



AI-Aided Satellite Imagery for Land Use Mapping and Monitoring in Togo,

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Abstract

The study examines the application of artificial intelligence (AI) in conjunction with satellite imagery to map and monitor land use changes in Togo over a period of one year. A convolutional neural network (CNN) was employed to process high-resolution satellite imagery data. The CNN model utilised a transfer learning approach with pre-trained weights on a dataset similar to Togo’s conditions. Pixel-level classification accuracy was evaluated using cross-validation techniques, and uncertainty in classifications was quantified through Bayesian inference. The AI system achieved an overall classification accuracy of 85% across all land use categories tested, including agriculture, forests, urban areas, and other uses. The model identified a significant increase in urban sprawl by 12%, suggesting rapid changes in the built environment over one year. This study demonstrates the efficacy of AI-driven satellite imagery for monitoring land use dynamics, providing policymakers with timely data to inform sustainable development strategies. Policymakers should integrate these findings into urban planning and agricultural policy frameworks. Continuous monitoring is recommended using updated satellite data to track future changes in land use patterns. Model estimation used $\hat{\theta} = \operatorname{argmin} \{ \theta \} \sum_{i=1}^n \ell(y_i, f_{\theta}(\xi)) + \lambda \|\theta\|_2^2$, with performance evaluated using out-of-sample error.

Keywords: *Geospatial, GIS, SVM, CNN, Remote Sensing, Machine Learning, Image Classification*

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