CS486C – Senior Capstone Design in Computer Science

Project Description

Project Title: GeoSTAC: Supporting Vector Data APIs in Planetary Web Mapping	
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Project Overview:

In the past twenty years digital data discovery has transitioned to being entirely online. Research scientists, data scientists, and the interested public seek out, find, and download data using search engines, web maps, and FTP sites. Spatially enabled data are data that one can locate in the context of a map. Examples include spatially enabled tweets, restaurant locations, polygons drawn on Google maps showing the most recent extent of lava flows on Hawaii, etc.

In the planetary context, spatial data include remotely sensed, satellite collected images (across the spectrum of light) which are stored as raster products and derived products such as geologic maps which are stored as vector data products. Simply put, users discover and sometimes analyze data online. When spatially enabled, those data have either a raster (gridded) representation or a vector (points, lines, polygon) representation.

The USGS Astrogeology group are leaders in planetary data preservation, analysis ready data delivery, and planetary data delivery. We create data products and maps for the community to support a myriad of activities. Many of these you have heard about in the news such as the landing of a Mars rover last year or the preparations for an upcoming human landing on the Moon.

One area that we, the sponsors, work in is supporting community data discovery and access. We spend our time thinking about data services, APIs, metadata, and spatial data standards that can help people find maps of interest to them. These are the small components that need to frictionlessly function so that a user can have a positive experience finding and downloading the data that they require. Within our group petabytes of data spread over millions of files are managed for this purpose.

We currently have a web application called GeoSTAC that has been built and expanded by two previous NAU capstone teams. The application, publicly available here, supports that discovery of analysis ready datasets across the solar system on a traditional web map. While the interface is traditional, some of the issues being solved are not, as bodies in the solar system use some non-Earth standard definitions (e.g., 0-360 longitude domains). We have a problem with this tool. Only raster data APIs are currently supported. Sure, this means that we can get the vast majority of our data products out to our users, but we are unable to show or make our vector data discoverable.

Vector spatial data encode a lot of information into a small digital footprint. For example, one can convey information by the placement, line weight, color, and line stroke of a feature. In contrast, a raster data product is simply a grid of values. We are seeking a capstone team that will enable our vector data APIs (which conform to Open Geospatial Consortium [OGC] standards) within the GeoSTAC application. Further, we want to not just make simple points, lines, and polygons visible on the map, but to enable the map to render stylized geometries using the OGC Styled Layer Descriptor (SLD) standard.

We envision the capstone team making a modification to the GeoSTAC web application and re-releasing it with rich support for vector data visualization, discovery, and download. We hope that the team will make use of the data APIs that we have publicly available.

Key features that a minimum viable product will include are:

- Ability to render OGC Features API compliant vector data sources in the GeoSTAC webmap.
- Ability to search using the OGC Features API CQL specification to the provided ElasticSearch backend.
- Ability to stylize the vector features using Styled Layer Descriptor (SLD) files.

Stretch goals will include the:

- Ability to select and download features from the GeoSTAC web map.
- Developer focused documentation describing how other developers can make use of the library and APIs in their web map applications.
- Updates to the UI as appropriate to support the visualization and discovery of vector data sets.

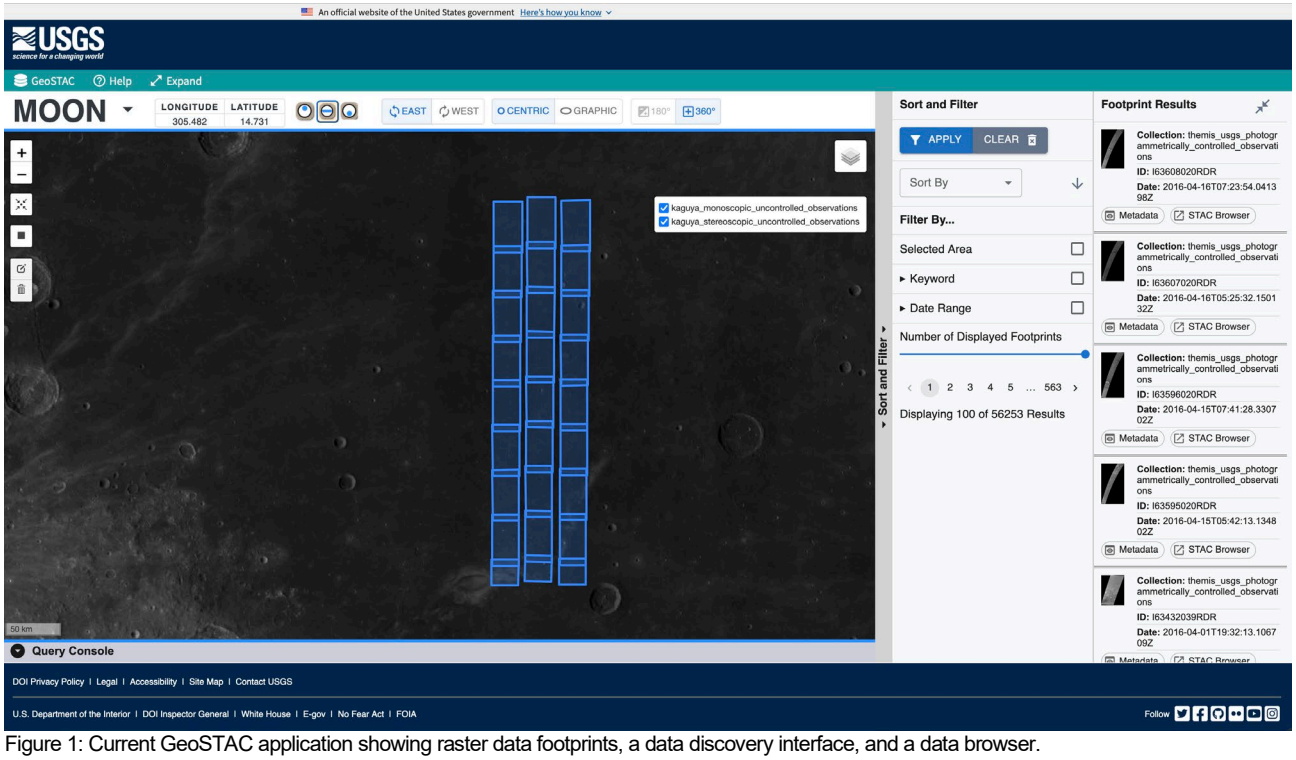

Figure 1: Current GeoSTAC application showing raster data footprints, a data discovery interface, and a data browser.

Knowledge, skills, and expertise required for this project:

- Application Programming Interface (API) usage
- Javascript / React / NPM
- Docker
- Knowledge of or experience with SVG graphics
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Equipment Requirements:

- Laptop, internet, other freely available tools

Software and other Deliverables:

- A strong as-built report detailing the design and implementation of the product in a complete, clear and professional manner. This document should provide a strong basis for future development of the product.
- Complete professionally-documented codebase, delivered as a repository in GitHub.
- A containerized deployment of the solution.