Satellite Imagery and AI in Land Use Mapping and Monitoring: A Systematic Review from South Africa's Perspective

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Abstract

Satellite imagery and artificial intelligence (AI) are increasingly used in land use mapping and monitoring applications. A comprehensive search strategy was employed using academic databases, with a focus on peer-reviewed articles published within the last five years. The review followed PRISMA guidelines for systematic reviews. The analysis identified a significant increase in studies utilising AI models like Convolutional Neural Networks (CNNs) and Random Forest for land use classification, achieving an average accuracy of 82% with varying levels of environmental variability. AI-enhanced satellite imagery has proven effective in improving the precision and efficiency of land use monitoring in South Africa. However, there is a need for further research to address issues related to data quality and cost-effective AI implementation. Investment should be directed towards developing robust AI models that can operate on limited satellite datasets and integrating these technologies into existing government monitoring systems. 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, GIS, remote sensing, data fusion, machine learning, spatial analysis, classification techniques*

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