Satellite Imagery and AI in Land Use Mapping and Monitoring: A Methodological Approach for Kenya's Agricultural Sector

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Abstract

In recent years, there has been a growing interest in utilising satellite imagery and artificial intelligence (AI) for land use mapping and monitoring to support sustainable agricultural practices. The methodology involves preprocessing satellite images to enhance spatial resolution and accuracy, followed by feature engineering from spectral bands and temporal sequences. An AI-based convolutional neural network (CNN) is employed for classification tasks, with a focus on achieving high precision in identifying different land cover types such as croplands, forests, and grasslands. The automated process achieved an overall accuracy of 92% in classifying land use categories across the test area, demonstrating the feasibility of integrating satellite imagery and AI for real-time monitoring of agricultural lands. This study provides a robust methodological approach that can be applied to other regions with similar environmental conditions, offering potential benefits for enhancing crop management practices and supporting policy decisions related to land use planning. Future research should explore the integration of additional data sources such as weather patterns and soil quality indicators to improve the predictive capabilities of the AI models in monitoring agricultural productivity and resilience. AI, Land Use Mapping, Satellite Imagery, Machine Learning, Convolutional Neural Network Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Geospatial, GIS, Remote Sensing, Machine Learning, Image Classification, Precision Agriculture, Data Analytics*

ABSTRACT-ONLY PUBLICATION

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