COAL-FO: COAL and Open-pit surface mining impacts on American Lands Follow-On

Tagline: Coal-FO will allow researchers to analyze the mineral, mining and environmental impacts to American lands from Open-pit surface mining

PROJECT BACKGROUND

- Coal and Open-pit surface mining impacts on American Lands Follow-On (COAL-FO) is the successor project to the 2016-2017 COAL project. COAL initially aimed to deliver a suite of algorithms to identify, classify, characterize, and quantify (by reporting a number of key metrics) the direct and indirect impacts of mining operations and related destructive surface mining activities across the continental U.S (and further afield). COAL successfully delivered a Python library for processing hyperspectral imagery from remote sensing devices such as the Airborne Visible/InfraRed Imaging Spectrometer (AVIRIS) and a Science Data System for running COAL pipelines. COAL-FO will utilize recent funding obtained from a recently awarded NSF-funded XSEDE high performance computing (HPC) grant to further improve, validate and document COAL algorithms, execution runtime performance and geospatial output results

Project Description:

The purpose of COAL-FO is to to create a searchable port for the existing COAL project. This will be augmented to accommodate the desire to (i) port the coal-sds software to the XSEDE platform and undertake test and evaluation of the system performance, (ii) process all AVIRIS and AVIRIS-NG imagery generating and archiving all science data products, and (iii) making the products searchable through a portal. To accomplish this we created COAL-SDS, an Apache OODT-powered Science Data System for COAL which can port data to XSEDE or AWS.

The project will also be focused around publicly available COAL algorithms created by the previous capstone group, publicly available spectral analysis collected from the NASA AVIRIS project, and a grant on the XSEDE environment to use HPC.We have fixed issues with pycoal and improved algorithms by making the examples easier to run, improving QGIS/GDAL installation instructions to accommodate more systems, create a Command Line Interface(CLI) to make the process of running correlations automated, and upgraded our docker image to python 3.

Figure 1: Visible-light image.

The Mineral Classification API provides methods for generating visible-light (Figure 1)

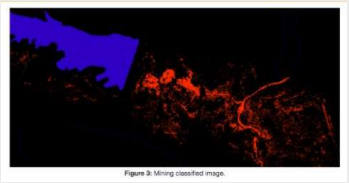


Figure 3: Mining classified image.

The Mining Identification API filters mineral classified images to identify specific classes of interest (figure 3)

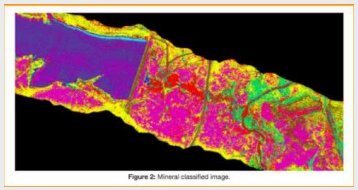


Figure 2: Mineral classified image.

The Mineral Classification API provides methods for mineral classified (Figure 2) images.

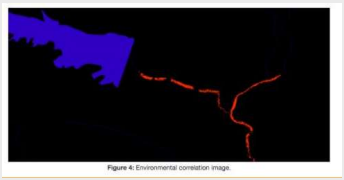


Figure 4: Environmental correlation image.

The Environmental Correlation API finds pixels in a mining classified image that are within a certain number of meters from features in a vector layer (Figure 4)

AVIRIS: Airborne Visible / Infrared Imaging Spectrometer

AVIRIS has been flown on four aircraft platforms: NASA's ER-2 jet, Twin Otter International's turboprop, Scaled Composites' Proteus, and NASA's WB-57.

COAL-SDS: An Apache OODT-powered Science Data System for COAL

Coal-sds is an end-to-end SDS capable of managing the data lifecycle (aquisition, cataloging, archival, retrieval, processing, etc.) required for COAL. The Apache OODT-poweredSDS itself consists of several components which when run as services, allow users to really explore COAL in its entirety.

XSEDE: Extreme Science and Engineering Discovery Environment

XSEDE will allow us to use 2 Terabytes for processing images. We will loop images through XSEDE and have them stored on another database for other users to then access them on the XSEDE platform. This will save a lot of time since other users won't have to deal with generating the images each time and will just have the images ready to go. We hope this will make the COAL reach a wider audience and be used in more research.

Conclusion & Results

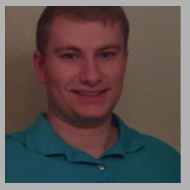
Bryce has been focusing on improving the existing COAL project. Bryce has made the examples easier to run, by fixing an error with anaconda3 and fixing several errors with file locations in the example scripts, improved QGIS/GDAL installation instructions to accommodate more systems so that product imagery created by COAL can be viewed, created a Command Line Interface(CLI) with the long term goal of making the process of running correlations automated, fixed our docker image which was broken and upgraded our docker image to python 3.

Kenny has been focused on getting COAL-SDS up and running and taking product imagery Bryce stored on google drive to be exported to AWS, with the eventual goal of using XSEDE.

THE TEAM:

-Lewis John Mcgibbney
-Client
lewis.mcgibbney@gmail.com

-Kenneth Thompson
-Student
thomkenn@oregonstate.edu



-Bryce Egley
-Student
egleyb@oregonstate.edu

Oregon State University