



AI-Powered Satellite Imagery in Land Use Mapping and Monitoring in Uganda

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Abstract

Satellite imagery has been widely used for land use mapping and monitoring due to its ability to provide comprehensive coverage of large geographical areas over time. A hybrid machine learning approach combining deep convolutional neural networks (CNNs) with transfer learning was employed. The dataset consisted of Landsat satellite images from multiple years, segmented into training and validation sets for model development and evaluation. The AI models achieved an overall accuracy of 92% in classifying land use types compared to manual interpretation, demonstrating the potential of automated systems in large-scale applications. This study highlights the efficacy of AI in satellite imagery analysis for sustainable land management practices and underscores its utility for monitoring environmental changes over time. Further research should focus on integrating AI into existing governmental and non-governmental initiatives to enhance spatial data governance and policy implementation. AI, Satellite Imagery, Land Use Mapping, Machine Learning, Uganda Model estimation used $\hat{\theta} = \operatorname{argmin} \{ \theta \} \operatorname{sumiell} (y_i, f\theta (\xi)) + \lambda \operatorname{Vert}\theta \operatorname{Vert} 2^2$, with performance evaluated using out-of-sample error.

Keywords: Sub-Saharan, GIS, CNNs, DL, SVM, IoT, remote sensing

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