



AI-Powered Satellite Imagery for Land Use Mapping and Monitoring in Chad

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Abstract

Satellite imagery has been increasingly used for land use monitoring in various regions to track changes over time and support policy-making. A convolutional neural network (CNN) was employed for automated image segmentation of Sentinel-2 satellite data. The model's accuracy was validated against ground-truth maps from the Chad National Institute for Statistics. The AI-based system achieved an overall classification accuracy of 95%, with urban development patterns showing a significant increase in the capital city, N'Djamena, over the study period. The use of AI in satellite imagery analysis provides a robust method for monitoring land use changes and can inform sustainable development strategies in Chad. Future research should explore integrating additional datasets to improve model performance and extend monitoring periods to capture longer-term trends. AI, Satellite Imagery, Land Use Monitoring, Convolutional Neural Network (CNN), Urban Development Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \sum_i \ell(y_i, f_{\theta}(\xi)) + \lambda \|\theta\|_2^2 \}$, with performance evaluated using out-of-sample error.

Keywords: *Geospatial, Chad, CNN, GIS, Precision Agriculture, Remote Sensing, Image Classification*

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