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**!pip install rasterio**

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**Requirement already satisfied: rasterio in /usr/local/lib/python3.10/dist-packages (1.3.9) Requirement already satisfied: affine in /usr/local/lib/python3.10/dist-packages (from rasterio) (2.4.0**) **Requirement already satisfied: attrs in /usr/local/lib/python3.10/dist-packages (from rasterio) (23.2.0**) **Requirement already satisfied: certifi in /usr/local/lib/python3.10/dist-packages (from rasterio) (2024.2.2) Requirement already satisfied: click>=**4.0 **in /usr/local/lib/python3.10/dist-packages (from rasterio) (8.1.7) Requirement already satisfied: cligj>**=**0.5 in /usr/local/lib/python3.10/dist-packages (from rasterio)** (0.7.2**) Requirement already satisfied: numpy in /usr/local/lib/python3.10/dist-packages (from rasterio) (1.25.2) Requirement already satisfied: snuggs>=1.4.1 in /usr/local/lib/python3.10/dist-packages (from rasterio) (1.4.7**) **Requirement already satisfied: click-plugins in /usr/local/lib/python3.10/dist-packages (from rasterio) (1.1.1) Requirement already satisfied: setuptools in /usr/local/lib/python3.10/dist-packages (from rasterio) (67.7.2) Requirement already satisfied: pyparsing>=2.1.6 in /usr/local/lib/python3.10/dist-packages (from snuggs>=1.4.1->ra**

**import rasterio**

**import numpy as np**

**import cv2**

**import matplotlib.pyplot as plt**

**# StepStep 1: Read satellite imagery**

**with rasterio.open**('X\_test.tif'**) as src:**

**# Read different bands from the satellite image**

**nir\_band = src.read(4) # Near-infrared band (indexing starts from 1) green\_band = src.read(3)**

**blue\_band**

**red\_band**

=

=

**# Green band**

**src.read(2) # Blue band**

**src.read**(1**) # Red band**

**plt.imshow(np.dstack((red\_band, green\_band, blue\_band))) plt.title(**'**Original Satellite Image**'**)**

**plt.axis('off**')

**(**-0.5**, 2508.5, 1676.5,** -0.5**)**

Original Satellite Image

**# Step 2: Compute NDWI (Normalized Difference Water Index)**

**ndwi**

=

**np.where((nir\_band + green\_band)**

**(nir\_band**

-

**==** 0.**,** 0,

**green\_band) / (nir\_band + green\_band))**

**plt.imshow(ndwi, cmap**='**RdYlBu**'**)**

**plt.title**(**'Normalized Difference Water Index (NDWT)')**

**https://colab.research.google.com/drive/1en\_41iPw4OGVjgkOWwt\_mjYFfXpl6K12#scrollTo=JC3IWOPOP01k&printMode=true**

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**plt.colorbar (label=**'**NDWI Value**') **plt.axis('off**'**)**

**(-0.5, 2508.5, 1676.5,** -0.5**)**

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Normalized Difference Water Index (NDWI)

0.6

0.5

0.4

0.3

0.2

0.1

0.0

-0.1

NDWI Value

**# Step 3: Thresholding**

**threshold =** 0.1

**water\_mask = np.where(ndwi > threshold, 1,** 0)

**# Step** 4: **Post-processing (Optional)**

**kernel**

=

**np.ones((5, 5), np.uint8)**

**water\_mask** = **cv2.morphologyEx(water\_mask.astype**(**np.uint8),**

**cv2.MORPH\_CLOSE, kernel)**

**plt.imshow(water\_mask, cmap=**'**Blues**'**)**

**plt.title(**'**Detected Water Bodies**'**)**

**plt.axis(**'**off**')

**(-0.5, 2508.5, 1676.5,** -0.5**)**

Detected Water Bodies

**https://colab.research.google.com/drive/1en\_41iPw4OGVjgkOWwt\_mjYFfXpl6K12#scrollTo=JC3IWOPOP01k&printMode=true**

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**#step 5:Overlay water mask with transparency plt.imshow(np.dstack((red\_band, green\_band, blue\_band))) plt.imshow(water\_mask, cmap=**'**Blues', alpha**=0.3) **plt.title(**'**Water Bodies Overlay'**)

**plt.axis(**'**off**')

**(-0.5, 2508.5, 1676.5, -0.5)**

Water Bodies Overlay

**https://colab.research.google.com/drive/1en\_41iPw4OGVjgkOWwt\_mjYFfXpl6K12#scrollTo=JC3IWOPOP01k&printMode=true**

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