African Sustainable Development Studies
(Interdisciplinary -

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

Motlatsi Tseduwa[1], **Tsetswe Mokgatlha**[1,2]

[1] Botswana University of Agriculture and Natural Resources (BUAN)

[2] Department of Data Science, University of Botswana

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Correspondence: mtseduwa@aol.com

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Author notes

Motlatsi Tseduwa is affiliated with Botswana University of Agriculture and Natural Resources (BUAN) and focuses on Computer Science research in Africa.

Tsetswe Mokgatlha is affiliated with Department of Data Science, University of Botswana and focuses on Computer Science research in Africa.

Abstract

African countries face significant challenges in monitoring land use changes due to limited resources and data availability. Satellite imagery from the WorldView-3 platform was processed using a convolutional neural network (CNN) model with an accuracy benchmark set at 95%. An initial dataset of 100 sample areas showed a thematic distribution pattern with urban areas accounting for 27%, rural agriculture 48%, and natural landscapes 25%. The CNN achieved a precision rate of 93.5% in identifying land use categories. AI-powered satellite imagery provides a robust tool for sustainable land management in Botswana, offering high accuracy in land use classification. Continue monitoring with expanded datasets to refine and validate the model's performance across different regions of Botswana. Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, AI, Convolutional Neural Networks, GIS, Precision Agriculture, Remote Sensing, Geospatial Analysis*

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