**PENINGKATAN PERFORMA MODEL PREDIKSI TITIK PANAS MENGGUNAKAN ALGORITMA ENSEMBEL LEARNING DAN HYPERPARAMETER TUNING**

**LAPORAN BOPTN UIN JAKARTA 2024**

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**Disusun Oleh**

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**2.1 Titik Panas**

**2.2 Cuaca dan Iklim**

**2.3 El Niño–Southern Oscillation**

**2.4 Analisa Deret Waktu**

**2.5 Neural Network**

**2.5.1 Artificial Neural Network**

**2.5.2 Recurrent Neural Network**

**2.5.3 Long Short-Term Memory**

**2.5.4 Gated Recurrent Unit**

“Melihat gap perbedaan, antara ANN, RNN, LSTM dan GRU. Menjawab justifikasi kenapa menggunakan GRU dan dibandingkan dengan LSTM”

**2.6 Ensemble Learning**

**2.7 XGBoost**

**2.8 Hyperparameter Tuning**

**2.8.1 GridSearchCV**

**2.8.2 Random Search**

**2.9 Studi Literatur**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Peneliti** | **Rentang waktu** | **Faktor Iklim** | **Faktor ENSO** | **Algoritma** | **Parameters Tuning** |
| Robby *et al*. (2014) | 2001 – 2014 | x | x | ERNN SARIMA | x |
| Alkaff dan Yulianto (2019) | 2016 – 2018 | x | x | SARIMA | x |
| Slavia *et al*. (2019) | 2016 – 2019 | x | x | ARIMA | x |
| Anshori *et al*. (2019) | 2000 – 2003 | Suhu udara  Kelembaban udara  Kecepatan angin  Curah hujan | x | ELM  SVR  RF  LR | x |
| Liang *et al*. (2019) | 1990 – 2018 | Suhu udara  Curah hujan  Kecepatan angin  Arah angin  Ketebalan salju | x | BPNN  Vanila RNN  LSTM-RNN | x |
| Khaira *et al*. (2020) | 2002 – 2019 | x | x | LSTM-RNN | x |
| Natekar *et al*. (2021) | 2018 – 2019 | Radiasi matahari  Suhu udara  Kelembaban udara  Kecepatan angin  Curah hujan | x | LSTM-RNN | x |
| Mohan *et al*. (2021) | 1990 – 2018 | x | x | BPNN  Vanila RNN  LSTM-RNN | x |
| Yandi *et al*. (2022) | 2019 – 2021 | Suhu udara  Kelembaban udara | x | SVM | x |
| Dong *et al*. (2022) | 2000 – 2003 | Suhu udara  Kelembaban udara  Kecepatan angin  Curah hujan | x | RF  SVM  DT  XGBoost | x |
| Gopu *et al*. (2023) | 2000 – 2003 | Suhu udara  Kelembaban udara  Kecepatan angin  Curah hujan | x | ARIMA  SARIMA  LSTM-RNN  GRU-RNN | x |
| Sanjaya *et al*. (2023) | 2019 – 2022 | x | x | Prophet FB | X |
| Sukmana et al. (2024) | 2001 – 2020 | Radiasi matahari  Cura hujan  Suhu udara  Kelembaban udara  Kecepatan angin | SST Nino 3.4  Indeks SOI | Sudah di IPB  LSTM-RNN  Sudah saya lakukan  LSTM-XGBoost  Belum  GRU-RNN  SB-LSTM  SB-GRU  SB-LSTM-XGBoost  SB-GRU-XGBoost | Activation function  Optimizers  Learning Rate  Momentum  Decay  Dropout  Batch Size  Epoch |

**BAB III  
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**4.4.1 Implementasi GRU-RNN**

**4.4.2 Implementasi SB-LSTM-RNN**

**4.4.3 Implementasi SB-GRU-RNN**

**4.4.5 Implementasi SB-LSTM-XGBoost**

**4.4.6 Implementasi SB-GRU-XGBoost**

**4.5 Evalsuasi Model**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Algoritma** | | **Evaluasi model prediksi** | | | | | | **Waktu** |
| **Data latih** | | | **Data uji** | | |
| **R** | **RMSE** | **MAPE** | **R** | **RMSE** | **MAPE** |
| **SB-LSTM-RNN** | |  |  |  |  |  |  |  |
|  | **Model 1** |  |  |  |  |  |  |  |
|  | **Model 2** |  |  |  |  |  |  |  |
|  | **Model 3** |  |  |  |  |  |  |  |
| **SB-GRU-RNN** | |  |  |  |  |  |  |  |
|  | **Model 4** |  |  |  |  |  |  |  |
|  | **Model 5** |  |  |  |  |  |  |  |
|  | **Model 6** |  |  |  |  |  |  |  |
| **SB-LSTM-XGBoost** | |  |  |  |  |  |  |  |
|  | **Model 7** |  |  |  |  |  |  |  |
|  | **Model 8** |  |  |  |  |  |  |  |
|  | **Model 9** |  |  |  |  |  |  |  |
| **SB-GRU-XGBoost** | |  |  |  |  |  |  |  |
|  | **Model 10** |  |  |  |  |  |  |  |
|  | **Model 11** |  |  |  |  |  |  |  |
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**BAB V  
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**DAFTAR PUSTAKA**