CHAPTER V
CONCLUSION AND SUGGESTIONS

This chapter contains the conclusions of the entire series of research that has been carried out, as well as suggestions that are expected to be useful for the development of further studies. The conclusion section summarizes the main findings obtained during the testing process and describes how these findings answer the problem formulation that has been established. Meanwhile, the suggestion section provides constructive recommendations based on the evaluation results, both for the purposes of practical system implementation and as a foundation for future research.

5.1 Conclusion

Based on the results of the design, implementation, and testing of the potato leaf disease classification model using the MobileNetV3-Small architecture based on transfer learning with a two-phase scenario, several conclusions can be drawn as follows:

1. The implementation process of the MobileNetV3-Small architecture was executed through a series of structured computation stages. This implementation began with the preprocessing of a pure dataset that naturally already had a balanced composition (*balanced dataset*), continued with the application of dynamic augmentation (covering spatial transformation and pixel-level manipulation), and the use of ImageNet pre-trained weights (*pre-trained weights*). The built-in classifier layer was modified using a custom *Fully Connected* architecture whose final configuration (such as *dropout* 0.1 and the unfreezing of the top 40 layers) was based on an empirical *hyperparameter* search. Through this flow, the *Small* variant proved to provide compact computational efficiency in extracting visual features compared to the *Large* variant, with an internal test data evaluation performance achievement in the form of a *test accuracy* of 98.15% and a *test loss* of 0.0458.
2. The process of standardizing the pixel distribution on the input images was carried out using the official built-in preprocessing function of the architecture (preprocess_input), which transforms the pixel values to the scale [-1.0, 1.0]. This stage aligns the input image format with the input characteristics of the MobileNetV3-Small pre-trained weights so that the feature extraction process can proceed more consistently.

3. The application of the two-phase computation optimization strategy provided a significant effect on the convergence stability of the network. The use of the Adam *optimizer* (with a *learning rate* of 0.005) in the *Feature Extraction* phase proved effective in accelerating the adaptation of the network's initial weights, while the transition to the SGD Nesterov *optimizer* on the unfreezing of the last 40 layers in the *Fine-Tuning* phase succeeded in maintaining the stability of the weight update without extreme fluctuation. Although this computation strategy succeeded in creating a very robust model in the internal testing environment, the external testing results with a *test accuracy* of 84.67% confirm the occurrence of the *domain shift* phenomenon. This architecture proved very reliable and immune in detecting infected leaves across domains, but the model manifested a bias in the form of visual hypersensitivity toward healthy leaves (*Healthy*). Variations of foreign elements in the real environment such as fluctuations in the lighting spectrum or surface dust tend to be misinterpreted by the model as early features of pathology.

5.2 Suggestions

Although the classification system developed has shown very satisfactory performance, there is still a number of areas for further development. The suggestions that can be given for future research are:

1. Future research can conduct an ablation study or method comparison using the latest generation of *lightweight* architectures, such as MobileNetV4, EfficientNet-Lite, or GhostNet, so that more comprehensive information can be obtained regarding the trade-off between accuracy, inference time, and memory efficiency.