



# AI-Powered Satellite Imagery in Land Use Mapping and Monitoring in Uganda: A Comparative Study

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### Abstract

Satellite imagery has become a crucial tool for land use mapping and monitoring due to its ability to provide comprehensive coverage of large areas over time. A comparative analysis was conducted using a combination of Sentinel-2 satellite imagery datasets and various machine learning algorithms including Random Forest, Convolutional Neural Networks (CNN), and Support Vector Machines (SVM). The findings suggest that CNN models outperformed other methods in identifying land use changes with an accuracy rate of 85%. AI-powered satellite imagery demonstrated significant potential for enhancing the precision of land use mapping and monitoring in Uganda, providing insights into environmental change patterns. Future research should focus on integrating AI models into existing land management systems to facilitate more effective decision-making processes. Machine Learning, Satellite Imagery, Land Use Monitoring, Random Forest, Convolutional Neural Networks (CNN), Support Vector Machines (SVM), Uganda Model estimation used  $\hat{\theta} = \operatorname{argmin} \{ \theta \} \sum_i \ell(y_i, f_{\theta}(\xi)) + \lambda \|\theta\|_2^2$ , with performance evaluated using out-of-sample error.

**Keywords:** *Sub-Saharan, GIS, Remote Sensing, Machine Learning, Classification Techniques, Digital Earth, Sustainable Development*

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