```
#Water Bodies Detection from Satellite Imagery
```

water bodies in satellite imagery

```
pip install rasterio
```

```
#tif >> to stores satalite image
```

Tag Image File Format, abbreviated TIFF or TIF, is an image file format for storing raster graphics images, popular among graphic artists, the publishing industry, and photographers

```
#rasterio >> to view satalite image
```

Geographic information systems use GeoTIFF and other formats to organize and store gridded, or raster, datasets. Rasterio reads and writes these formats and provides a Python API based on N-D arrays.

```
import rasterio as rio
from rasterio.plot import show

# Mounting Google Drive
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.moun
```

```
ds=rio.open(r"/content/drive/My Drive/project/y_test.tif")
```

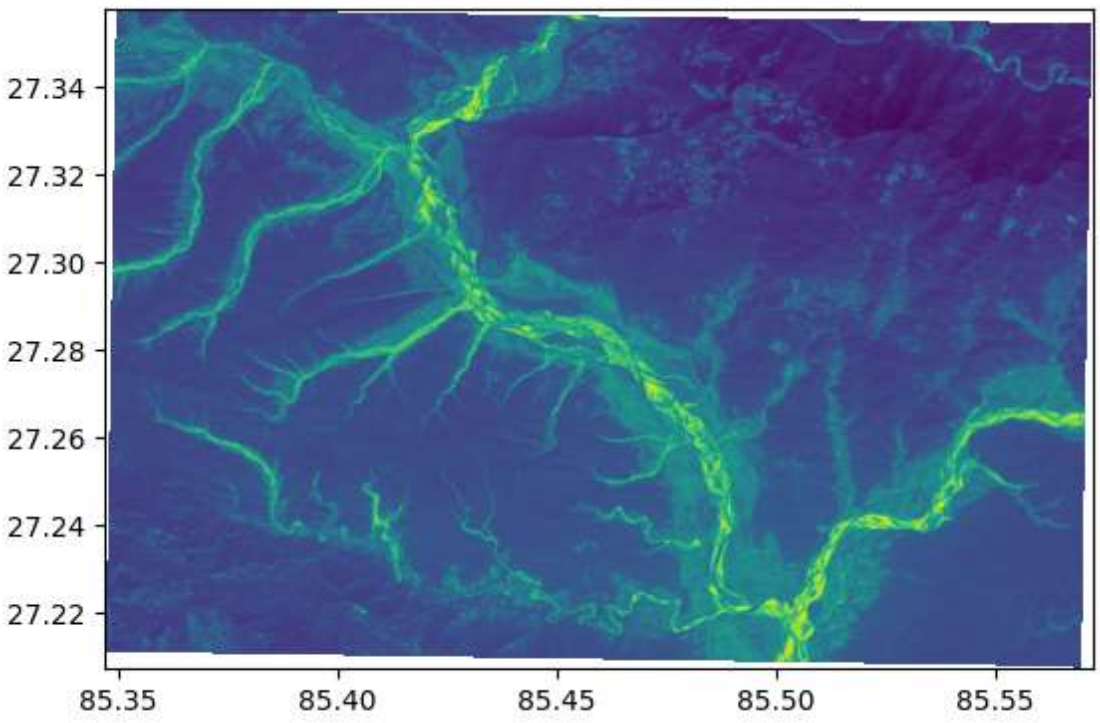
Saving...

```
ds.meta
```

```
{'driver': 'GTiff',
 'dtype': 'uint8',
 'nodata': None,
 'width': 2509,
 'height': 1677,
 'count': 1,
 'crs': CRS.from_epsg(4326),
```

```
        'transform': Affine(8.983152841195215e-05, 0.0, 85.34704868209909,
               0.0, -8.983152841195215e-05, 27.35792248327479)}
```

```
show(ds)
```



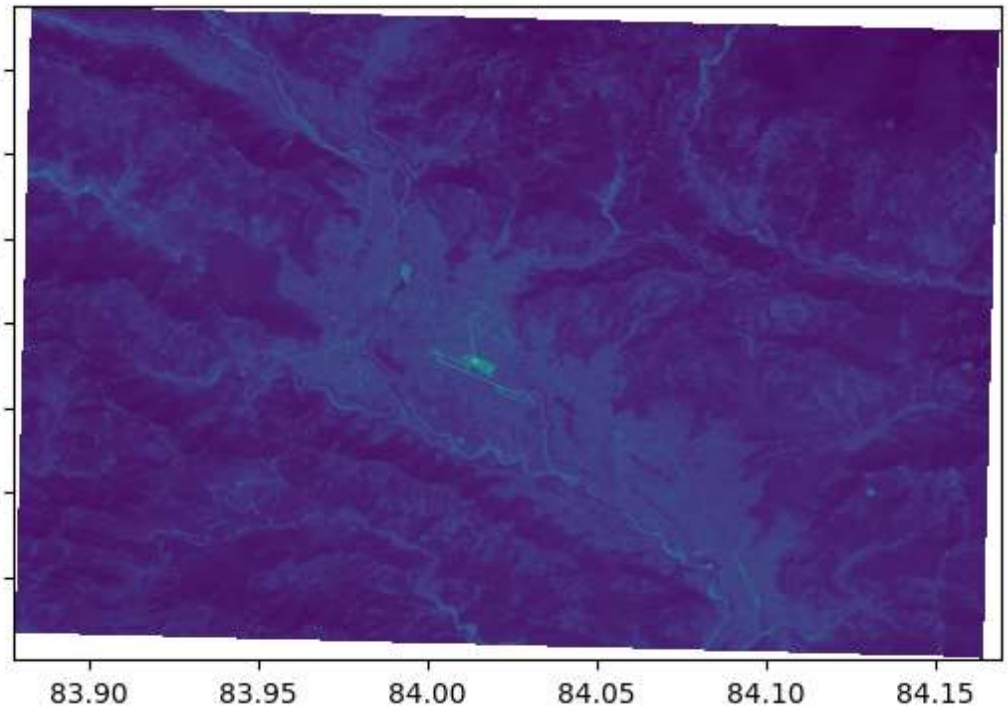

```
<Axes: >
```

```
ds=rio.open(r"/content/drive/My Drive/project/y_train.tif")
```

```
show(ds)
```

```
ds=rio.open(r"/content/drive/My Drive/project/X_train.tif")
```

```
show(ds)
```

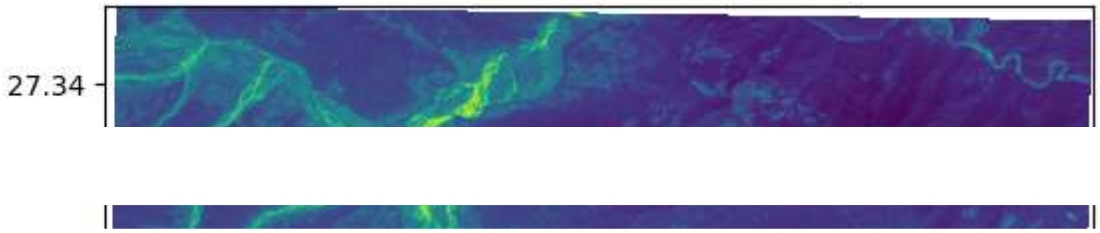



```
<Axes: >
```

```
ds=rio.open(r"/content/drive/My Drive/project/X_test.tif")
```

```
show(ds)
```

Saving...



Now Actual code is hear

```
import numpy as np
import matplotlib.pyplot as plt
import rasterio as rio
```

```
ds=rio.open(r"/content/drive/My Drive/project/X_train.tif")
```

```
arr= ds.read()
arr
```

```
array([[[nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        ...,
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan]],

       [[nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        ...,
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan]],

       [[nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        ...,
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan]],
```

Saving...

```
        [[nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        ...,
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan],
        [nan, nan, nan, ..., nan, nan, nan]]], dtype=float32)
```

```
arr=np.where(np.isnan(arr), 0,arr)
```

```
arr
```

```
array([[[0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        ...,
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.]],

       [[0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        ...,
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.]],

       [[0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        ...,
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.]],

       [[0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        ...,
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.],
        [0., 0., 0., ..., 0., 0., 0.]]], dtype=float32)
```

```
arr.shape

#4 show just like RBC
```

```
(4, 2147, 3246)
```

```
arr=np.moveaxis(arr, 0,-1)
arr.shape
```

Saving...

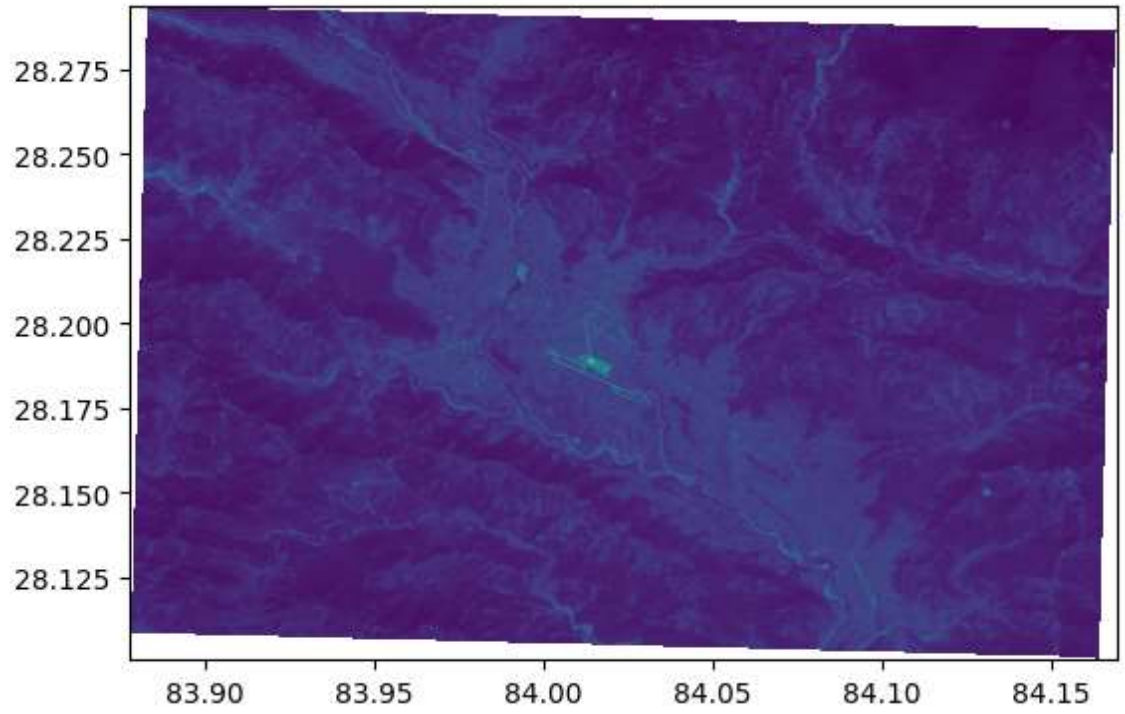
```
X_train=np.reshape(arr, (arr.shape[0]* arr.shape[1], arr.shape[2]))

X_train.shape  # row * col
```

```
(6969162, 4)
```

```
# writting all the code in one cell


ds=rio.open(r"/content/drive/My Drive/project/X_train.tif")
arr = ds.read()

arr = np.where(np.isnan(arr), 0, arr)
arr = np.moveaxis(arr, 0, -1)

nrow_train = arr.shape[0]
ncol_train = arr.shape[1]

X_train = np.reshape(arr, (arr.shape[0] * arr.shape[1], arr.shape[2]))
X_train.shape
```

```
(6969162, 4)
```

```
show(ds)
```




```
<Axes: >
```

Saving...

```
row_train, ncol_train, 4)
plt.imshow(X_train_reshaped)
plt.show()
```


```
ds=rio.open(r"/content/drive/My Drive/project/y_train.tif")

arr=ds.read()
arr = np.moveaxis(arr, 0, -1)
arr = np.where(arr == np.nan, 0, arr)
y_train = arr.reshape(-1)

# nrow_test = arr.shape[0]
# ncol_test = arr.shape[1]

y_train.shape
```

```
(6969162,)
```

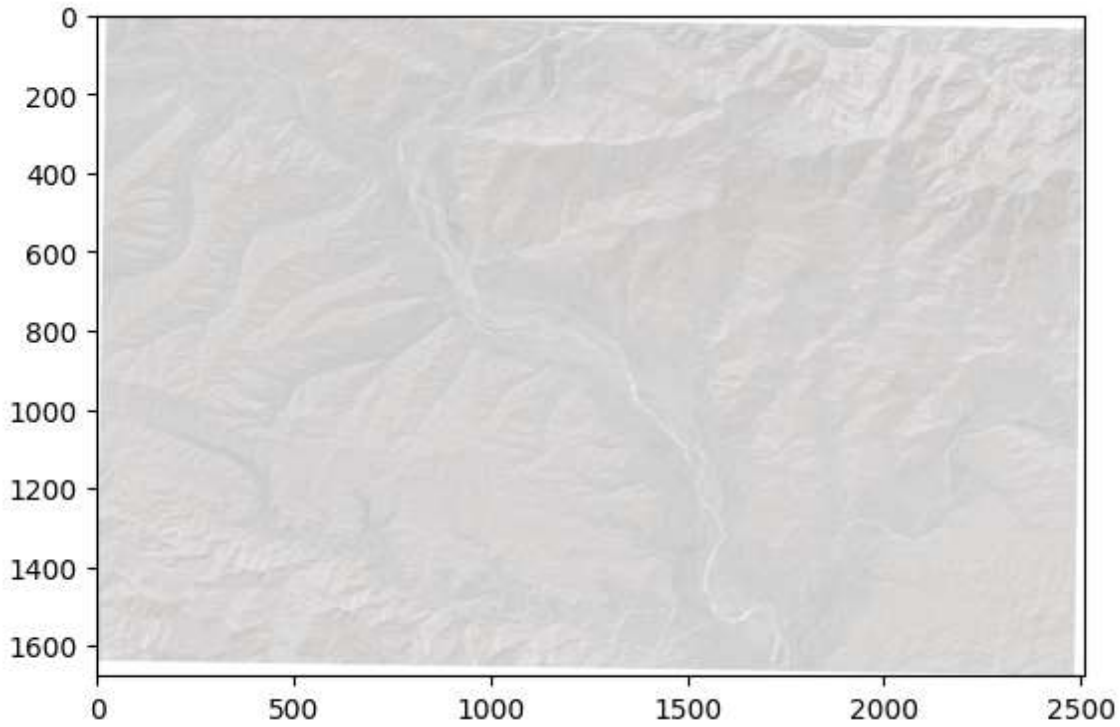
```
# ncol_test = arr.shape[1]
#ncol_train = arr.shape[1]  train or test same raha ga as it it jatna row and coloum ha


ds=rio.open(r"/content/drive/My Drive/project/X_test.tif")

arr = ds.read()
arr = np.moveaxis(arr, 0, -1)
arr = np.where(np.isnan(arr), 0, arr)

nrow_test = arr.shape[0]
```



```
X_test = np.reshape(arr, (arr.shape[0] * arr.shape[1], arr.shape[2]))
X_test.shape
```

```
(4207593, 4)
```

```
X_test_reshaped = X_test.reshape(nrow_test, ncol_test, 4)
plt.imshow(X_test_reshaped)
plt.show()
```




```
ds=rio.open(r"/content/drive/My Drive/project/y_test.tif")

arr = ds.read()
arr = np.moveaxis(arr, 0, -1)
arr = np.where(np.isnan(arr), 0, arr)
y_test = arr.reshape(-1)

nrow_test = arr.shape[0]
ncol_test = arr.shape[1]

y_test.shape
```



```
from sklearn.ensemble import RandomForestClassifier


rfc = RandomForestClassifier(n_estimators=10, random_state=42, verbose=3, n_jobs=-1)
```

```
rfc.fit(X_train,y_train)
```

```
[Parallel(n_jobs=-1)]: Using backend ThreadingBackend with 2 concurrent workers.
building tree 1 of 10
building tree 2 of 10
building tree 3 of 10
building tree 4 of 10
building tree 5 of 10
building tree 6 of 10
building tree 7 of 10
building tree 8 of 10
building tree 9 of 10
building tree 10 of 10
[Parallel(n_jobs=-1)]: Done  10 out of  10 | elapsed:  3.3min finished
```

```
RandomForestClassifier(n_estimators=10, n_jobs=-1, random_state=42, verbose=3)
```

```
y_pred = rfc.predict(X_test)
```

```
[Parallel(n_jobs=2)]: Using backend ThreadingBackend with 2 concurrent workers.
[Parallel(n_jobs=2)]: Done  10 out of  10 | elapsed:   12.3s finished
```

```
from sklearn.metrics import classification_report
```

```
# o > non water bodies and 1 > water bodies
```

```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           0       0.88      1.00      0.94   3682263
           1       0.71      0.06      0.12    525330

    accuracy                           0.88   4207593
   macro avg       0.80      0.53      0.53   4207593
weighted avg       0.86      0.88      0.83   4207593
```

Saving...

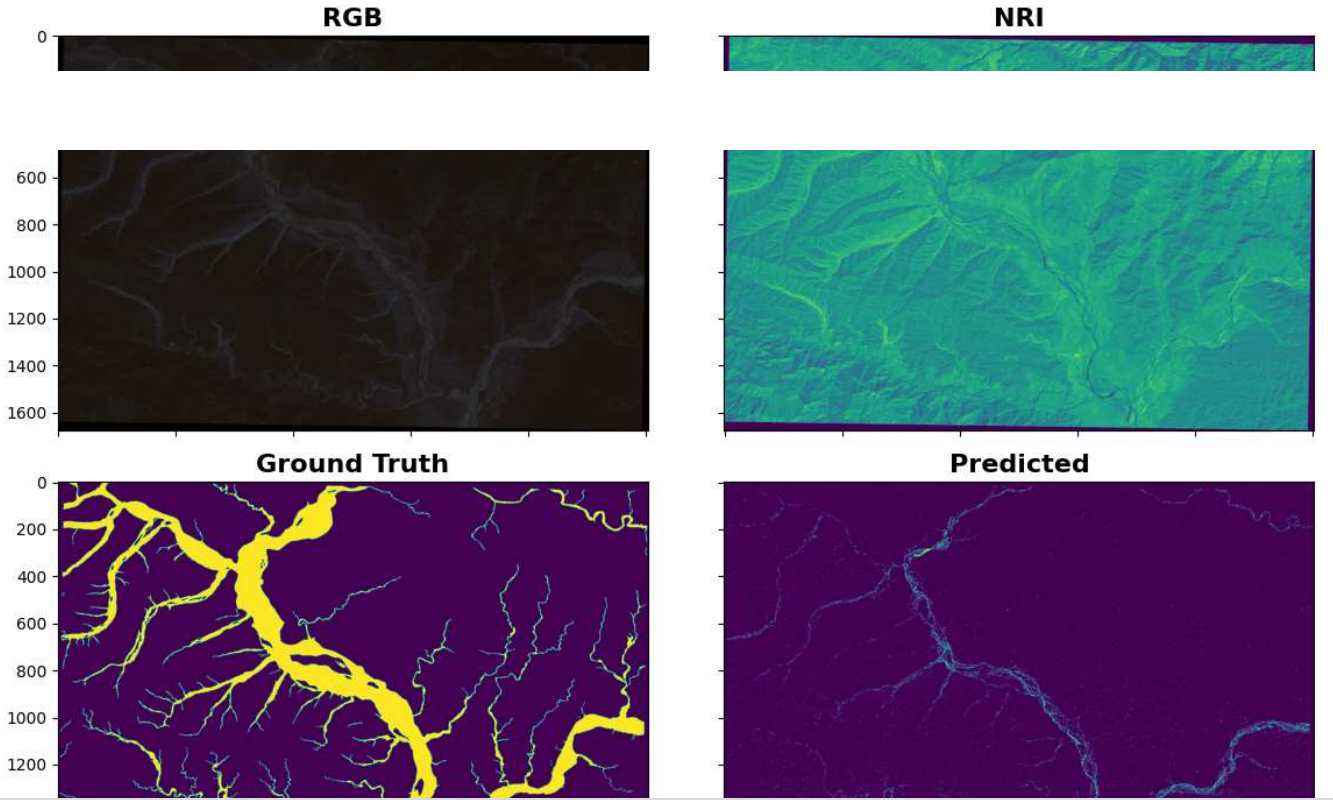
```
#y_test same
```

```
(4207593,)
```

```
y_pred_reshaped = y_pred.reshape(nrow_test, ncol_test)
y_test_reshaped = y_test.reshape(nrow_test, ncol_test)
X_test_reshaped = X_test.reshape(nrow_test, ncol_test, 4) # 4 x_test wala ka ha jo RBC ka jasa
print(y_pred_reshaped.shape, X_test_reshaped.shape)
```

```
(1677, 2509) (1677, 2509, 4)
```

```
fig, axes = plt.subplots(nrows=2, ncols=2, sharex=True, sharey=True, figsize=(12,8))
ax1, ax2, ax3, ax4 = axes.flatten()

ax1.set_title("RGB", fontweight='bold', fontsize='16')
ax1.imshow(X_test_reshaped[:,:,:3])  # 3 RGB

ax2.set_title("NRI", fontweight='bold', fontsize='16')
ax2.imshow(X_test_reshaped[:,:,-1])  # 4 th value is NRI

ax3.set_title("Ground Truth", fontweight='bold', fontsize='16')
ax3.imshow(y_test_reshaped[:,:])

ax4.set_title("Predicted", fontweight='bold', fontsize='16')
ax4.imshow(y_pred_reshaped[:,:])

plt.tight_layout()

plt.show()
```



✓ 3s completed at 1:32 AM

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Saving...