

KLASIFIKASI STATUS GIZI BALITA UNTUK MENDETEKSI DINI MALNUTRISI MEGGUNAKAN XGBOOST “KABUPATEN LOMBOK BARAT”

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ABSTRAK

Malnutrisi pada balita merupakan tantangan kritis di Kabupaten Lombok Barat dengan prevalensi stunting 32,7% pada 2022. Deteksi manual melalui buku KIA rentan kesalahan interpretasi oleh kader posyandu, terutama dalam mengidentifikasi kasus minoritas gizi buruk (4,70%) dan gizi lebih (4,44%) pada dataset tidak seimbang yang didominasi gizi baik (90,86%). Penelitian ini bertujuan mengembangkan sistem klasifikasi status gizi balita menggunakan XGBoost dengan penanganan class imbalance melalui SMOTE berdasarkan 3 kategori WHO 2006: Gizi Buruk ($ZS\ BB/TB < -2$), Gizi Baik ($-2 \leq ZS\ BB/TB \leq +2$), dan Gizi Lebih ($ZS\ BB/TB > +2$). Dataset 788 balita usia 24–59 bulan dari 12 desa di Kecamatan Labuapi dikumpulkan Oktober 2024. Pra-pemrosesan meliputi filtering nilai tidak valid berdasarkan kriteria WHO, penghapusan LILA (>99% missing value), dan normalisasi MinMaxScaler. SMOTE diterapkan eksklusif pada training set (630 data) untuk mencegah data leakage, sedangkan testing set tetap asli (158 data). Evaluasi dengan 5-Fold Cross-Validation menunjukkan XGBoost mencapai F1-Score Macro $0,8434 \pm 0,0466$ dan Recall Gizi Buruk $90,28\% \pm 6,57\%$, unggul dibanding Random Forest, KNN, Decision Tree, dan Naïve Bayes. Confusion matrix menunjukkan Recall 100% untuk Gizi Buruk (7/7 kasus terdeteksi), memenuhi standar WHO (>80%). Prototipe Streamlit dikembangkan dengan fitur prediksi manual untuk ketiga kategori dan rekomendasi rujukan berbasis prinsip human-in-the-loop. Hasil penelitian berkontribusi pada percepatan penurunan stunting sejalan dengan target nasional 18,8% pada 2025 serta SDG 2.2 (Zero Hunger) dan SDG 3.2 (Good Health).

Kata kunci: *XGBoost, Pembelajaran mesin, status gizi anak balita, antropometri, deteksi dini malnutrisi, class imbalance.*

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ABSTRACT

Malnutrition in toddlers represents a critical challenge in West Lombok Regency with stunting prevalence reaching 32.7% in 2022. Manual detection through Maternal and Child Health books remains vulnerable to interpretation errors by posyandu cadres, particularly in identifying minority cases of undernutrition (4.70%) and overnutrition (4.44%) within imbalanced datasets dominated by normal nutrition (90.86%). This study develops a toddler nutritional status classification system using XGBoost with class imbalance handling through SMOTE based on 3 WHO 2006 categories: Undernutrition ($ZS\ BB/TB < -2$), Normal Nutrition ($-2 \leq ZS\ BB/TB \leq +2$), and Overnutrition ($ZS\ BB/TB > +2$). Dataset of 788 toddlers aged 24–59 months from 12 villages in Labuapi District was collected in October 2024. Preprocessing included filtering biologically invalid values per WHO criteria, removal of MUAC/LILA (>99% missing values), and MinMaxScaler normalization. SMOTE was applied exclusively to the training set (630 samples) to prevent data leakage, while the testing set remained original (158 samples). Evaluation with 5-Fold Cross-Validation showed XGBoost achieved Macro F1-Score 0.8434 ± 0.0466 and Undernutrition Recall $90.28\% \pm 6.57\%$, outperforming Random Forest, KNN, Decision Tree, and Naïve Bayes. Confusion matrix analysis revealed 100% Recall for Undernutrition (7/7 cases detected), meeting WHO clinical standards (>80%) for acute wasting detection. A Streamlit-based prototype was developed with manual prediction features for all three nutritional categories and automatic referral recommendations based on the human-in-the-loop principle. The research contributes to accelerating stunting reduction aligned with Indonesia's national target of 18.8% by 2025 and SDG 2.2 (Zero Hunger) and SDG 3.2 (Good Health and Well-being).

Keywords: Xgboost, Machine Learning, Nutritional Status Of Children Under Five, Anthropometry, early malnutrition detection, class imbalance.