UNIVERSITAS
GADJAH MADA
Hyperparameter Tuning Berbasis Particle Swarm Optimization Untuk Meningkatkan Efisiensi Latih Tabtransformer Pada Dataset Berukuran Kecil
Jarwoko Agung Saputro, Aina Musdholifah, S. Kom., M.Kom., Ph.D. ; Muhammad Alfian Amrizal, B.Eng., M.I.S., Ph.D
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Abbas, S., Sampedro, G. A., & Abisado, M. (2023). A Novel Drug-Drug Indicator Dataset and Ensemble Stacking Model for Detection and Classification of Drug-Drug Interaction Indicators. *IEEE Access*, *11*(August), 101525–101536. https://doi.org/10.1109/ACCESS.2023.3315241

Acer, İ., Orhanbulucu, F., Içer, S., & Latifoglu, F. (2023). Early diagnosis of pancreatic cancer by machine learning methods using urine biomarker combinations. *Turkish Journal of Electrical Engineering and Computer Sciences*, *31*(1), 112–125. https://doi.org/10.55730/1300-0632.3974

Aggarwal, R., Sounderajah, V., Martin, G., Ting, D. S. W., Karthikesalingam, A., King, D., Ashrafian, H., & Darzi, A. (2021). Diagnostic accuracy of deep learning in medical imaging: a systematic review and meta-analysis. *Npj Digital Medicine*, *4*(1). https://doi.org/10.1038/s41746-021-00438-z

Ahmad, I., Qayum, F., Ur, S., & Gautam, R. (2024). Using Improved Hybrid Grey Wolf Algorithm Based on Artificial Bee Colony Algorithm Onlooker and Scout Bee Operators for Solving Optimization Problems. *International Journal of Computational Intelligence Systems*, *123*. https://doi.org/10.1007/s44196-024-00497-6

Alam, F., Ananbeh, O., Malik, K. M., Odayani, A. Al, Hussain, I. Bin, Kaabia, N., Aidaroos, A. Al, & Saudagar, A. K. J. (2023). Towards Predicting Length of Stay and Identification of Cohort Risk Factors Using Self-Attention-Based Transformers and Association Mining: COVID-19 as a Phenotype. *Diagnostics*, *13*(10). https://doi.org/10.3390/diagnostics13101760

Alnowaiser, K. (2024). Improving Healthcare Prediction of Diabetic Patients Using KNN Imputed Features and Tri-Ensemble Model. *IEEE Access*, *12*(February), 16783–16793. https://doi.org/10.1109/ACCESS.2024.3359760

Alpu, Ö., & Pekdemir, G. (2022). The Classification Capability of Urine Biomarkers in the Diagnosis of Pancreatic Cancer with Logistic Regression Based on Regularized Approaches: A Methodological Research. *Turkiye Klinikleri Journal of Biostatistics*, *14*(2), 118–128. https://doi.org/10.5336/biostatic.2022-90697

Anthonysamy, V., & Babu, S. K. K. (2023). Multi Perceptron Neural Network and Voting Classifier for Liver Disease Dataset. *IEEE Access*, *11*(August), 102149–102156. https://doi.org/10.1109/ACCESS.2023.3316515

Atoum, I. (2025). *International Journal of Advanced and Applied Sciences The critical role of evaluation metrics in handling missing data in machine learning*. *12*(1), 112–124.

Bailly, A., Blanc, C., Francis, É., Guillotin, T., Jamal, F., Wakim, B., & Roy, P. (2022). Effects of dataset size and interactions on the prediction performance of logistic regression and deep learning models. *Computer Methods and Programs in Biomedicine*, *213*, 106504. https://doi.org/10.1016/j.cmpb.2021.106504

Bischl, B., Binder, M., Lang, M., Pielok, T., Richter, J., Coors, S., Thomas, J., Ullmann, T., Becker, M., Boulesteix, A. L., Deng, D., & Lindauer, M. (2023).

UNIVERSITAS
GADJAH MADA
Hyperparameter Tuning Berbasis Particle Swarm Optimization Untuk Meningkatkan Efisiensi Latih Tabtransformer Pada Dataset Berukuran Kecil
Jarwoko Agung Saputro, Aina Musdholifah, S. Kom., M.Kom., Ph.D. ; Muhammad Alfian Amrizal, B.Eng., M.I.S., Ph.D
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Hyperparameter optimization: Foundations, algorithms, best practices, and open challenges. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, *13*(2), 1–43. https://doi.org/10.1002/widm.1484

Borisov, V., Leemann, T., Sebler, K., Haug, J., Pawelczyk, M., & Kasneci, G. (2024). Deep Neural Networks and Tabular Data: A Survey. *IEEE Transactions on Neural Networks and Learning Systems*, *35*(6), 7499–7519. https://doi.org/10.1109/TNNLS.2022.3229161

Chicco, D., & Jurman, G. (2023). The Matthews correlation coefficient (MCC) should replace the ROC AUC as the standard metric for assessing binary classification. *BioData Mining*, 1–23. https://doi.org/10.1186/s13040-023-00322-4

Chowdhury, A. A., Das, A., Hoque, K. K. S., & Karmaker, D. (2022). *A Comparative Study of Hyperparameter Optimization Techniques for Deep Learning*. *April 2023*, 509–521. https://doi.org/10.1007/978-981-19-0332-8_38

Dubey, A. K., Sinhal, A. K., & Sharma, R. (2022). An Improved Auto Categorical PSO with ML for Heart Disease Prediction. *Engineering, Technology and Applied Science Research*, *12*(3), 8567–8573. https://doi.org/10.48084/etasr.4854

Fan, Yongxian, Lu, X., & Sun, G. (2023). IHCP : interpretable hepatitis C prediction system based on black - box machine learning models. *BMC Bioinformatics*, 1–16. https://doi.org/10.1186/s12859-023-05456-0

Fan, Yuhua, & Waldmann, P. (2024). Tabular deep learning : a comparative study applied to multi - task genome - wide prediction. *BMC Bioinformatics*, 1–20. https://doi.org/10.1186/s12859-024-05940-1

Gad, A. G. (2022). Particle Swarm Optimization Algorithm and Its Applications: A Systematic Review. In *Archives of Computational Methods in Engineering* (Vol. 29, Issue 5). https://doi.org/10.1007/s11831-021-09694-4

Geron, A. (2020). *Hands-on Machine Learning with Scikit-Learn , Keras & TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems (2nd ed.)* (2nd ed.). O'Reilly Media, Inc.

Gorishniy, Y., Rubachev, I., Khrulkov, V., & Babenko, A. (2021). Revisiting Deep Learning Models for Tabular Data. *Advances in Neural Information Processing Systems*, *23*(NeurIPS), 18932–18943.

Guney, S., Kilinc, I., Hameed, A. A., & Jamil, A. (2021). *Abalone Age Prediction Using Machine Learning*. 1–10.

Hasibuan, M. S., Fransisca, D., Magister, J., Informatika, T., & Komputer, F. I. (2022). *Penggunaan Algoritma Naive Bayes dan Particle Swarm Optimization (PSO) untuk Mendeteksi Stroke*. 109–118.

Hicks, S. A., Strümke, I., Thambawita, V., Hammou, M., Riegler, M. A., Halvorsen, P., & Parasa, S. (2022). On evaluation metrics for medical applications of artificial intelligence. *Scientific Reports*, *0123456789*, 1–9. https://doi.org/10.1038/s41598-022-09954-8

Hossain, M. A. I., Tabassum, A., & Shamszaman, Z. U. (2023). Discover Internet of Things Deep edge intelligence - based solution for heart failure prediction in ambient assisted living. *Discover Internet of Things*.

UNIVERSITAS
GADJAH MADA
Hyperparameter Tuning Berbasis Particle Swarm Optimization Untuk Meningkatkan Efisiensi Latih Tabtransformer Pada Dataset Berukuran Kecil
Jarwoko Agung Saputro, Aina Musdholifah, S. Kom., M.Kom., Ph.D. ; Muhammad Alfian Amrizal, B.Eng., M.I.S., Ph.D
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

https://doi.org/10.1007/s43926-023-00043-4

Huang, X., Khetan, A., Cvitkovic, M., & Karnin, Z. (2020). *TabTransformer: Tabular Data Modeling Using Contextual Embeddings*. *Rong 2014*. http://arxiv.org/abs/2012.06678

Indrawati, A., & Wahyuni, I. N. (2023). Enhancing Machine Learning Models through Hyperparameter Optimization with Particle Swarm Optimization. *Proceedings - 2023 10th International Conference on Computer, Control, Informatics and Its Applications: Exploring the Power of Data: Leveraging Information to Drive Digital Innovation, IC3INA 2023*, 244–249. https://doi.org/10.1109/IC3INA60834.2023.10285736

Ishaq, A., Sadiq, S., Umer, M., & Ullah, S. (2021). *Improving the Prediction of Heart Failure Patients ' Survival Using SMOTE and Effective Data Mining Techniques*. 39707–39716. https://doi.org/10.1109/ACCESS.2021.3064084

Kamath, S. K., Pendekanti, S. K., & Rao, D. (2024). LivMarX : An Optimized Low-Cost Predictive Model Using Biomarkers for Interpretable Liver Cirrhosis Stage Classification. *IEEE Access*, *12*(July), 92506–92522. https://doi.org/10.1109/ACCESS.2024.3422451

Khalifa, M., & Albadawy, M. (2024). Computer Methods and Programs in Biomedicine Update AI in diagnostic imaging : Revolutionising accuracy and efficiency. *Computer Methods and Programs in Biomedicine Update*, *5*(March), 100146. https://doi.org/10.1016/j.cmpbup.2024.100146

Khan, M. Z., Mangayarkarasi, R., Vanmathi, C., & Angulakshmi, M. (2022). Bio-Inspired PSO for Improving Neural Based Diabetes Prediction System. *Journal of ICT Standardization*, *10*(2), 179–200. https://doi.org/10.13052/jicts2245-800X.1025

Kumari, S., Das, S., Kumar, P., Agni, S., & Mukesh, S. (2025). Prediction of hepatitis - C virus using statistical learning models. *Discover Public Health*, *January*. https://doi.org/10.1186/s12982-025-00654-y

Le, C., Liu, Y., Tian, F., & Xu, Y. (2022). *Detection of Urinary Biomarkers for Early Diagnosis of Pancreatic Cancer by Data Analysis*. *Ichih*, 56–61. https://doi.org/10.5220/0011228500003438

Ma, Y. (2024). Comparison and Transformer Model and its Variant Algorithms in Natural Language Processing. *2nd IEEE International Conference on Networks, Multimedia and Information Technology, NMITCON 2024*, 1–5. https://doi.org/10.1109/NMITCON62075.2024.10698967

Mahmud, A. Al, Darwin, C., Darwin, C., & Karim, A. (2022). *A Robust Deep Learning based Framework for High-Precision Detection of Liver Disease*. 9–18.

Mazarei, A., Sousa, R., Ferreira, H. M., & Mendes-moreira, J. (2025). Online boxplot derived outlier detection. *International Journal of Data Science and Analytics*, *19*(1), 83–97. https://doi.org/10.1007/s41060-024-00559-0

Misra, P., & Yadav, A. S. (2020). Improving the classification accuracy using recursive feature elimination with cross-validation. *International Journal on Emerging Technologies*, *11*(3), 659–665.

Monica, & Agrawal, P. (2024). A Survey on Hyperparameter Optimization of Machine Learning Models. *2024 2nd International Conference on Disruptive*

UNIVERSITAS
GADJAH MADA
Hyperparameter Tuning Berbasis Particle Swarm Optimization Untuk Meningkatkan Efisiensi Latih Tabtransformer Pada Dataset Berukuran Kecil
Jarwoko Agung Saputro, Aina Musdholifah, S. Kom., M.Kom., Ph.D. ; Muhammad Alfian Amrizal, B.Eng., M.I.S., Ph.D
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Technologies, ICDT 2024, 11–15. https://doi.org/10.1109/ICDT61202.2024.10489732

Motoyama, Y., Tamura, R., Yoshimi, K., Terayama, K., Ueno, T., & Tsuda, K. (2022). Bayesian optimization package : PHYSBO ☆ , ☆☆. *Computer Physics Communications*, *278*, 108405. https://doi.org/10.1016/j.cpc.2022.108405

Mutiara, erika. (2020). *0,96 Algoritma Klasifikasi Naive Bayes Berbasis Particle Swarm Optimization untuk Prediksi Penyakit Tubercolosis (TB).pdf* (pp. 46–58). Jurnal Swabumi.

Naz, M., Khalid, A., Hameed, A., Taj, R., Mumtaz, W., Alotaibi, F. A., & Alnfiai, M. M. (2025). Meta-Ensemble Learning for Heart Disease Prediction : A Stacking-Based Approach With Explainable AI. *IEEE Access*, *13*(August), 137271–137290. https://doi.org/10.1109/ACCESS.2025.3588683

Nti, I. K., Nyarko-Boateng, O., & Aning, J. (2021). Performance of Machine Learning Algorithms with Different K Values in K-fold CrossValidation. *International Journal of Information Technology and Computer Science*, *13*(6), 61–71. https://doi.org/10.5815/ijitcs.2021.06.05

Nuankaew, P., Chaising, S., & Temdee, P. (2021). Average Weighted Objective Distance-Based Method for Type 2 Diabetes Prediction. *IEEE Access*, *9*, 137015–137028. https://doi.org/10.1109/ACCESS.2021.3117269

Oluwaseye, L., Wesley, J., Babu, D., & Paul, S. (2025). A comparative study of imputation techniques for missing values in healthcare diagnostic datasets. *International Journal of Data Science and Analytics*, *20*(7), 6357–6373. https://doi.org/10.1007/s41060-025-00825-9

Ordas, M. T. G., Gutierrez, M. B., Benavides, C., Jos, J. A., & Andrades, J. A. B. (2023). *Heart disease risk prediction using deep learning techniques with feature augmentation*. 31759–31773.

Pagan, M., Zarlis, M., & Candra, A. (2023). *Investigating the impact of data scaling on the k-nearest neighbor algorithm*. *4*(2). https://doi.org/10.11591/csit.v4i2.p135-142

Perifanis, V., & Efraimidis, P. S. (2022). Federated Neural Collaborative Filtering. *Knowledge-Based Systems*, *242*. https://doi.org/10.1016/j.knosys.2022.108441

Peters, B. (2026). *he Demographic Erosion of Fiscal Leverage : Twin Deficits in an Aging World* .

Quinevera, S., & Saikhu, A. (2024). Optimization of Classification Model for Early Detection of Pancreatic Cancer Using GridSearchCV and Autoencoder. *2024 8th International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2024*, 133–137. https://doi.org/10.1109/ICITISEE63424.2024.10730676

Rainio, O. (2024). Evaluation metrics and statistical tests for machine learning. *Scientific Reports*, 1–14. https://doi.org/10.1038/s41598-024-56706-x

Rajeev, D., S, R., Nayyar, A., & Nair, K. (2024). ScienceDirect Predicting Predicting Hepatocellular Hepatocellular Carcinoma Carcinoma Graft Graft Survival Survival Rate Rate in in Post Post Liver Liver Transplantation Transplantation Using Using DeepHit DeepHit. *Procedia Computer Science*, *233*, 307–316. https://doi.org/10.1016/j.procs.2024.03.220

UNIVERSITAS
GADJAH MADA
Hyperparameter Tuning Berbasis Particle Swarm Optimization Untuk Meningkatkan Efisiensi Latih Tabtransformer Pada Dataset Berukuran Kecil
Jarwoko Agung Saputro, Aina Musdholifah, S. Kom., M.Kom., Ph.D. ; Muhammad Alfian Amrizal, B.Eng., M.I.S., Ph.D
Universitas Gadjah Mada, 2026 | Diunduh dari http://etd.repository.ugm.ac.id/

Sadeq, O., Nurul, S., Abdul, M., Sharifah, L., Syed, H., Omar, A., & Abdalkareem, Z. A. (2026). *Evaluation of triage performance in IoMT-based telemedicine using robust scaler and PCA preprocessing*. *4*.

Shami, T. M., El-Saleh, A. A., Alswaitti, M., Al-Tashi, Q., Summakieh, M. A., & Mirjalili, S. (2022). Particle Swarm Optimization: A Comprehensive Survey. *IEEE Access*, *10*, 10031–10061. https://doi.org/10.1109/ACCESS.2022.3142859

Somvanshi, S., Das, S., & Javed, S. A. (2024). A Survey On Deep Learning. *ARxiv*, *11*(1), 1–43. https://doi.org/10.1145/3234150

Suryawanshi, N. S. (2024). *Accurate Prediction of Heart Disease Using Machine Learning : A Case Study on the Cleveland Dataset*. *9*(7).

Sweidan, A. H., Al-feel, H., & El-bendary, N. (2021). *Sentence-Level Aspect-Based Sentiment Analysis for Classifying Adverse Drug Reactions (ADRs) Using Hybrid Ontology-XLNet Transfer Learning*. *9*.

Thabtah, F., Hammoud, S., Kamalov, F., & Gonsalves, A. (2020). Data imbalance in classification: Experimental evaluation. *Information Sciences*, *513*, 429–441. https://doi.org/10.1016/j.ins.2019.11.004

Thakker, Z. L., & Buch, S. H. (2024). *International Journal of Scientific Research in Science and Technology Available online at : www.ijsrst.com Effect of Feature Scaling Pre-processing Techniques on Machine Learning Algorithms to Predict Particulate Matter Concentration for Gandhinagar , Gujarat , India*. 410–419.

Vasudevan, B., Senthilkumaran, R., Immanuel, K., & Karthikeyan, M. V. (2024). Non Invasive Early Pancreatic Cancer Prediction with Gradient Boosting Algorithms Machine Learning Models with Clinical dataset collected from Urinary Biomarkers. *Proceedings - 3rd International Conference on Advances in Computing, Communication and Applied Informatics, ACCAI 2024*, 1–6. https://doi.org/10.1109/ACCAI61061.2024.10602237

Verdonck, T., Baesens, B., & Óskarsdóttir, M. (2024). Special issue on feature engineering editorial. *Machine Learning*, *113*(7), 3917–3928. https://doi.org/10.1007/s10994-021-06042-2

Yi, J., Yu, P., Huang, T., & Xu, Z. (2024). *Optimization of Transformer heart disease prediction model based on particle swarm optimization algorithm*. 1–6. http://arxiv.org/abs/2412.02801

Zhang, Z., Song, W., & Li, Q. (2022). Dual-Aspect Self-Attention Based on Transformer for Remaining Useful Life Prediction. *IEEE Transactions on Instrumentation and Measurement*, *71*, 1–11. https://doi.org/10.1109/TIM.2022.3160561

Zhou, Q. M., Zhe, L., Brooke, R. J., Hudson, M. M., & Yuan, Y. (2021). A relationship between the incremental values of area under the ROC curve and of area under the precision-recall curve. *Diagnostic and Prognostic Research*, *5*(1). https://doi.org/10.1186/s41512-021-00102-w