



AI-Aided Satellite Imagery for Land Use Mapping and Monitoring in Ethiopia: A Methodological Framework

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Abstract

Satellite imagery plays a crucial role in monitoring land use changes across vast geographical areas, such as Ethiopia, where diverse ecosystems and anthropogenic activities require detailed mapping and analysis. The proposed method integrates convolutional neural networks (CNNs) with temporal dynamic time warping (DTW), utilising publicly available Landsat imagery. A cross-validation approach is employed to ensure model robustness across different regions of interest. A preliminary analysis suggests that the AI model achieved an accuracy rate of approximately 85% in distinguishing between primary forest and agricultural land, demonstrating potential for operational use. The methodology developed herein offers a viable framework for leveraging satellite imagery and AI to support sustainable land management practices in Ethiopia. Further validation through real-world applications is recommended to refine the model and enhance its applicability across various regions of Ethiopia. AI, CNN, DTW, Land Use Mapping, Satellite Imagery Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \sum_{i=1}^n \ell(y_i, f_{\theta}(\xi_i)) + \lambda \|\theta\|_2^2 \}$, with performance evaluated using out-of-sample error.

Keywords: *African GIS, Remote Sensing, Machine Learning, Image Classification, Spatial Analysis, Geospatial Data Analytics, Geographic Information Systems*

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