

ABSTRACT

Land use and land cover (LULC) classification is essential for sustainable land use planning and natural resource management. This study adopts the Cross-Industry Standard Process for Data Mining (CRISP-DM) framework as a structured approach to guide each phase of the research, from problem understanding to deployment. A deep learning model based on U-Net, which is a convolutional neural network (CNN) architecture designed for semantic segmentation, was developed for classifying LULC in Bali Province using Landsat 8 and 9 satellite imagery, along with various geospatial variables. There are nine categories of land cover in this classification: dryland forest, mangrove forest, plantation forest, bare land, savanna and grassland, water body, dry agriculture, paddy field, and build-up. The model was trained on data from 2014, 2019, and 2024, utilizing six driver variables. The evaluation findings demonstrated excellent performance, with an overall accuracy of 0.88, an average Intersection over Union (IoU) of 0.76, and an average Dice Score of 0.86. Based on these results, the U-Net model has the potential to support the Regional Development Planning Agency (Bappeda) in generating reliable base maps for future spatial planning (RTRW). Furthermore, with further validation and adaptation, this system may serve as a practical tool for monitoring land use changes, assessing spatial conformity, and supporting sustainable land management initiatives in Bali.

Keywords – CNN, Deep Learning, Land Use and Land Cover (LULC), Satellite, Spatial Planning, Supervised Learning, U-Net.