Remote Data Access with IDL

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A tool based on IDL (Interactive Data Language) and DAP (Data Access Protocol) has been developed for user-friendly remote data access. A difficulty for many NASA researchers using IDL is that often the data to analyze are located remotely and are too large to transfer for local analysis. Researchers have developed a protocol for accessing remote data, DAP, which is used for both SOHO and STEREO data sets. Server-side side analysis via IDL routine is available through DAP.

The tools allow normal DAP users to run IDL scripts on their data remotely via DAP. This powerful, user-friendly interface to DAP for IDL improved OPeNDAP bindings that fixed bugs in existing functionality, created a GUI client to explore data sets served with DAP, developed a pure IDL DAP implementation that provided complete DAP capabilities along with a simple installation, improved network capabilities for GDL (the open source IDL alternative) and older versions of IDL, and modified the OPeNDAP Hyrax DAP server to process data on the server-side via a syntax in the DAP request.

This work was done by Michael Galloy of Tech-X Corporation for Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16253-1

Data Compression Algorithm Architecture for Large Depth-of-Field Particle Image Velocimeters

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A large depth-of-field particle image velocimeter (PIV) is designed to characterize dynamic dust environments on planetary surfaces. This instrument detects lofted dust particles, and senses the number of particles per unit volume, measuring their sizes, velocities (both speed and direction), and shape factors when the particles are large. To measure these particle characteristics in-flight, the instrument gathers two-dimensional image data at a high frame rate, typically >4,000 Hz, generating large amounts of data for every second of operation, approximately 6 GB/s.

To characterize a planetary dust environment that is dynamic, the instrument would have to operate for at least several minutes during an observation period, easily producing more than a terabyte of data per observation. Given current technology, this amount of data would be very difficult to store onboard a spacecraft, and downlink to Earth. Since 2007, innovators have been developing an autonomous image analysis algorithm architecture for the PIV instrument to greatly reduce the amount of data that it has to store and downlink. The algorithm analyzes PIV images and automatically reduces the image information down to only the particle measurement data that is of interest, reducing the amount of data that is handled by more than 10^3. The state of development for this innovation is now fairly mature, with a functional algorithm architecture, along with several key pieces of algorithm logic, that has been proven through field test data acquired with a proof-of-concept PIV instrument.

This work was done by Brent Bos, Nargess Memarsadeghi, Semion Kizhner, and Scott Antonille of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15960-1

Vectorized Rebinning Algorithm for Fast Data Down-Sampling

Applications include image processing, filter design, and anti-aliasing techniques.

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A vectorized rebinning (down-sampling) algorithm, applicable to N-dimensional data sets, has been developed that offers a significant reduction in computer run time when compared to conventional rebinning algorithms. For clarity, a two-dimensional version of the algorithm is discussed to illustrate some specific details of the algorithm content, and using the language of image processing, 2D data will be referred to as "images," and each value in an image as a "pixel." The new approach is fully vectorized, i.e., the down-sampling procedure is done as a single step over all image rows, and then as a single step over all image columns.

Data rebinning (or down-sampling) is a procedure that uses a discretely sampled N-dimensional data set to create a representation of the same data, but with fewer discrete samples. Such data down-sampling is fundamental to digital signal processing, e.g., for data compression applications. Additional applications include image processing, filter design, and anti-aliasing techniques. Data rebinning is a computationally intensive procedure and thus the goal in this technology development is a more efficient algorithm