Title: Integrating SAR, Optical, and Machine Learning for Enhanced Coastal Mangrove Monitoring in Guyana

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Abstract:

Mangrove forests are a biodiverse ecosystem known for a wide variety of crucial eco- logical services, including carbon sequestration, coastal erosion control, and prevention of saltwater intrusion. Given the ecological importance of mangrove forests, a comprehensive and up-to-date mangrove extent mapping at broad geographic scales is needed to define mangrove forest changes, assess their implications, and support restoration activities and decision making. The main objective of this study is to evaluate mangrove classifications derived from a combination of Landsat-8 OLI, Sentinel-2, and Sentinel-1 observations using a random forest (RF) machine learning (ML) algorithm to identify the best approach for monitoring Guyana's mangrove forests on an annual basis. Algorithm accuracy was tested using high-resolution planet imagery in Collect Earth Online. Results varied widely across the different combinations of input data (overall accuracy, 88–95% producer's accuracy for mangroves, 50–87%; user's accuracy for mangroves, 13–69%). The combined optical–radar classification demonstrated the best

performance with an over- all accuracy of 95%. Area estimates of mangrove extent ranged from 908.4 to 3645.0 hectares. A ground-based validation exercise confirmed the extent of several large, previously undocumented areas of mangrove forest loss. The results establish that a data fusion approach combining optical and radar data performs marginally better than optical-only approaches to mangrove classification. This ML approach, which leverages free and open data and a cloud-based analytics platform, can be applied to mapping other areas of mangrove forests in Guyana. This approach can also support the operational monitoring of mangrove restoration areas managed by Guyana's National Agricultural and Research Extension Institute (NAREI).

Biography

Kim Chan-Bagot is a Geographical Information Systems (GIS) Consultant and Research Scientist for SERVIR- Amazonia and National Agricultural Research and Extension Institute (NAREI) Mangrove Department. She specializes in the use of optical and radar remote sensing applications for land use and land cover change (particularly in mangrove forest), vulnerability and sensitivity assessments and impact assessments in Guyana. She co-developed a National Mangrove Monitoring System and Guyana Mangrove information System (GuyMIS). She has a BSc in Geography, MSc in Disaster Risk Management and Climate Governance and MSc in Urban and Regional Planning. She has also contributed to the capacity building of number remote sensing programs and trainings at the local level.