Interactive Point Visualization

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USGS science for a changing world

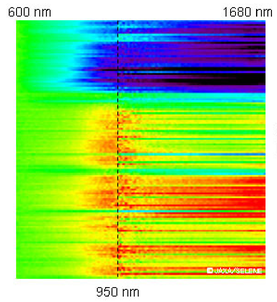
Problem

From September 2007 to June 2009, the Japanese lunar orbiter Kaguya went into orbit around the moon to collect spectrometer data from its surface. This data was then given to the United States Geological Survey (USGS) for open distribution and scientific use. Until now, USGS has not had an efficient way to access, analyze, and visualize this data.

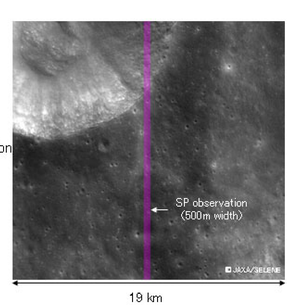
The Kaguya Spectral Profiler

What is a Spectrometer?

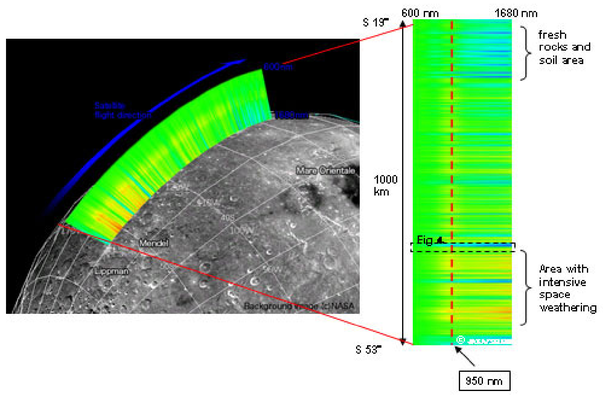
A spectrometer is a device that can measure a plot of the intensity of energy detected versus the wavelength of the energy detected. Some common examples of spectroscopy are x-ray and infrared.



Spectrometer data of a crater



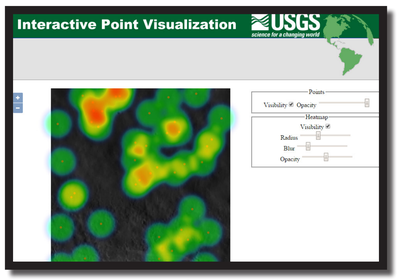
Same crater image simultaneously observed by the Multi-band Imager



First Light Data of Spectral Profiler

Solution

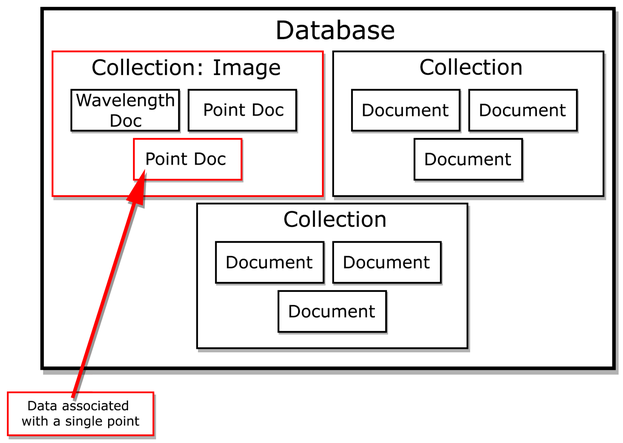
The Interactive Point Visualization project is composed of a database to store the large quantity of spectral point data, and a web application to apply special visualization techniques to the data.



The Interactive Point Visualization Web Application

Database

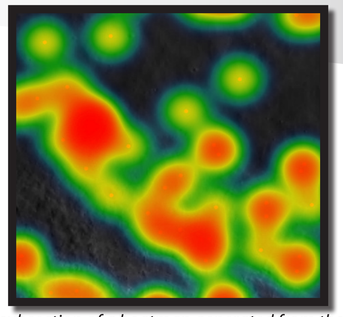
The database we implemented is in MongoDB which is a NoSQL database. This allows us to store a large amount of various types of data that can be accessed quickly. By choosing a NoSQL database, it also gives USGS the option to merge additional attributes beyond that of the original Spectral Profiler for future expansion and scalability.



The data includes attributes from each point such as radiance and reflectivity. It also contains the wavelength associated with each point and header information based on each image. The data goes through a decryption process which is then followed by a preprocessing step that separates the data into logical groupings based on inter-data relationships, all while taking the structure of a MongoDB NoSQL database into consideration.

Web Application

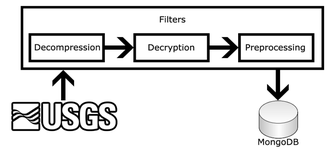
An example of a visualization technique is a heatmap, as seen to the right. The heatmap visualization highlights areas of concentrated data points, which can show users where possible concentrations of minerals may be, for example.



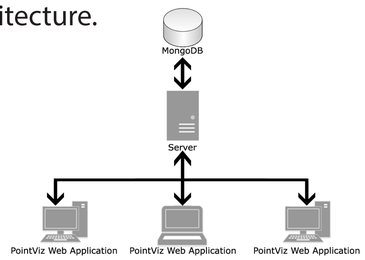
A subsection of a heatmap generated from the Interactive Point Visualization Web Application

Architecture

Our project is split between a Pipe-and-Filter architecture as well as a Client-Server architecture.

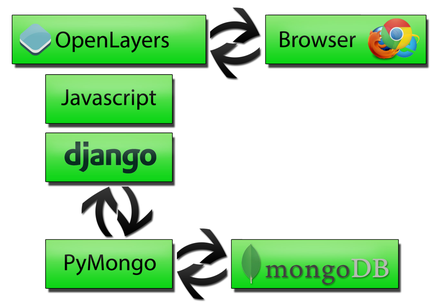


Pipe and Filter Architecture



Client Server Architecture

Technologies



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