

ABSTRAK

Stunting merupakan kondisi gagal tumbuh pada balita akibat kekurangan gizi kronis yang dapat mempengaruhi perkembangan fisik dan kognitif anak. Penelitian ini bertujuan untuk mengklasifikasi status stunting balita menggunakan algoritma *Extreme Gradient Boosting (XGBoost)*, menangani ketidakseimbangan data menggunakan *Synthetic Minority Oversampling Technique (SMOTE)*, melakukan *hyperparameter tuning* menggunakan *Grid Search*, serta mengimplementasikan model ke dalam sistem berbasis *web*. Dataset penelitian berasal dari data antropometri balita Puskesmas Watukapu, Kabupaten Ngada, Nusa Tenggara Timur dan data tambahan yang berkaitan dengan faktor eksternal, seperti kondisi ibu, lingkungan, tempat tinggal, dan pola asuh anak. Tahapan meliputi *data cleaning*, *data transformation*, *feature selection*, *data normalization*, *balancing data* menggunakan *SMOTE*, pemodelan menggunakan *XGBoost*, serta evaluasi menggunakan *Stratified K-Fold Cross Validation* dengan nilai $k = 3, 5$, dan 7 . Variasi jumlah fitur yang digunakan yaitu $3, 5, 10, 15$, and 18 fitur terbaik hasil seleksi fitur. Hasil penelitian menunjukkan bahwa penerapan *SMOTE* dan *hyperparameter tuning* mampu meningkatkan performa model dalam mendeteksi kasus stunting. Model terbaik diperoleh pada *XGBoost* dengan *SMOTE* dan *tuning hyperparameter* menggunakan 15 fitur terbaik dan $k\text{-fold} = 7$ dengan *accuracy* sebesar 98.70% , *precision* 94.74% , *recall* 92.80% , dan *f1-score* 93.69% . Fitur yang paling berpengaruh terhadap klasifikasi stunting meliputi Tinggi, Usia Ibu Melahirkan, BB Lahir, Berat, TB Lahir, LiLA, Jumlah anak dalam keluarga, Usia_Bulan, Pendidikan Ibu, Rata-rata penghasilan per bulan, Frekuensi Konsumsi Protein, Status Penerimaan Bantuan Sosial, Cara Ukur, JK, dan ASI Eksklusif 0-6 Bulan. Model yang dihasilkan berhasil diimplementasikan ke dalam sistem berbasis *web* dan memperoleh tingkat penerimaan pengguna dengan kategori sangat diterima berdasarkan hasil *usability testing*.

Kata Kunci: Stunting, *XGBoost*, *SMOTE*, *Grid Search*, *Machine Learning*, Klasifikasi

ABSTRACT

Stunting is a condition of growth failure in children under five caused by chronic malnutrition, which can affect a child's physical and cognitive development. This study aims to classify the stunting status of children under five using the Extreme Gradient Boosting (XGBoost) algorithm, address data imbalance using the Synthetic Minority Oversampling Technique (SMOTE), perform hyperparameter tuning using Grid Search, and implement the resulting model into a web-based system. The dataset was obtained from anthropometric data of children under five collected at Watukapu Community Health Center (Puskesmas Watukapu), Ngada Regency, East Nusa Tenggara, along with additional data related to external factors such as maternal conditions, environmental factors, living conditions, and child-rearing practices. The research stages included data cleaning, data transformation, feature selection, data normalization, data balancing, model development using XGBoost, and evaluation using Stratified K-Fold Cross Validation with k values of 3, 5, and 7. Variations in the number of features used consisted of the top 3, 5, 10, 15, dan 18 features selected through feature selection. The results showed that the application of SMOTE and hyperparameter tuning improved the model's performance in detecting stunting cases. The best model was achieved using XGBoost with SMOTE and hyperparameter tuning, employing the top 15 selected features and k-fold = 7, resulting in an accuracy of 98.70%, precision of 94.74%, recall of 92.80%, and F1-score of 93.69%. The most influential features for classification were Height, Maternal Age at Childbirth, Birth Weight, Weight, Birth Length, Mid-Upper Arm Circumference (MUAC), Number of Children in the Family, Age in Months, Mother's Education, Average Monthly Income, Protein Consumption Frequency, Social Assistance Recipient Status, Measurement Method, Gender, and Exclusive Breastfeeding During the First 0–6 Months. The developed model was successfully implemented in a web-based system and achieved a user acceptance level categorized as highly accepted based on usability testing results.

Keywords: Stunting, XGBoost, SMOTE, Grid Search, Machine Learning, Classification