

# RANCANG BANGUN WEBSITE OPTIMASI BTS 4G BERDASARKAN 5 ALGORITMA MACHINE LEARNING

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## ABSTRAK

Peningkatan trafik data di wilayah Jabodetabek menuntut infrastruktur jaringan 4G LTE yang stabil dan andal. Namun, penanganan gangguan jaringan (*network fault*) secara manual sering kali lambat dan tidak efisien. Penelitian ini bertujuan merancang sistem rekomendasi berbasis *Artificial Intelligence* (AI) untuk mendukung otomatisasi *Self-Healing* dalam kerangka kerja *Self-Organizing Network* (SON). Sistem dikembangkan dalam bentuk *website* interaktif menggunakan *framework* Streamlit yang mengintegrasikan data *Coverage Monitoring* (CovMo), *Incident Logs*, dan *Metadata* BTS. Penelitian ini membandingkan performa lima algoritma *Machine Learning*, yaitu *Logistic Regression*, *Support Vector Machine* (SVM), *K-Nearest Neighbors* (KNN), *Random Forest*, dan XGBoost, dengan penerapan teknik *resampling* untuk mengatasi ketidakseimbangan data. Hasil pengujian menunjukkan bahwa XGBoost merupakan model terbaik dengan skor komposit 0,853, AUC-ROC sebesar 0,976, dan *Recall* 0,864. Dari total 2.668 data observasi, sistem berhasil mengidentifikasi 597 situs (22,4%) yang membutuhkan optimasi dan menghasilkan 1.819 rekomendasi tindakan teknis. Mayoritas rekomendasi berfokus pada optimasi cakupan (*coverage*) sebesar 40,7%, di mana 68% dari total tindakan dapat dieksekusi secara otomatis atau jarak jauh (*remote*). Implementasi sistem ini menunjukkan efektivitas dalam memprioritaskan penanganan gangguan kritis dan mendukung efisiensi operasional jaringan.

**Kata Kunci:** *4G LTE, Machine Learning, Self-Healing, Self-Organizing Network (SON), Streamlit, XGBoost.*

# **DESIGN AND DEVELOPMENT OF 4G BTS OPTIMIZATION WEBSITE BASED ON 5 MACHINE LEARNING ALGORITHMS**

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## **ABSTRACT**

*The surge in data traffic within the Jabodetabek area demands a stable and reliable 4G LTE network infrastructure. However, manual handling of network faults is often slow and inefficient. This study aims to design an AI-based recommendation system to support Self-Healing automation within the Self-Organizing Network (SON) framework. The system is developed as an interactive website using the Streamlit framework, integrating Coverage Monitoring (CovMo) data, Incident Logs, and BTS Metadata. This research compares the performance of five Machine Learning algorithms: Logistic Regression, Support Vector Machine (SVM), K-Nearest Neighbors (KNN), Random Forest, and XGBoost, utilizing resampling techniques to address data imbalance. The results demonstrate that XGBoost is the champion model, achieving a composite score of 0.853, an AUC-ROC of 0.976, and a Recall of 0.864. Out of 2,668 observations, the system successfully identified 597 sites (22.4%) requiring optimization and generated 1,819 technical action recommendations. The majority of recommendations focused on coverage optimization (40.7%), with 68% of total actions being executable automatically or remotely. The implementation of this system has proven effective in prioritizing critical fault resolution and enhancing network operational efficiency.*

**Keywords:** 4G LTE, Machine Learning, Self-Healing, Self-Organizing Network (SON), Streamlit, XGBoost.