Tianyu (Neve) Zhang, Homework 2, MUSA 6500

Research Summary
Evaluating Combinations of Sentinel-2 Data and Machine-Learning Algorithms for Mangrove Mapping in West Africa

Project Purpose

"Evaluating Combinations of Sentinel-2 Data and Machine-Learning Algorithms for Mangrove Mapping in West Africa" leverages the use of Sentinel-2 imagery sourced via Google Earth Engine (GEE) and two machine learning algorithms - random forest (RF) and classification and regression trees (CART) - to devise a reproducible and accessible framework for monitoring mangroves in Senegal and The Gambia.

Why It Matters? (Impacts)

Over the past decade, the two selected countries have experienced accelerating deforestation and extreme weather events. As a result, mangroves play a crucial role in creating climate resilience for agricultural communities. By leveraging open satellite data and cloud computing platforms like Google Earth Engine, the project establishes a robust machine-learning method, effectively addressing painpoints in local natural resource management, particularly national progress documentation and SDG indicator tracking.

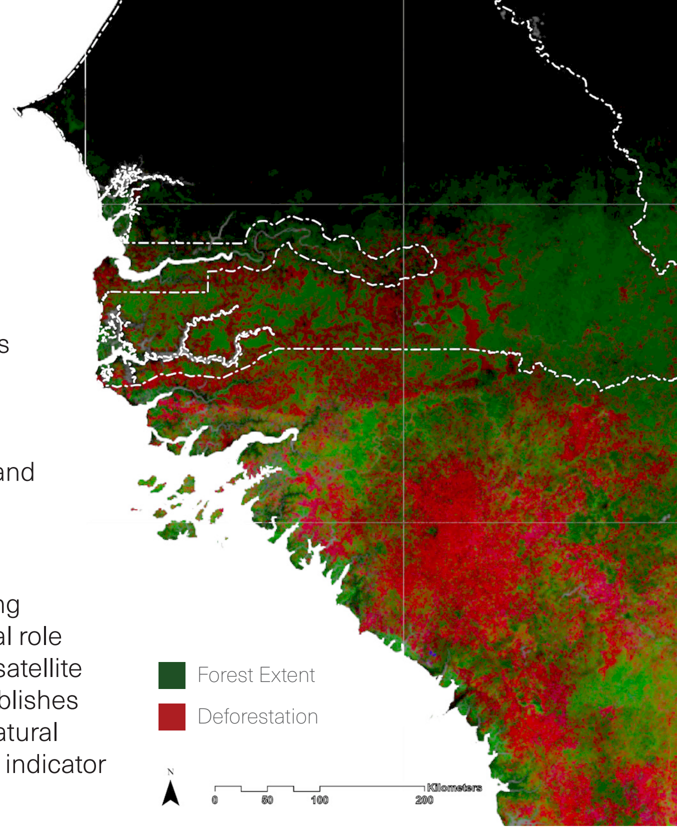
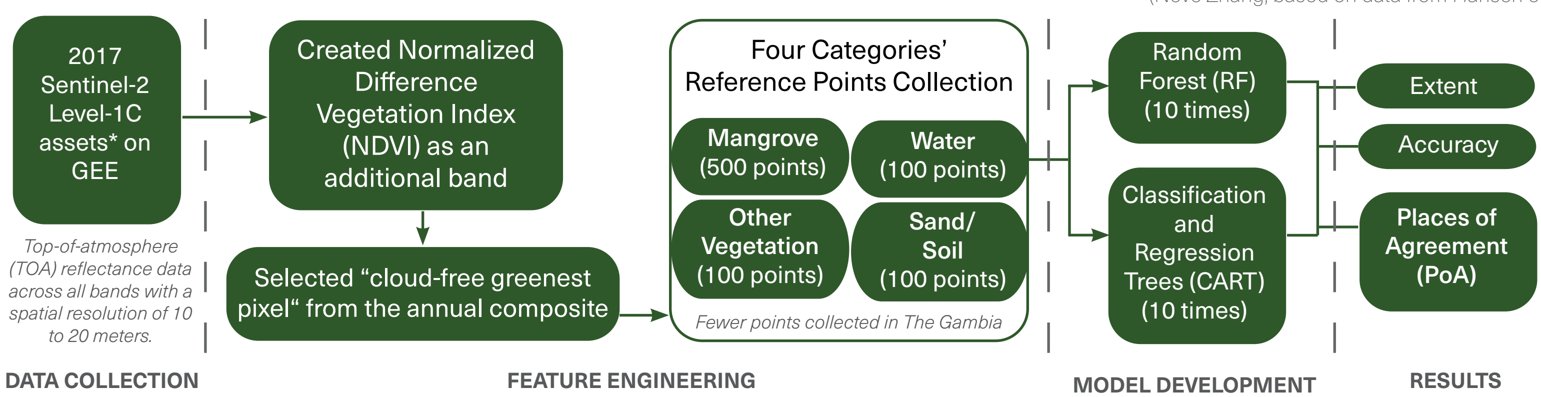


Fig.1 Forest Extent versus Deforestation 2000-2019
(Neve Zhang, based on data from Hansen et al.)

Methodology



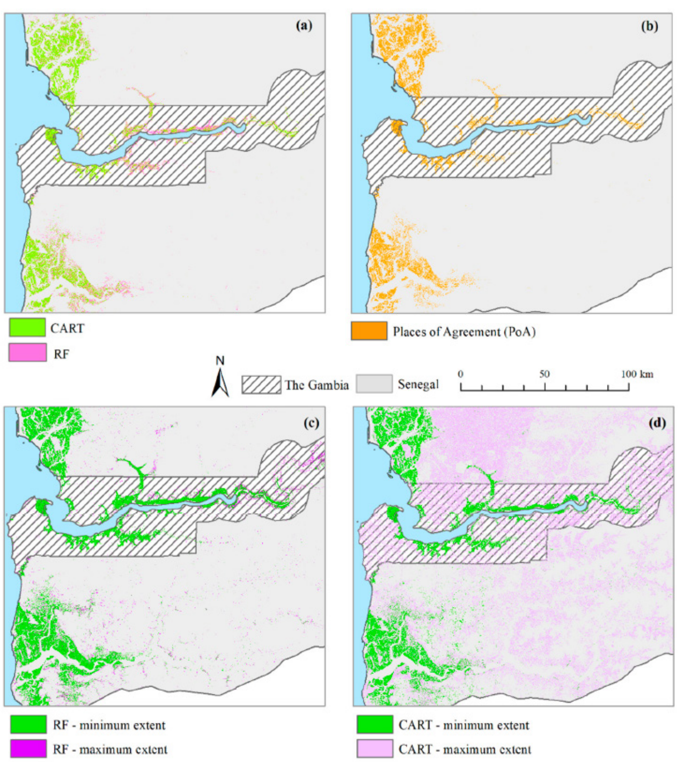


Fig. 2 Prediction Results of Mangrove Forests (Mondal et al. 2019)

Results

> 90%
Overall Accuracy in Both Countries

639.2
km^2 of PoA Mangroves in Total

- Both classifiers achieved **high overall accuracy** (>90%) in both countries.
- For both countries, the **Mangrove class has the highest accuracy, followed by the "Other Vegetation" class**.
- **RF generated more stable and consistent results than CART**. Respectively, RF and CART predicted: 990~2726 km^2 (RF) vs. 826~4396 km^2 (CART) mangroves in Senegal, and 340~964 km^2 (RF) vs. 245~1271 km^2 (CART) mangroves in The Gambia.

Question

What's the benefit and trade-offs of running and comparing multiple iterations of the same classifier?
How feasible can the methodology be promoted for understudied regions?

Citations

1. Mondal, P., Liu, X., Fatoyinbo, T. E., & Lagomasino, D. (2019). Evaluating Combinations of Sentinel-2 Data and Machine-Learning Algorithms for Mangrove Mapping in West Africa. Remote Sensing, 11(24), 2928. https://doi.org/10.3390/rs11242928
2. Hansen, M. C., P. V. Potapov, R. Moore, M. Hancher, S. Turubanova, A. Tyukavina, D. Thau, S. Stehman, S. Goetz, T. Loveland, A. Kommareddy, A. Egorov, L. Chini, C. Justice, and J. R. G. Townshend. Global Forest Change. University of Maryland, 2025. Accessed February 19, 2025. https://glad.earthengine.app/view/global-forest-change.