ABSTRAK

ALHAMDY RAMADAN. Prediksi Curah Hujan dikota Tanjungpinang Menggunakan Algoritma LSTM dan GRU. Dibimbing oleh NURFALINDA dan BERTA ERWIN SLAM.

Variabilitas iklim yang tinggi di Kota Tanjungpinang menyebabkan pola curah hujan menjadi sangat fluktuatif dan sulit diprediksi, di mana kondisi data meteorologi yang bersifat nonlinier dan penuh *noise* menjadi tantangan utama dalam membangun model prediksi yang representatif. Penelitian ini bertujuan untuk meningkatkan akurasi peramalan cuaca dengan menerapkan teknik *preprocessing Simple Moving Average* (SMA) guna mereduksi fluktuasi data ekstrem, serta membandingkan kinerja model *Deep Learning* berbasis *Long Short-Term Memory* (LSTM), *Gated Recurrent Unit* (GRU), dan arsitektur *Hybrid* LSTM-GRU. Melalui serangkaian pengujian hiperparameter yang sistematis meliputi optimasi *learning rate*, ukuran *batch*, jumlah *neuron*, rentang *timestep*, dan durasi *epoch*, penelitian ini mengevaluasi dampak perataan data terhadap kemampuan model dalam menangkap pola tren cuaca. Hasil eksperimen menunjukkan perbedaan kinerja yang signifikan. Pada pengujian menggunakan data harian asli, model mengalami kesulitan menangkap pola dengan capaian *error* terbaik hanya pada *Root Mean Square Error* (RMSE) 5,4731 dan *Mean Absolute Error* (MAE) 3.8857, sedangkan penerapan metode SMA terbukti mampu meningkatkan stabilitas prediksi secara drastis. Model *Hybrid* LSTM-GRU dengan konfigurasi optimal menggunakan *optimizer* Adam (*learning rate* 0,001), *batch size* 32, kapasitas 64 *neuron*, *timestep* 30 hari, dan durasi pelatihan 100 *epoch* terbukti menjadi model paling unggul dibandingkan model tunggal. Model usulan ini mencatatkan nilai evaluasi *error* terendah dengan RMSE sebesar 1,5823 dan (MAE) sebesar 1,1973, yang membuktikan bahwa kombinasi strategi *preprocessing* data dan integrasi arsitektur *Hybrid* mampu menghasilkan sistem prediksi yang cukup baik untuk pemetaan curah hujan.

Kata Kunci: Curah Hujan, *Deep Learning*, *Hybrid* LSTM-GRU, Optimasi Hiperparameter, *Simple Moving Average.*

ABSTRACT

ALHAMDY RAMADAN. Rainfall Prediction in Tanjungpinang City Using LSTM and GRU Algorithms. Supervised by NURFALINDA and BERTA ERWIN SLAM.

High climate variability in Tanjungpinang City causes rainfall patterns to be highly fluctuating and difficult to predict, where nonlinear and noisy meteorological data conditions pose a major challenge in building a representative prediction model. This study aims to improve weather forecasting accuracy by applying the Simple Moving Average (SMA) preprocessing technique to reduce extreme data fluctuations, as well as comparing the performance of Deep Learning models based on Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), and Hybrid LSTM-GRU architectures. Through a series of systematic hyperparameter tests, including optimization of learning rate, batch size, number of neurons, timestep range, and epoch duration, this study evaluates the impact of data smoothing on the model's ability to capture weather trend patterns. The experimental results show significant differences in performance. In tests using original daily data, the model had difficulty capturing patterns, with the best error achieved only at a Root Mean Square Error (RMSE) of 5.4731 and a Mean Absolute Error (MAE) of 3.8857, while the application of the SMA method proved to be able to dramatically improve prediction stability. The Hybrid LSTM-GRU model with optimal configuration using the Adam optimizer (learning rate 0.001), batch size 32, capacity of 64 neurons, timestep of 30 days, and training duration of 100 epochs proved to be the most superior model compared to single models. This proposed model recorded the lowest evaluation error values with an RMSE of 1.5823 and an MAE of 1.1973, proving that the combination of data preprocessing strategies and Hybrid architecture integration can produce a fairly good prediction system for rainfall mapping.

Keywords: Rainfall, Deep Learning, Hybrid LSTM-GRU, Hyperparameter Optimization, Simple Moving Average.