ABSTRACT

Convolutional Neural Network (CNN) is part of Deep learning in Artificial Intelligence (AI) which is commonly used for identification, recognition, or classification of objects. CNN classification models have been adopted and applied in various application fields including agriculture, namely smart agriculture, pest/disease identification, fertilization recommendation systems, and crop identification. CNN architecture is designed using several parameters that can be adjusted during the learning process to optimize identification accuracy, even if the type of object has complex features.

This dissertation proposes research with the title "Optimization of Mangrove Tree Type Identification Based on Leaf Morphology Features Through Hyperparameter Tuning Convolutional Neural NetworkProcess". The basic idea of selecting mangrove tree research objects is the importance of species recognition, conservation of mangrove forests that play a major role as carbon sinks and storage, maintaining salinity, coastal abrasion, climate change, mapping the distribution of mangrove species, marine life, and biopharmaceutical potential.

The main problem of this research is the design of CNN architecture and hyperparameter tuning process to produce an identification model with high accuracy. The proposed research method consists of three parts. The first is data collection through literature study, field survey, and leaf image acquisition of seven mangrove tree species. Second is the design and training of the CNN model, starting with the formation of a dataset of seven mangrove tree classes, each represented by 1,000 variations of leaf morphological features and divided into 80% training dataset and 20% test dataset. The CNN identification architecture design consists of the first design on the Jupyter Notebook and the second design on the NVIDIA DGX A100 machine, performed on various combinations of the number of datasets and the number of convolution layers. The training process is accompanied by hyperparameter tuning to obtain the model with the highest level of accuracy. The last part is testing the CNN identification model using 20% of the test dataset and model evaluation.

The mangrove tree species identification application software as a product of this dissertation research was built using the proposed CNN classification architecture and the six best parameters from the hyperparameter tuning results. The proposed CNN architecture consists of 4 convolution layers with max pooling of 2x2 size and uses 2 Fully Connected Layers. The six best parameters applied to the proposed CNN architecture are a learning rate of 3E-04; several epochs 150; batch size 32; kernel size in each convolution layer is 3, 5, 3, 3; using ReLU activation function; and Adam optimizer. The application software has been tested using 20% of mangrove leaf images from the dataset that has been created and obtained accuracy results of 98.93%, precision 98.71%, Recall 98.71%, and F1-Score 98.93%.

Key words: Adam Optimizer, CNN, Dataset, Hyperparameter Tuning, Mangrove, Leaf Morphology.