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

**LAPORAN BOPTN UIN JAKARTA 2024**

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|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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 |

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|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **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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**LAMPIRAN**

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|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Tahun** | **Jan** | **Feb** | **Mar** | **Apr** | **Mei** | **Jun** | **Jul** | **Ags** | **Sep** | **Okt** | **Nov** | **Des** |
| 2001 | 3 | 5 | 10 | 20 | 39 | 8 | 192 | 171 | 141 | 20 | 13 | 4 |
| 2002 | 25 | 12 | 5 | 14 | 22 | 78 | 211 | 3324 | 2826 | 3724 | 237 | 17 |
| 2003 | 17 | 4 | 26 | 22 | 101 | 346 | 418 | 1584 | 1504 | 309 | 16 | 12 |
| 2004 | 13 | 6 | 13 | 26 | 36 | 224 | 186 | 2256 | 3659 | 2070 | 562 | 5 |
| 2005 | 32 | 9 | 9 | 26 | 46 | 70 | 280 | 1211 | 1616 | 264 | 34 | 33 |
| 2006 | 4 | 17 | 18 | 24 | 55 | 104 | 507 | 3585 | 7640 | 8662 | 1072 | 154 |
| 2007 | 14 | 22 | 17 | 26 | 53 | 92 | 238 | 1312 | 2377 | 988 | 107 | 18 |
| 2008 | 30 | 9 | 13 | 54 | 223 | 254 | 583 | 932 | 1760 | 269 | 36 | 5 |
| 2009 | 13 | 15 | 75 | 109 | 195 | 304 | 1044 | 2453 | 4372 | 401 | 81 | 17 |
| 2010 | 8 | 9 | 11 | 39 | 56 | 62 | 187 | 456 | 371 | 356 | 35 | 43 |
| 2011 | 9 | 49 | 19 | 30 | 145 | 218 | 642 | 2366 | 5726 | 529 | 243 | 34 |
| 2012 | 68 | 22 | 53 | 117 | 165 | 674 | 800 | 2699 | 5141 | 1719 | 73 | 8 |
| 2013 | 26 | 13 | 63 | 17 | 66 | 230 | 130 | 1122 | 789 | 326 | 76 | 9 |
| 2014 | 1 | 38 | 76 | 45 | 135 | 194 | 543 | 1038 | 4484 | 4306 | 1749 | 22 |
| 2015 | 26 | 40 | 32 | 40 | 181 | 332 | 891 | 2776 | 14181 | 14416 | 1533 | 78 |
| 2016 | 36 | 13 | 28 | 22 | 18 | 70 | 93 | 229 | 165 | 54 | 15 | 7 |
| 2017 | 12 | 3 | 19 | 20 | 41 | 62 | 107 | 158 | 264 | 61 | 21 | 26 |
| 2018 | 26 | 13 | 8 | 29 | 34 | 28 | 147 | 182 | 411 | 352 | 38 | 26 |
| 2019 | 10 | 7 | 18 | 21 | 75 | 44 | 115 | 732 | 3962 | 3913 | 1735 | 44 |
| 2020 | 27 | 24 | 59 | 60 | 27 | 24 | 29 | 65 | 29 | 40 | 30 | 8 |
| 2021 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2022 |  |  |  |  |  |  |  |  |  |  |  |  |
| 2023 |  |  |  |  |  |  |  |  |  |  |  |  |