UNDERGRADUATE THESIS

STROKE PREDICTION USING A STACKED CLASSIFIER BASED ON A META-LEARNER ARTIFICIAL NEURAL NETWORK (ANN) AND EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI)

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ABSTRACT

Student Name / NPM:	M. Naufal Rafy Ghaly / 22081010295
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Stroke is one of the leading causes of death and disability worldwide, requiring accurate early detection to support prompt clinical intervention. Conventional machine learning algorithms are capable of effectively predicting stroke risk; however, high-performing models are generally "black-box" in nature, making the reasoning behind their decisions difficult to interpret and medically justify. This study proposes a two-level Stacking Classifier architecture that combines Logistic Regression (LR), Random Forest (RF), and Extreme Gradient Boosting (XGBoost) as base learners with an Artificial Neural Network (ANN) as the meta-learner, and integrates it with Explainable Artificial Intelligence (XAI) using the SHAP and LIME methods. The research dataset integrates secondary data from Kaggle and primary data from the Peneleh Community Health Center in Surabaya into 8,316 rows of cleaned data with nine selected clinical features based on Information Gain. To prevent data leakage and address class imbalance, Z-score standardization and the SMOTE oversampling technique were strictly applied within a 5-fold stratified cross-validation scheme during the training phase of the base learners. Test results demonstrate that the Stacking Classifier approach significantly boosts the sensitivity of stroke patient detection (Class 1 Recall) compared to individual models, which only reached a maximum of 81.01%; the highest Recall performance was achieved by the RF + XGBoost combination at 94.94% (ROC-AUC 83.32%) and the full combination of LR + RF + XGBoost, which recorded a Recall of 88.61% (ROC-AUC 84.81%). XAI transparency evaluations using SHAP and LIME consistently identified age as the most dominant clinical feature at the base-learner level and demonstrated that the ANN meta-learner assigns the highest confidence weight to the Logistic Regression prediction probability when formulating the final verdict in the Streamlit-based web interface system.

Keywords: Stroke Prediction, Stacking Classifier, Artificial Neural Network, Explainable Artificial Intelligence, SHAP, and LIME.

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Author

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