CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

Exploratory data analysis of the daily average air temperature in Surabaya for the 2020–2025 period reveals three primary characteristics: a long-term trend fluctuating between 28°C and 29.5°C; an annual seasonal pattern characterized by lower temperatures during the January - March period and elevated temperatures in October - November; and a weekly seasonal pattern with a minimal effect (±0.07°C) that is statistically insignificant regarding daily temperature variations.

An air temperature prediction model was successfully developed using Prophet with default parameters as the baseline model within the OSEMN framework. The baseline model yielded a Root Mean Square Error (RMSE) of 0.8684°C, a Mean Absolute Error (MAE) of 0.6602°C, and a Mean Absolute Percentage Error (MAPE) of 2.3259%. These results indicate that the default Prophet configuration already possesses a strong predictive capability for the daily temperature data of Surabaya.

Hyperparameter optimization utilizing the Grid Search method across 18 parameter combinations produced the optimal configuration with a changepoint_prior_scale of 0.1, a seasonality_prior_scale of 20, and an additive seasonality_mode. This configuration demonstrates that moderate trend flexibility and an additive seasonal pattern align best with the characteristics of Surabaya's temperature data, while simultaneously confirming that the Grid Search method can systematically identify optimal parameter configurations.

A performance comparison between the default Prophet model and the Grid Search-optimized model reveals consistent improvements across all three evaluation metrics. The RMSE value decreased from 0.8684°C to 0.8584°C (a 1.15% reduction), the MAE from 0.6602°C to 0.6580°C (a 0.34% reduction), and the MAPE from 2.3259% to 2.3114% (a 0.62% reduction). Although these improvements are incremental, the concurrent and consistent decline across all

three metrics indicates that hyperparameter optimization via Grid Search successfully enhances the predictive accuracy of the Prophet model in a systematic manner.

5.2 Recommendations

Based on the research findings, hyperparameter optimization utilizing Grid Search yielded an enhancement in the Prophet model's performance, although this improvement remains relatively marginal in predicting the daily air temperature of Surabaya. A discrepancy persists between the predicted and actual values, which may be attributed to various factors, including random daily temperature fluctuations, the limited number of utilized variables, and the restricted range of hyperparameter values evaluated during the optimization process. To improve predictive accuracy in future research, the following recommendations are proposed:

1. Utilizing Primary Data Sources. This study acquired data via the timeanddate.com platform, which serves as a third-party aggregator. For subsequent research, it is highly recommended to obtain data directly from the Meteorology, Climatology, and Geophysical Agency (BMKG) through official channels or available APIs to ensure scientific validity and data traceability. This approach simultaneously eliminates potential inaccuracies that may arise from third-party data aggregation processes.

2. Incorporating Exogenous Variables. In the current study, the model exclusively utilized daily average temperature data as the sole input variable. By integrating additional meteorological variables such as relative humidity, precipitation, wind speed, and atmospheric pressure as exogenous variables (regressors) within the Prophet framework, the model possesses a greater potential to capture more complex temperature dynamics, thereby consistently enhancing predictive accuracy.

3. Exploring Alternative Predictive Methods. Although Prophet is widely recognized for its proficiency in handling time-series data with pronounced seasonal patterns, alternative methodologies such as SARIMA, LSTM, XGBoost, or NeuralProphet warrant exploration.