Prioritizing Scientific Data for Transmission

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A software system has been developed for prioritizing newly acquired geological data onboard a planetary rover. The system has been designed to enable efficient use of limited communication resources by transmitting the data likely to have the most scientific value. This software operates onboard a rover by analyzing collected data, identifying potential scientific targets, and then using that information to prioritize data for transmission to Earth. Currently, the system is focused on the analysis of acquired images, although the general techniques are applicable to a wide range of data modalities. Image prioritization is performed using two main steps. In the first step, the software detects features of interest from each image. In its current application, the system is focused on visual properties of rocks. Thus, rocks are located in each image and rock properties, such as shape, texture, and albedo, are extracted from the identified rocks. In the second step, the features extracted from a group of images are used to prioritize the images using three different methods: (1) identification of key target signature (finding specific rock features the scientist has identified as important), (2) novelty detection (finding rocks we haven’t seen before), and (3) representative rock sampling (finding the most average sample of each rock type). These methods use techniques such as K-means unsupervised clustering and a discrimination-based kernel classifier to rank images based on their interest level.

This work was done by Gregory Bearman, Michael Pelletier, and Suresh Seshadri of Caltech for NASA’s Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

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Determining Sizes of Particles in a Flow From DPIV Data

The same equipment would be used to measure sizes as well as velocities.

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A proposed method of measuring the size of particles entrained in a flow of a liquid or gas would involve utilization of data from digital particle-image velocimetry (DPIV) of the flow. That is to say, with proper design and operation of a DPIV system, the DPIV data could be processed according to the proposed method to obtain particle sizes in addition to particle velocities. As an additional benefit, one could then compute the mass flux of the entrained particles from the particle sizes and velocities.

As in DPIV as practiced heretofore, a pulsed laser beam would be formed into a thin sheet to illuminate a plane of interest in a flow field and the illuminated plane would be observed by means of a