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Satellite Imagery Analysis

Capstone by Lara Strachan

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What areas of Colorado are most vital to protect?

Can this question be answered by analyzing satellite imagery depicting biodiversity and human impact in the state?

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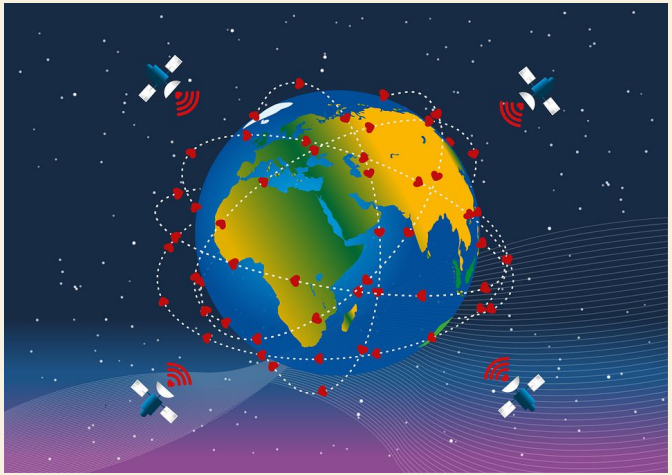
Background on Satellite Imagery

- Nearly 5k active satellites orbiting Earth at the beginning of 2022



- Spatial resolution (what each pixel represents on earth) and temporal resolution differs
- More than just “pictures” - different bands, or wavelengths, are recorded (spectral resolution)

Tools and methods

- GIS specific python libraries for working with geospatial data types
  - Rasterio, xarray, geopandas, etc
- Unsupervised learning methods for unlabeled data
  - k-Means
- Two of the best beginner friendly satellite data tools for collecting and satellite imagery
  - Sentinelhub’s EO Browser
  - Esri’s ArcGIS

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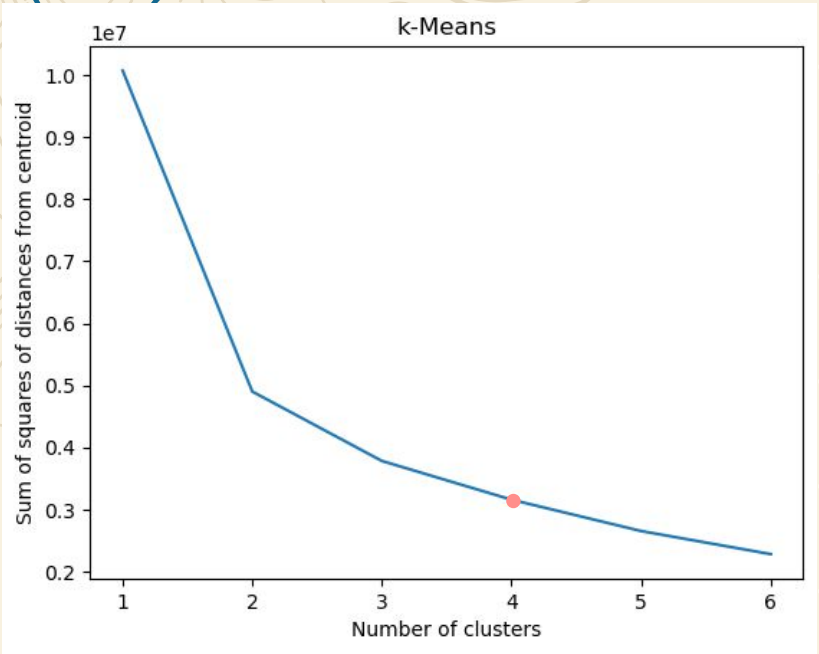

k-Means Clustering

- Unsupervised - no labeled data
- Segmenting land classes
- Identifying habitats and monitoring change in human development, forest change, etc

Satellite image from Sentinel-2 (area west of Denver)

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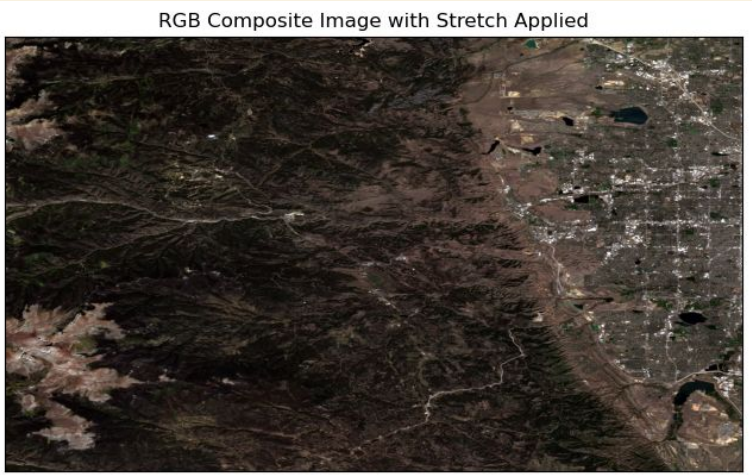
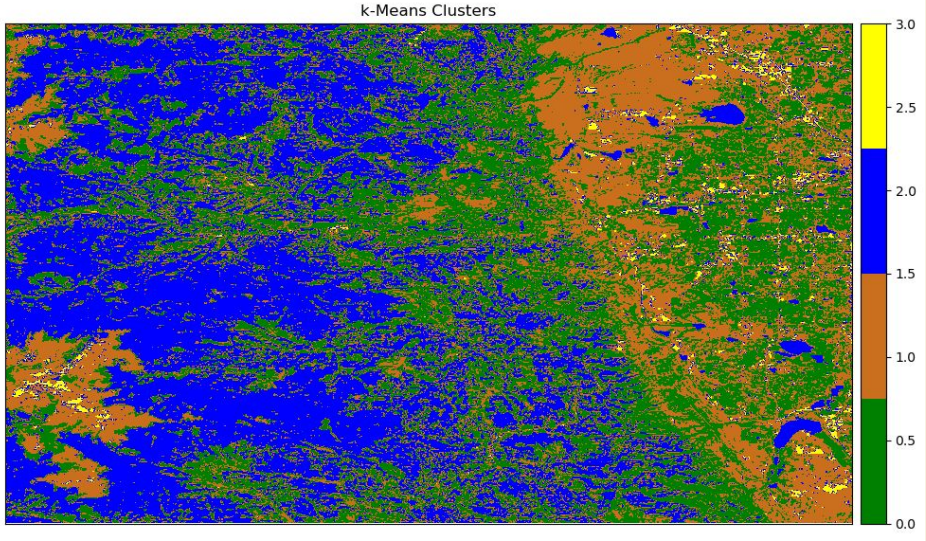
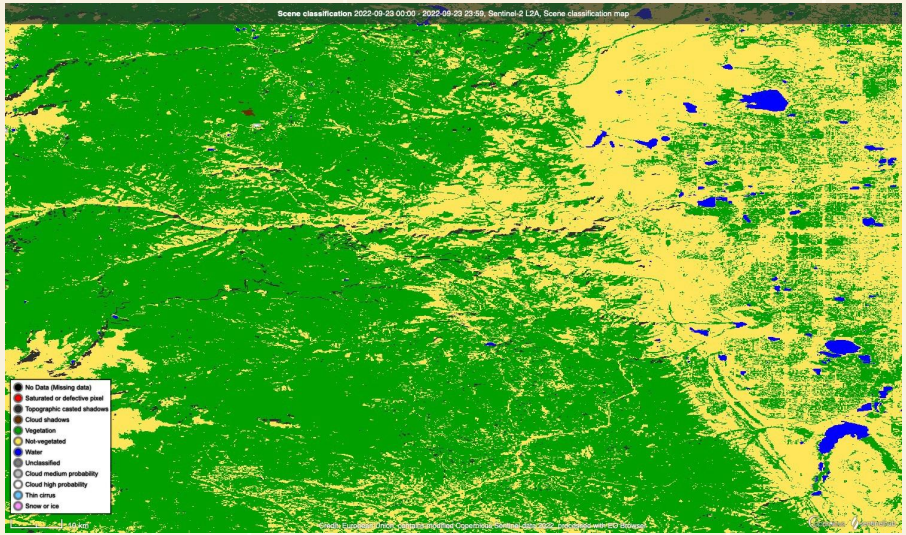
k-Means clusters from model



Classification map from Sentinel-2 processing products





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Features Used in ArcGIS map:

Biodiversity

Areas of unprotected biodiversity importance of imperiled species

Parks

Nat'l & State park or forest, regional, county, or local parks

Human Impact

Land cover vulnerability change by 2050

ArcGIS Web Map

Conclusions

- Visual analysis alone is not enough to make formal recommendations, however it can assist in honing in area of interest
- Areas around Gunnison and Grand Junction have overlap of imperiled biodiversity and vulnerability to land change by 2050
- Creating a resource of beginner friendly GIS data tools could be of value to others
- Leveraging the unique perspectives and info provided by satellite imagery could be an essential tool for finding new ways to live in harmony with our environment

References

https://www.statista.com/statistics/264472/number-of-satellites-in-orbit-by-operating-country/

Machine Learning Human Footprint Index
http://dx.doi.org/10.25675/10217/216207

Human Footprint Index
https://datadryad.org/stash/dataset/doi:10.5061/dryad.3tx95x6d9

Global Forest Change
https://earthenginepartners.appspot.com/science-2013-global-forest/download_v1.7.html

Sentinel-2 https://www.sentinel-hub.com/explore/eobrowser/