17. Given Google Maps satellite views of a city, identify the amount of greenery, urban cover

Github link: https://github.com/anirudh456/DIP_project_Greenery_Cover

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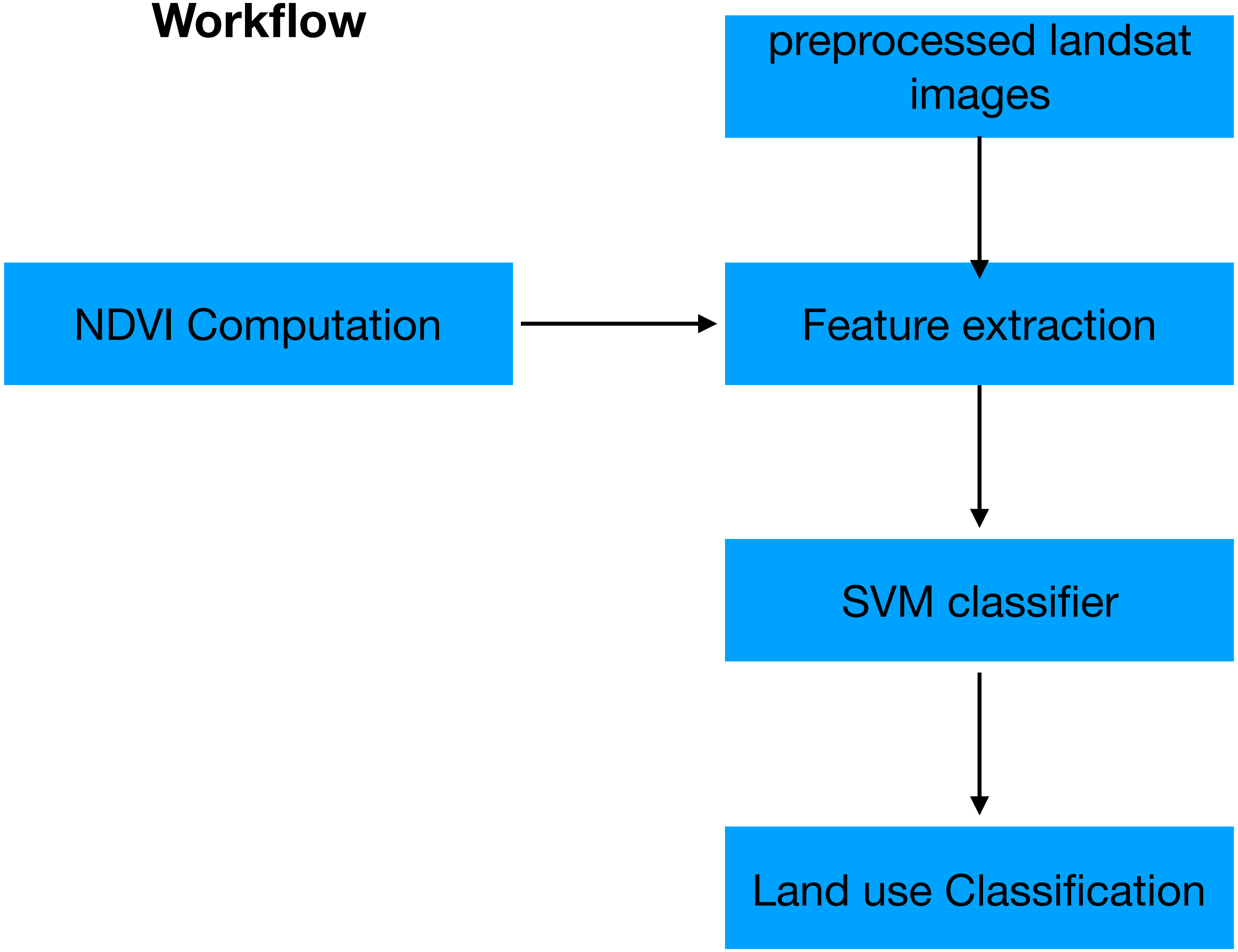
Overview

Given Google Satellite view of a city, identify the amount of greenery and urban cover.Green spaces play an important role in deciding the quality of life in urban areas. They decide the local micro-climate and the regional climate of the city .Therefore it is important to know the amount of green cover of an area.

Workflow


preprocessed landsat images
NDVI Computation
Feature extraction
SVM classifier
Land use Classification

Datasets

1.We are using the Landsat-8 satellite images for our project.
2.The various bands of the Landsat-8 images are shown below

Band	Wavelength	Useful for mapping
Band 1 – Coastal Aerosol	0.435 - 0.451	Coastal and aerosol studies
Band 2 – Blue	0.452 - 0.512	Bathymetric mapping, distinguishing soil from vegetation, and deciduous from coniferous vegetation
Band 3 - Green	0.533 - 0.590	Emphasizes peak vegetation, which is useful for assessing plant vigor
Band 4 - Red	0.636 - 0.673	Discriminates vegetation slopes
Band 5 - Near Infrared (NIR)	0.851 - 0.879	Emphasizes biomass content and shorelines
Band 6 - Short-wave Infrared (SWIR) 1	1.566 - 1.651	Discriminates moisture content of soil and vegetation; penetrates thin clouds
Band 7 - Short-wave Infrared (SWIR) 2	2.107 - 2.294	Improved moisture content of soil and vegetation and thin cloud penetration
Band 8 - Panchromatic	0.503 - 0.676	15 meter resolution, sharper image definition
Band 9 – Cirrus	1.363 - 1.384	Improved detection of cirrus cloud contamination
Band 10 – TIRS 1	10.60 – 11.19	100 meter resolution, thermal mapping and estimated soil moisture
Band 11 – TIRS 2	11.50 - 12.51	100 meter resolution, Improved thermal mapping and estimated soil moisture

Method:

1. We can do the classification just using the r, g, b bands of the Landsat image
2. But for a better and more accurate classification, we can compute the NDVI value and use it as one the features for classification.

NDVI computing

The Normalised Difference Vegetation Index (NDVI) is one of the most widely used numerical indicator that uses the visible(VIS) and near-infrared brands (NIR) of the electromagnetic spectrum and it is utilised to analyse remote sensing images and assesses whether the target contains live green vegetation or not .

Live green plants absorb solar radiation in the photosynthetically active radiation (PAR) spectral region, which they use as a source of energy in the process of photosynthesis. Leaf cells have also evolved to re-emit solar radiation in the near-infrared spectral region.

The NDVI is calculated from these individual measurements as follows:

$$NDVI = (NIR - Red) / (NIR + Red)$$

where red and NIR stand for the spectral reflectance measurements acquired in the red (visible) and near-infrared regions, respectively.

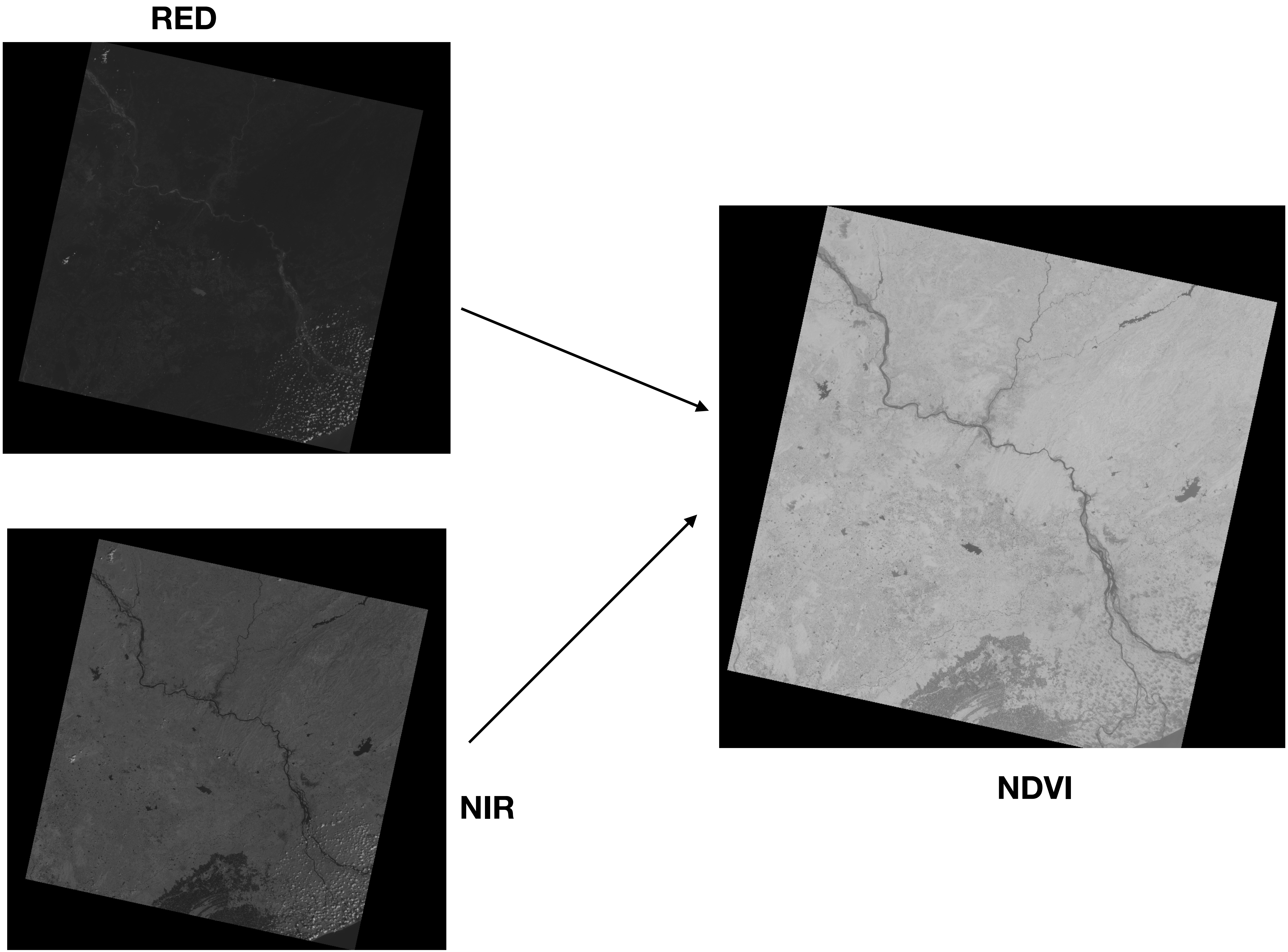
NDVI value varies between -1.0 and +1.0.

when you have negative values, it's highly likely that it's water. On the other hand, if you have a NDVI value close to +1, there's a high possibility that it's dense green leaves.

But when NDVI is close to zero it could be an urbanised area.

It can be seen from its mathematical definition that the NDVI of an area containing a dense vegetation canopy will tend to positive values (say 0.3 to 0.8) while clouds and snow fields will be characterised by negative values of this index. Other targets on Earth visible from space include

- free standing water (e.g., oceans, seas, lakes and rivers) which have a rather low reflectance in both spectral bands (at least away from shores) and thus result in very low positive or even slightly negative NDVI values,
- soils which generally exhibit a near-infrared spectral reflectance somewhat larger than the red, and thus tend to also generate rather small positive NDVI values (say 0.1 to 0.2).


RED
NIR
NDVI

Milestones left:

1. Complete the SVM classifier using the NDVI values as one of the features calculated from above.
2. Testing the Classifier over large datasets and find the accuracy.
3. Calculate the percentage of green cover and urban cover.

Challenges:

1. Calculating the green cover when there is a cloud cover in the satellite image
2. When there is shadow of a Tall building effecting the surrounding area
3. When the roof of the buildings have are having a shade of green