AUTOMATED LAND USE PREDICTION MODEL

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GISC 6388

AGENDA

Create land use land cover map

Compare them

Detect change

Use change to Predict and Create an

Automated Land Use Prediction Model

INTRODUCTION

The popularity of satellite images has been seeing the upward trend since the early 2000s and is still ongoing. There are a lot of software including ArcGIS Pro, ERDAS Imagine, ENVI etc. that works with satellite images to detect changes and predict future land use. This proposal aims to introduce a model that will create a model to predict future land use change using arcpy.

OBJECTIVES

Previous

- Create land use land cover maps based on signatures (created on ArcGIS Pro/ ERDAS Imagine)
- Train the prediction model to detect changes using Random Forest Classifier
- Use the model to predict future land use
- Optional: Assess accuracy of the model

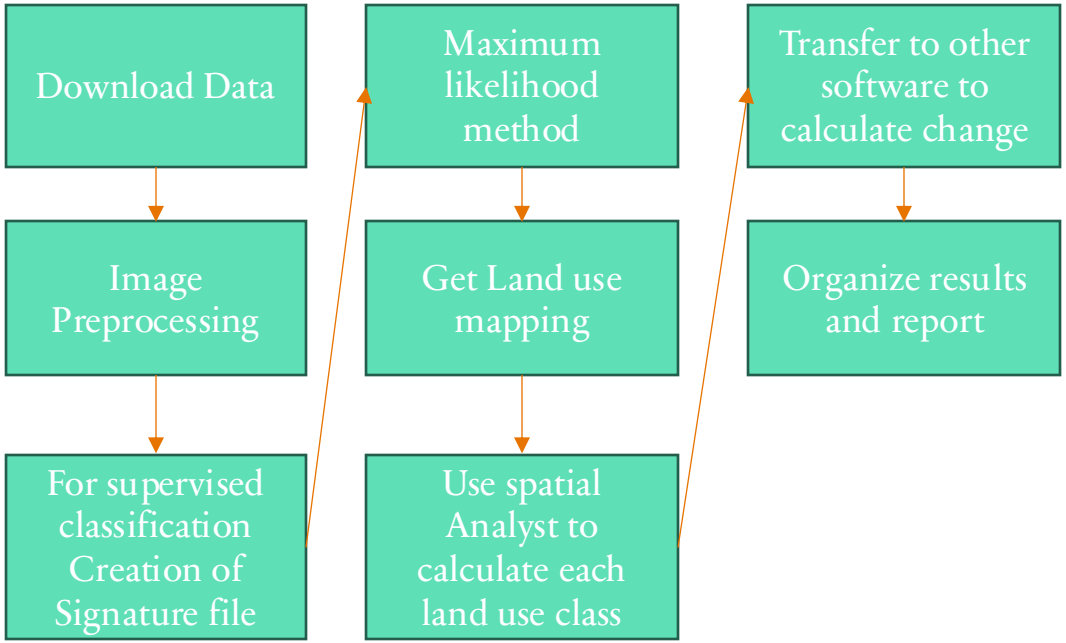
OBJECTIVES

Achieved

- Create land use land cover maps based on signatures (created on ERDAS Imagine)
- Detect changes using pixel values
- Use those changes to predict a future map

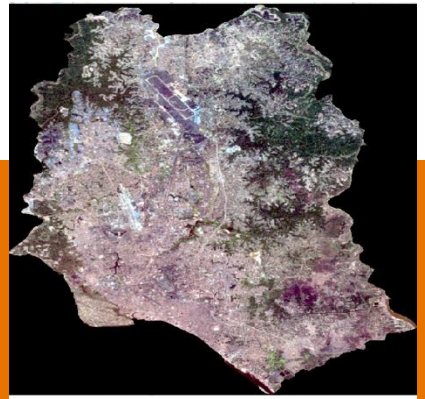
MOTIVATION

- General Work flow of calculating land use land cover change
- There are several other steps that have been excluded



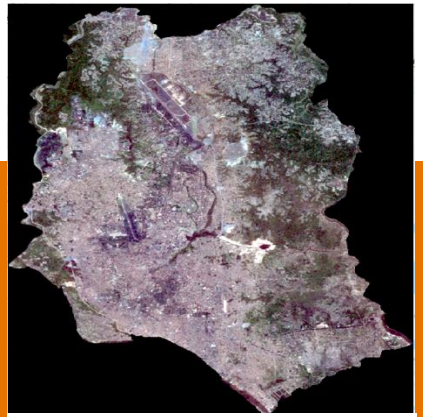
TO GET A PREDICTED LAND USE AT ONCE

DATA



LANDSAT 4

1989

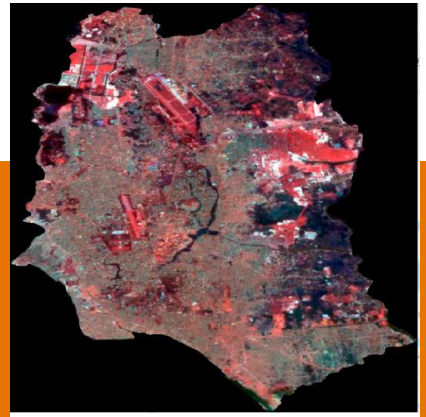


LANDSAT 5

1999

LANDSAT 8

2009



LANDSAT 8

2019

MY WORKFLOW

DOWNLOAD

USGS Website

PROCESSING

Layer stacking, mosaic, clip, correction, spatial reference etc.

PROCESSING

Signature file creation and supervised classification

STRATEGY

Create an ArcPy code to detect change and predict land use

RESULT

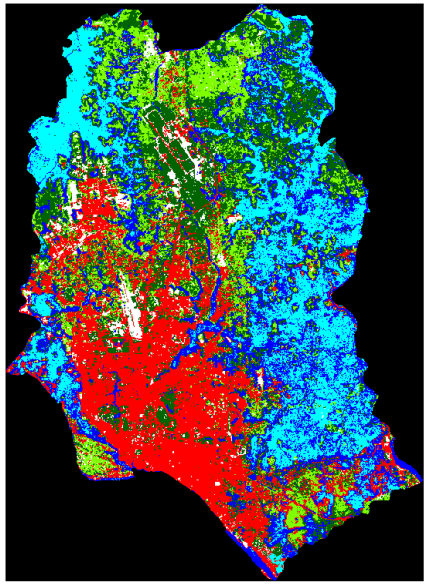
Prediction of Land Use in 2029

LAND USE LAND COVER

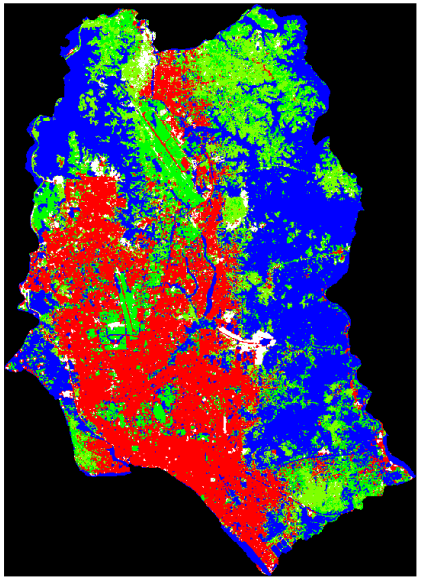
- Water (Value 1)
- Wetlands (Value 2)
- Built-up Areas (Value 3)
- Barren Lands (Value 4)
- Agricultural Land (Value 5)
- Vegetation (Value 6)

LULC

1989



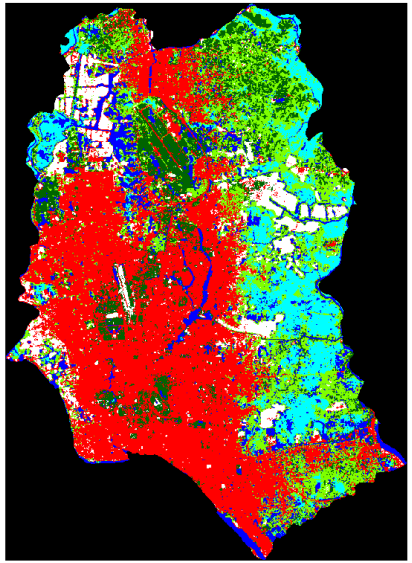
1999



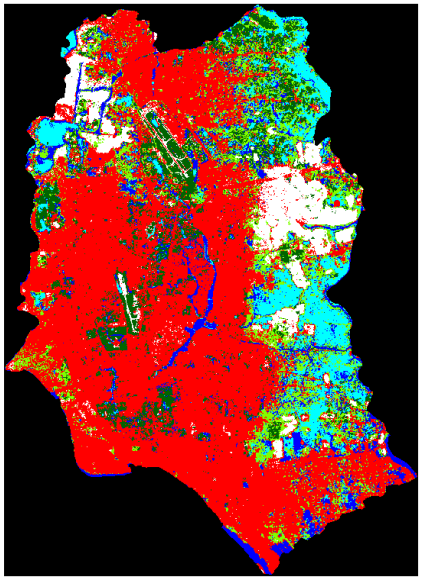
LULC

- Unclassified
- Water
- Wetland
- Vegetation
- Agricultural Land
- Built up Area
- Barren Land / Open Space

2009



2019



HOW I GET THERE

ARCPY

- All the classified images were converted to arrays
- Resized and resampled to match the resolution and dimensions
- Transition was calculated

ARCPY

- Pixel counts were stored in a dictionary based on class names and values were
- The change was calculated based on the difference of count of pixels per class from later year to previous year

ARCPY

- The code gave a list of change rates
- That was used to predict land use land cover for the year 2029

Sample Code

```
import arcpy
import numpy as np
from PIL import Image

# Check out Spatial Analyst extension
arcpy.CheckOutExtension("Spatial")
arcpy.env.workspace = r"K:\gis_work\Project6388\LULC"
arcpy.env.overwriteOutput = True

# Load classified raster data for all years
classified_1989 = arcpy.Raster(r"1989.img")
classified_1999 = arcpy.Raster(r"1999.img")
classified_2009 = arcpy.Raster(r"2009.img")
classified_2019 = arcpy.Raster(r"2019.img")

# Convert raster data to NumPy arrays
array_1989 = arcpy.RasterToNumPyArray(classified_1989)
array_1999 = arcpy.RasterToNumPyArray(classified_1999)
array_2009 = arcpy.RasterToNumPyArray(classified_2009)
array_2019 = arcpy.RasterToNumPyArray(classified_2019)

# Resize or resample all arrays to have the same shape (using interpolation)
target_shape = (1243, 1725)  # Define the target shape for resizing
array_1989_resized = np.array(Image.fromarray(array_1989).resize(target_shape))
array_1999_resized = np.array(Image.fromarray(array_1999).resize(target_shape))
array_2009_resized = np.array(Image.fromarray(array_2009).resize(target_shape))
array_2019_resized = np.array(Image.fromarray(array_2019).resize(target_shape))

# Define class names and their corresponding values
class_names = ["unclassified", "water", "wetland", "built up", "bare", "agriculture", "vegetation"]
class_values = [0, 1, 2, 3, 4, 5, 6]  # Corresponding values for each class

# Initialize dictionaries to store pixel counts for each transition and land use class
transitions = ["2019-2009", "2009-1999", "1999-1989"]
change_counts = {transition: {class_name: 0 for class_name in class_names} for transition in transitions}
change_rates = {transition: {class_name: 0 for class_name in class_names} for transition in transitions}

# Calculate pixel counts for each transition and land use class
for transition in transitions:
    current_year = int(transition.split("-")[0])
```

```
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import numpy as np
from PIL import Image
from arcpy.sa import *

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class_values = [0, 1, 2, 3, 4, 5, 6]  # Corresponding values for each class

# Define change rates manually based on printed results and include signs
change_rates = {
    "2019-2009": {
        "unclassified": 0.0,  # No change
        "water": -0.28,  # Decreased by 0.28%
        "wetland": +2.39,  # Increased by 2.39%
```
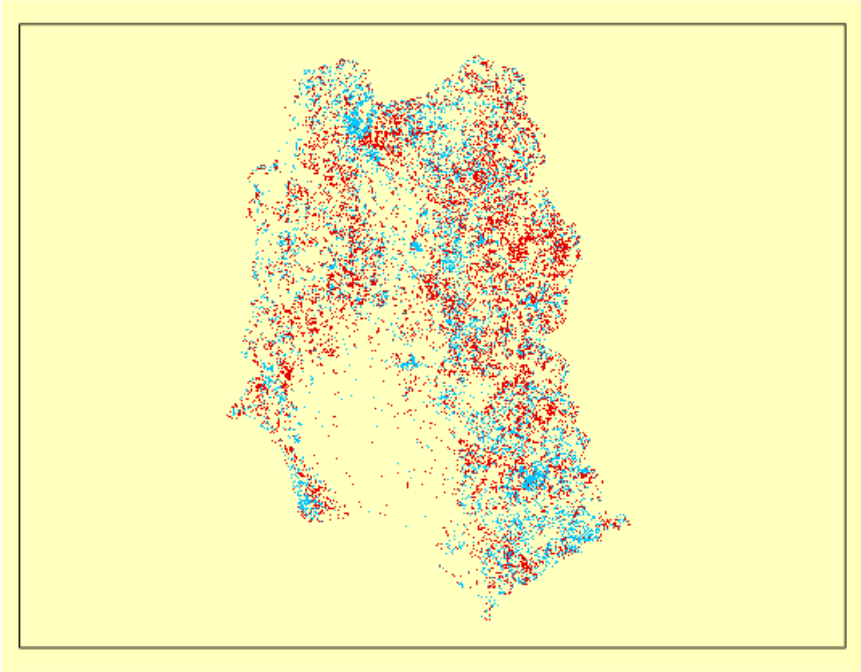

PREDICTED MAP



LIMITATION

- A geoprocessing tool would have been more convenient
- The results of the predicted land use for the year 2029 only consists of wetlands and built-up areas
- According to the model those are the only to land use land cover class that are increasing
- Although built up areas are undoubtedly increasing in the study area increase of wetland is doubtful
- The accuracy of the model has not been assessed

THANK YOU

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