CS 205
Milestone 2
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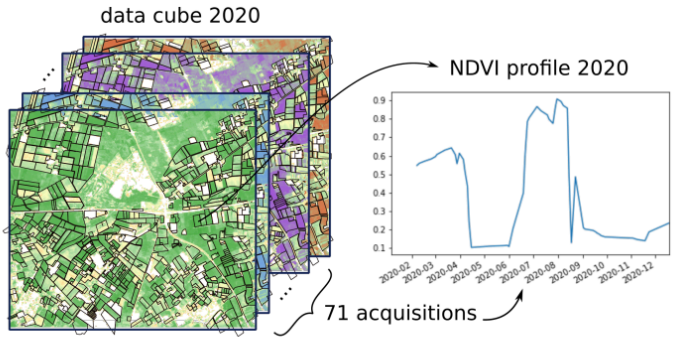
Project Proposal:

Our project aims to optimize computing resources for processing geospatial image data within the cloud computing infrastructure, AWS. We will explore parallelization through the integration of two strategies: image tiling and multi-threading. Our primary objective is to enhance processing efficiency and reduce processing time. The combination of tiling and multi-threading techniques has shown promising results in achieving maximum speedup.[1] However, we also acknowledge the trade-offs involved in this approach. While tiling enables parallel processing of image segments, it introduces overhead during image reading, leading to a portion of the program limited to serial execution. This is a MIMD setup.

We will conduct a quantitative assessment of speedup from our serial implementation to evaluate the potential and limitations of parallel processing through tiling and multi-threading. Our assessments will be based on an implementation utilizing APIs that abstracts platform-specific details, including those related to data access. The subject matter this project will be based on is a characterization of phenology (the cyclic pattern of sprouting, growing, harvesting) of different crop types along the agronomic year for each parcel of agricultural land. The geographic region we will be focusing on is water-resource region 17 (Pacific Northwest) of the United States which includes all of Washington, majority of Oregon and Idaho, and parts of California, Montana, Nevada, Utah, and Wyoming.[2]



Example of data cube **input** and output of crop phenology for one parcel of agricultural land.

Dataset Description:

The Copernicus SENTINEL-2 mission comprises two polar-orbiting satellites positioned in the same sun-synchronous orbit with a phase difference of 180°.[3] Its primary objective is to monitor changes in land surface conditions. The satellites offer a wide swath width of 290 km and a high revisit time, enabling effective monitoring of Earth's surface changes for agricultural crop analysis. Sentinel-2A was launched on June 23, 2015, followed by Sentinel-2B on March 7, 2017.

Libraries/APIs:

- *openEO* Python client library
- *pyjeo* image processing library
- *openMP* API

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[1] : Kempeneers, P.; Kliment, T.; Marletta, L.; Soille, P. Parallel Processing Strategies for Geospatial Data in a Cloud Computing Infrastructure. Remote Sens. 2022, 14, 398. https://doi.org/10.3390/ rs14020398

[2] https://water.usgs.gov/GIS/regions.html

[3] https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-2