

Assignment-02

Remote Sensing

and GIS

Name - Parth Garg

Roll - 11T2021116

① Useful bands for remote sensing:

- Vegetation - Bands sensitive to chlorophyll content, such as NIR and Red Edge bands (in the range of 700-800nm), are useful for studying vegetation health, type, and density. These bands are sensitive to vegetation vigor and can distinguish between healthy and stressed vegetation.
- Urban Area - Urban areas are characterized by different materials like Buildings, roads, and vegetation within a compact area. Bands in the visible and near-infrared regions (such as Red and NIR bands) are helpful for distinguishing between these materials. Additionally, Shortwave infrared (SWIR) bands can help in identifying man-made materials like concrete and asphalt.
- Water Area :- Water bodies have unique spectral signatures, especially in the SWIR region. Bands like Band 11 (1.64µm) and Band 12 (2.2µm) in Landsat-8 and Sentinel-2 are sensitive to water.

absorption features, allowing for differentiation between land and water areas.

② Procedure for Extracting ROI and Sampling:

- ROI Extraction - Use software like QGIS, ArcGIS, or specialized remote sensing software to delineate the region of interest (ROI) using shapefiles or polygons. This can be done manually by digitizing or automatically using classification algorithms.
- Sampling - For land cover classification, representative samples should be taken per cover type within the ROI. The number of samples depends on the variability within each class and the desired accuracy level. Typically, 20 to 30 samples per class are recommended to capture the spectral variability accurately.

③ Pure pixel vs Mixed pixel and Information Extraction:

- Pure pixel - A Pure pixel represents a single ground cover type within a pixel. For example, a pixel containing only vegetation or only water.

- Mixed Pixel - A mixed pixel contains multiple cover types within a single pixel. For example, a pixel containing both vegetation and bare soil.

• Information Extraction from mixed pixel -

Spectral unmixing models like Linear Spectral unmixing (LSU) or Multiple Endmember Spectral Mixture Analysis (MESMA) can be used to estimate the proportions of different cover types within a mixed pixel. These models use Spectral Signatures of known materials (endmembers) to unmix the Spectral Signature of a mixed pixel and determine the fractions of each endmember present.

④ DEM vs. DTM -

- DEM (Digital elevation model) -

Represents the elevation of the Earth's surface without considering any objects like buildings or vegetation.

- DTM (Digital Terrain Model) -

Represents the bare Earth surface without any objects like buildings, trees, or other structures.

Method to create DEM:

DEMs are often created using LiDAR (Light Detection and Ranging) data or by deriving elevation information from stereo satellite imagery.

⑤ Minimizing Errors in GIS Data Collections -

- use high-resolution imagery or LiDAR data for accurate mapping.
- Ground truthing and validation are crucial to identify and correct errors.
- utilize quality control measures during data collection and processing to minimize errors.
- Errors can propagate if not corrected initially, leading to inaccurate analysis and decision-making.

⑥ Metadata in GIS -

- Metadata provides essential information about GIS data such as source, accuracy, projection, and creation date.
- It helps in understanding the data's quality, suitability, and reliability for specific applications.
- Metadata can be collected during data acquisition, processing, and storage stages using standardized formats like ISO 19115.

⑦ Elements of visual inspection:-

- Texture - Texture refers to spatial arrangement and frequency of tonal variations within an image.
→ In Prayagraj region, urban areas exhibit rough texture due to presence of buildings, roads etc. Grass fields has smooth texture.
- Pattern - It is the spatial arrangement of features on ground, which can be natural or human-made.

→ In Prayagraj region, urban areas like: civil lines exhibit a grid-like pattern, with roads and buildings ~~arrangements~~ arranged in regular, geometric layout.

- color or tone - It reveals about the composition and characteristics of image.

→ In Prayagraj region, Gomti river appears in shades of blue, indicating water bodies.

- Shape - The shape of feature can provide valuable information about their identity and characteristics.

→ In Prayagraj region, the confluence of Ganges and Yamuna rivers would create a distinctive Y shape. IITM campus have rectangular shape.

- Association - It refers to spatial relationship between different features in an image.

→ In Prayagraj region, Presence of ~~ghats~~ ~~and~~ ~~temple~~ ghats and temples along the banks of Ganges and Yamuna rivers indicate their cultural and religious significance.

⑧ TP and FN in a Confusion Matrix -

- True Positive (TP) - Instances correctly classified as belonging to a specific class.
- False Negative (FN) - Instances of a class incorrectly classified as another class.

Example confusion Matrix -

For Four classes A, B, C, D -

Actual / Predicted	Class A	Class B	Class C	Class D
Class A	TP	FN	FN	FN
Class B	FP	TP	FN	FN
Class C	FN	FP	TP	FN
Class D	FN	FN	FP	TP

In this Confusion matrix -

- Class A has TP instances correctly classified as A but misclassified B, C, D (FN)
- Class B has TP instances correctly classified as B but misclassified as A, C, and D (FP)
- Class C has TP instances correctly classified as C but misclassified as A, B, and D (FP)
- Class D has TP instances correctly classified as D but misclassified as A, B and C (FP)