission's message bus using the GMSEC [God-

dard Space Flight Center (GSFC) Mission Services Evolution Center (GMSEC)] standard. Other components, such as automation and monitoring components, can use ANSR to send directives to notify users or groups. The ANSR system, in addition to notifying users, can check for message acknowledgements from a user and escalate the notification to another user if there is no acknowledgement.

When a firewall prevents ANSR from accessing the Internet directly, proxies

can be run on the other side of the wall. These proxies can be configured to access the Internet, notify users, and poll for their responses. Multiple ANSRs can be run in parallel, providing a seamless failover capability in the event that one ANSR system becomes incapacitated.

This work was done by Joseph Gurganus of Goddard Space Flight Center and Everett Cary, Robert Antonucci, and Peter Hitchener of Emergent Space Technologies, Inc. Further information is contained in a TSP (see page 1). GSC-15592-1

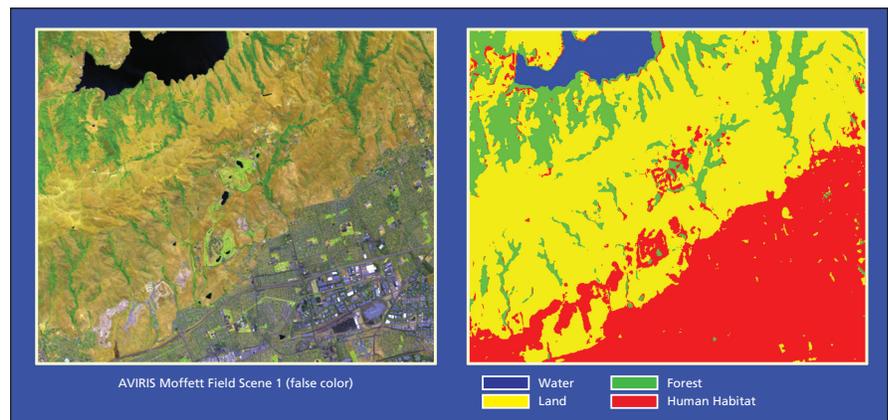
Lossless Compression of Classification-Map Data

This algorithm performs better than do general-purpose image-data compression algorithms.

NASA's Jet Propulsion Laboratory, Pasadena, California

A lossless image-data-compression algorithm intended specifically for application to classification-map data is based on prediction, context modeling, and entropy coding. The algorithm was formulated, in consideration of the differences between classification maps and ordinary images of natural scenes, so as to be capable of compressing classification-map data more effectively than do general-purpose image-data-compression algorithms.

Classification maps are typically generated from remote-sensing images acquired by instruments aboard aircraft (see figure) and spacecraft. A classification map is a synthetic image that summarizes information derived from one or more original remote-sensing image(s) of a scene. The value assigned to each pixel in such a map is the index of a class that represents some type of content deduced from the original image data — for exam-



This **False-Color Image and Classification Map** were derived from image data acquired by an airborne visible/infrared imaging spectrometer (AVIRIS) over Moffett Field, California. The classification map is typical of images meant to be processed by use of the present algorithm.

ple, a type of vegetation, a mineral, or a body of water — at the corresponding location in the scene. When classification maps are generated onboard the aircraft

or spacecraft, it is desirable to compress the classification-map data in order to reduce the volume of data that must be transmitted to a ground station.

Unlike ordinary (continuous-tone) images, a classification map typically contains a relatively small number of pixel values. Also, unlike in continuous-tone images, numerically close pixel values do not necessarily represent similar content. These properties make the problem of compressing classification-map-data differ from the problem of compressing data from ordinary images.

Prediction is commonly used in loss-less-compression schemes. In predictive compression, pixels or other samples are encoded sequentially on the basis of a probability distribution estimated from previously encoded samples. Context modeling is often used in conjunction with predictive compression. In context modeling, each pixel or other sample to be encoded is classified into one of several contexts based on previously en-

coded samples. A context-modeling algorithm maintains separate statistics for each context and uses these statistics to estimate and encode samples more effectively. Ideally, contexts are defined so that different contexts contain sets of pixels or other samples characterized by substantially different statistics.

The present algorithm incorporates a simple adaptive context modeler that feeds into a binary interleaved entropy coder. The algorithm operates on the pixels of a classification map or other image in raster scan order. A sequence of binary decision bits is produced for each pixel to indicate which, if any, neighboring pixel(s) it matches. The encoder maintains probability-of-zero estimates for these bits for each of the contexts. The interleaved entropy coder is bit-wise adaptable, enabling the context

modeler to quickly adapt to changing statistics in the image.

In tests, the present algorithm and three prior general-purpose image-data-compression algorithms were applied to five classification maps containing from 4 to 32 different classes. The four-class map is shown in the figure. The results of the tests showed that the volumes of data generated by the present algorithm ranged from 15 to 40 percent below those of the prior algorithms.

This work was done by Hua Xie and Matthew Klimesh of Caltech for NASA's Jet Propulsion Laboratory.

The software used in this innovation is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45103.

Framework for ReSTful Web Services in OSGi

NASA's Jet Propulsion Laboratory, Pasadena, California

Ensemble ReST is a software system that eases the development, deployment, and maintenance of server-side application programs to perform functions that would otherwise be performed by client software. Ensemble ReST takes advantage of the proven disciplines of ReST (Representational State Transfer — a style of software architecture for such distributed hypermedia systems as the World Wide Web) and OSGi (formerly, Open Services Gateway Initiative — an industry standard for software for connecting such devices as home appliances and security systems to the Internet). ReST leverages the standardized HTTP protocol to enable developers to offer services to a diverse variety of

clients: from shell scripts to sophisticated Java application suites.

Ensemble ReST abstracts away complexities associated with development of server-side application programs, enabling programmers to focus more on business logic than on server issues. It is robust, scalable, and secure; capable of serving dynamic as well as static content; and extensible to provide additional functionality. Services can be added, removed, or updated on a server, without restarting the server. Furthermore, the development environment for these services (Eclipse IDE) allows developers to debug the server-side applications side-by-side with the clients. The framework enables rapid prototyping and development of produc-

tion level ReSTlets that can be deployed to support mission critical applications. The rapid development cycle offered by this framework has enabled the Maestro team to develop and deploy many production server-side applications to MER, Phoenix, and MSL missions.

This program was written by Khawaja S. Shams, Jeffrey S. Norris, Mark W. Powell, Thomas M. Crockett, David S. Mittman, Jason M. Fox, Joseph C. Joswig, Michael N. Wallick, Recaredo J. Torres, and Kenneth Rabe of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45848.

MAGIC: Model and Graphic Information Converter

John F. Kennedy Space Center, Florida

MAGIC is a software tool capable of converting highly detailed 3D models from an open, standard format, VRML 2.0/97, into the proprietary DTS file format used by the Torque Game Engine from GarageGames. MAGIC is used to convert 3D simulations from authoritative sources into the data needed to run the simulations in NASA's Distributed Observer Network.

The Distributed Observer Network (DON) is a simulation presentation tool

built by NASA to facilitate the simulation sharing requirements of the Data Presentation and Visualization effort within the Constellation Program. DON is built on top of the Torque Game Engine (TGE) and has chosen TGE's Dynamix Three Space (DTS) file format to represent 3D objects within simulations.

The DTS file structure is generally intended to contain common game objects, with less than ten thousand polygons

each, and if built using the standard methods will break (fail to load or contain corrupted geometry) after that amount.

MAGIC employs techniques to work around the DTS limitations, allowing for much more information to be successfully represented with the DTS file structure (millions of polygons). This ability opens up the Torque Game Engine to be used in applications where such detail is needed.