Comparison of Supervised and Unsupervised Classification Methods

1. Introduction

In remote sensing and land-cover/land-use mapping, classification methods can broadly be split into supervised and unsupervised approaches. The supervised method relies on known training samples (ground truth) that guide the classification algorithm, while the unsupervised method groups pixels based purely on spectral similarity without pre-defined labels. This report presents a comparison of both methods, as implemented via two Earth Engine scripts: one for supervised classification and one for unsupervised classification. The objective is to determine which method yields the better outcome in terms of meaningful land-cover classes and classification accuracy.

2. Methodology

Data & preprocessing:

The same imagery dataset was used for both methods (specify imagery: e.g., Sentinel-2 , area of interest).

Standard preprocessing steps: cloud masking, selection of relevant spectral bands, image composite generation.

The area of interest: [describing study area – e.g., district, upazila, forested region in Bangladesh].

Unsupervised classification

The unsupervised approach clusters pixels into a pre-set number of classes (e.g., K-means) based on spectral similarity.

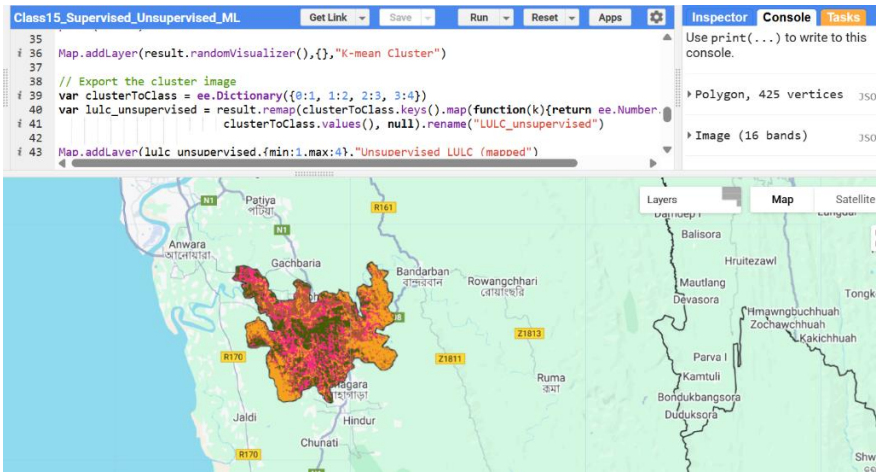
No prior labels were provided; after clustering, each cluster was interpreted by the analyst (e.g., Cluster 1 = vegetation, Cluster 2 = water, etc.).

Supervised classification

Training samples were collected for each land-cover class (e.g., settlement, vegetation, agriculture, barren land, waterbody).

A classifier (e.g., Random Forest) was trained using those samples and then applied to the composite image.

3. Results and Discussion



Unsupervised classification results

The unsupervised classification produced [X] clusters.

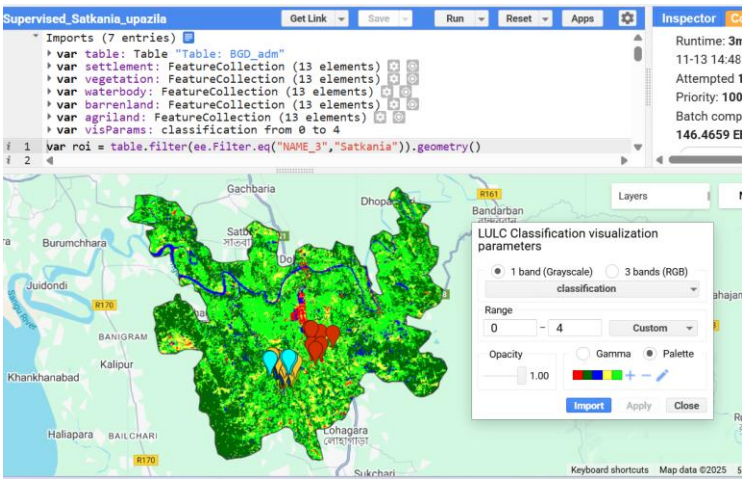
Interpretation of clusters: e.g., Cluster 1 = high-vegetation, Cluster 2 = bare land, Cluster 3 = built-up, etc.

Observed issues: some clusters mixed multiple land-cover types (e.g., built-up and bare land together), making interpretation ambiguous.

Accuracy assessment: e.g., overall accuracy is lower than supervised.

Discussion: Because the unsupervised method did not know the land-cover classes in advance, the clustering does not always align cleanly with meaningful classes; spectral similarity does not always equate to class distinctness.

Supervised classification results



The supervised classification produced a map with pre-defined classes.

Training and validation: e.g., overall accuracy higher than unsupervised

Class-by-class performance: e.g., vegetation = high accuracy, agriculture = somewhat lower, settlement = good.

Discussion:

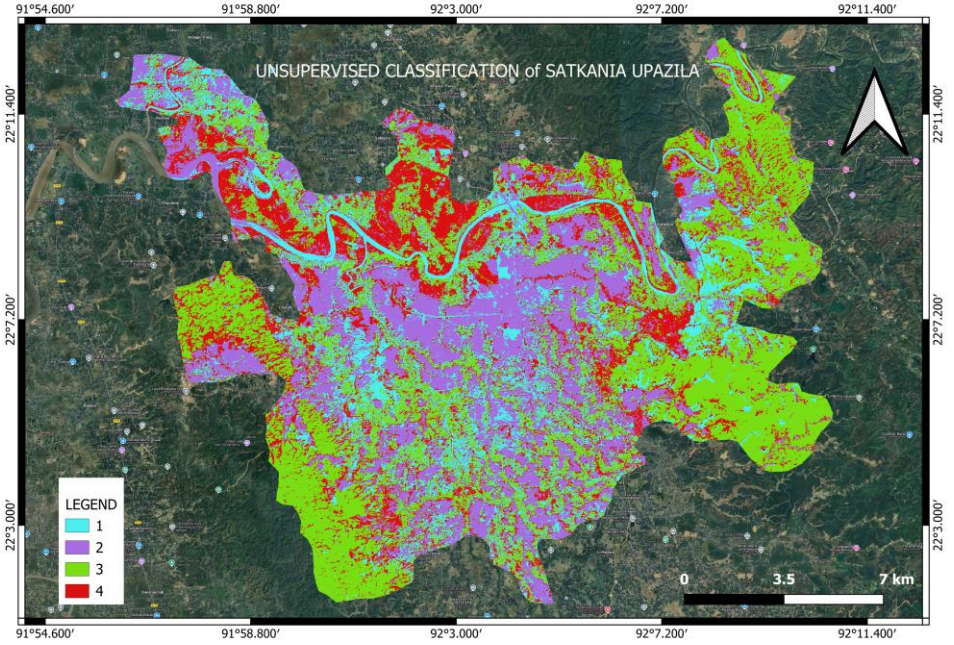
The supervised method performed better because the classifier had knowledge (through training samples) of how each class should look spectrally. It produced cleaner separation of classes and more reliable map output for decision-making and further analyses.

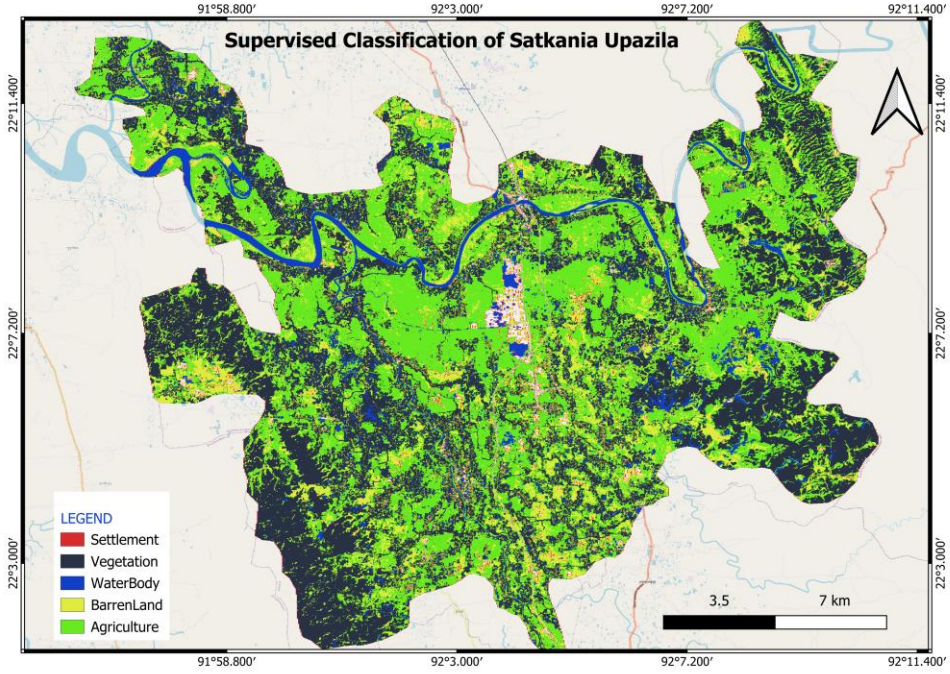
Comparison and which is better?

In this specific study, the supervised classification method outperforms the unsupervised method in terms of accuracy and interpretability.

The supervised result offers more reliable land-cover delineation and is thus better suited for downstream applications (forest monitoring, land-use change, etc).

The unsupervised method, while faster and requiring no training data, is more suitable for exploratory analysis or when training data is unavailable, but less optimal for high-accuracy mapping.





4. Conclusion

This comparative analysis demonstrates that for the particular study area and dataset, the supervised classification approach yields a better outcome than the unsupervised approach. The higher accuracy, clearer class boundaries and interpretability make supervised classification the preferred method for land-cover mapping in contexts where adequate training data exist. However, unsupervised classification remains a valuable tool when training data are lacking or for quick exploratory assessments.