# LANDCOVER ANALYSIS USING SATELLITE DATA

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## Motivation and About the project

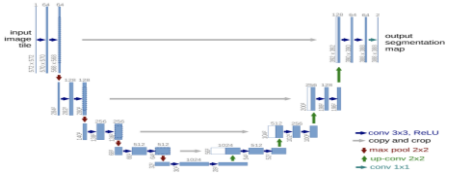
Population growth and the expansion of cities together with an increase in environmental pollution from human activity create non-principled changes in vegetative cover and land use in forestland built-up areas and agricultural land and increase the exertion of non-principled land productivity methods.
**Land cover** is the physical material at the surface of Earth. Land covers include grass, asphalt, trees, bare ground, water, etc. Two methods to capture information

- Survey and analysis of remotely sensed imagery.
- Land change models can be built from these types of data to assess future shifts in land cover.

## Workflow and Model

Acquiring Image Data → Image Data Filtering → Prediction of Model → Cleaning, EDA and Inference from Final Data

**U-Net** is an architecture for semantic segmentation. It consists of a contracting path and an expansive path. The contracting path follows the typical architecture of a convolutional network. ***We will be using the data along with their hand annotated masks for semantic segmentation.***




## Data and Labels

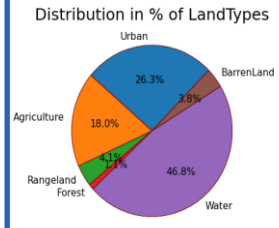
We use the **pystac** client API to access sentinel-2 satellite data collection on AWS.With the input latitude and longitude, firstly a 5km * 5km area is taken around that location and converted to a **geoJson** file which by using rasterio mask is converted to a **geotiff**.

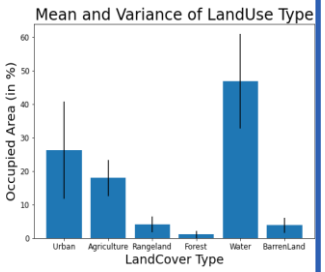
*GeoTiff* is a public domain metadata standard which allows georeferencing information to be embedded within a TIFF file. The potential additional information includes map projection, coordinate systems, ellipsoids, datums and everything else necessary to establish the exact spatial reference for the file.
**Dataset contains images of area (5km * 5 km) for every month between Jan 2016 to Sep 2022 for a desired location.**
*A handful of these images are hand annotated to create masks for training the model.*

## References

**Earth search(STAC Index API)-** https://stacindex.org/catalogs/earth-search#/
**Environmental impact and Assessment Audit-** *https://www.sciencedirect.com/topics/earth-and-planetary-sciences/land-cover-analysis#:~:text=The%20surface%20of%20the%20Earth,it%20is%20natural%20or%20manmade.*

## Results




| | Dates | Urban | Agriculture | Rangeland | Forest | Water | BarrenLand | Others |
|---|---|---|---|---|---|---|---|---|
| 0 | 2017-01 | 38.97 | 18.15 | 7.85 | 0.09 | 34.29 | 0.65 | 0.00 |
| 1 | 2017-02 | 1.72 | 22.94 | 8.37 | 3.94 | 62.28 | 0.76 | 0.00 |
| 2 | 2017-03 | 2.23 | 10.59 | 6.30 | 7.85 | 70.30 | 2.74 | 0.00 |
| 3 | 2017-04 | 26.24 | 17.94 | 4.07 | 1.09 | 46.78 | 3.79 | 0.09 |
| 4 | 2017-05 | 26.24 | 17.94 | 4.07 | 1.09 | 46.78 | 3.79 | 0.09 |

## Conclusion and Future Work

For the given location, in the past 5-6 years, there haven't been much change like urban expansion, deforestation/afforestation, etc. In fact, its hard to find places, where just in 5-6 years there are considerable changes in land-use. Also, the SENTINEL program started in 2016, so we are restricted to years after that. If we go to LANDSAT satellite images, there resolution in 30m and can never be used for semantic segmentation or classification.
But overall, the performance of our model is good enough, as the mean value of percentage land-use is almost correct as it appears from the above images. As it appears from the above image, our classification model has predicted all of the pixels almost correctly. It is visible that water, urban area and agriculture are the most dominant classes in the given image.
Problem is that in the last 5-6 years there have not been much changes in this area (or in any other area in the world), so we can't get real power of the developed model and the data pipeline. However, this can be a really good asset when this pipeline is applied on images acquired from premium satellites which have higher image resolution, thus can detect any minute changes in the land-cover.