

# Pengembangan Model Deteksi Potensi Fraud Klaim Diagnosis Penyakit Kardiovaskular Berbasis Machine Learning pada Program Jaminan Kesehatan Nasional

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## Abstrak

Latar Belakang: Fraud dalam klaim Jaminan Kesehatan Nasional (JKN), khususnya dalam bentuk upcoding diagnosis penyakit kardiovaskular, merupakan tantangan serius yang dapat mengancam keberlanjutan sistem jaminan kesehatan di Indonesia. Penyakit kardiovaskular, sebagai penyebab beban biaya tertinggi dalam layanan rawat inap, rentan terhadap praktik kecurangan yang sulit dideteksi melalui metode konvensional. Oleh karena itu, diperlukan pendekatan berbasis data dan teknologi untuk mendeteksi potensi fraud secara lebih efisien. Metode: Penelitian ini menggunakan pendekatan kuantitatif eksploratif dengan metode supervised machine learning. Data klaim rawat inap penyakit kardiovaskular tahun 2022&ndash;2024 dianalisis berdasarkan beberapa variabel yaitu lama hari rawat, lama rawat di ICU, waktu penggunaan ventilator, jumlah diagnosis sekunder, jumlah prosedur, dan biaya RS. Proses mencakup cleansing, encoding, pseudo-labeling, feature selection, serta pelatihan model menggunakan beberapa algoritma supervised, seperti Random Forest, Tree, Gradient Boosting, Neural Network, Na&iuml;lve Bayes, Logistic Regression, Support Vector Machine (SVM), dan kNN. Evaluasi kinerja model dilakukan dengan menggunakan metrik akurasi, precision, recall, F1-score, dan AUC. Hasil: Hasil penelitian menunjukkan bahwa algoritma Random Forest menghasilkan performa terbaik dalam mendeteksi potensi fraud pada sebagian besar kategori diagnosis dan kelas rumah sakit. Nilai akurasi dan AUC yang dihasilkan berada dalam kategori baik hingga sangat baik. Selain itu, analisis pola klaim menunjukkan adanya perbedaan distribusi biaya dan indikator klinis antara klaim normal dan klaim yang terindikasi anomali, mendukung keberadaan pola upcoding Kesimpulan: Model machine learning, khususnya Random Forest, terbukti efektif dalam mendeteksi potensi fraud upcoding diagnosis penyakit kardiovaskular pada klaim JKN. Penerapan sistem berbasis algoritma ini berpotensi menjadi alat bantu auditor dalam pengawasan klaim yang lebih akurat dan efisien. Hasil penelitian ini memberikan dasar bagi pengembangan sistem deteksi fraud terintegrasi di masa depan guna meningkatkan akuntabilitas dan efisiensi pembiayaan kesehatan.

Background: Fraud in the National Health Insurance (JKN) claims, particularly in the form of upcoding for cardiovascular disease diagnoses, poses a serious threat to the sustainability of Indonesia's health financing system. As the leading contributor to inpatient service expenditures, cardiovascular disease claims are highly susceptible to fraudulent practices that are difficult to detect using conventional methods. Therefore, a data-driven and technology-based approach is essential for more efficient fraud detection. Methods: This study employed a quantitative exploratory approach using supervised machine learning methods. The dataset consisted of inpatient cardiovascular disease claims from 2022 to 2024. The analysis involved data cleansing, encoding, pseudo-labeling, feature selection, and model training using several classification algorithms such as Random Forest, XGBoost, and Logistic Regression. Model performance was evaluated using metrics including accuracy, precision, recall, F1-score, and AUC. Results: The results demonstrated that the Random Forest algorithm achieved the highest performance in detecting potential fraud across most

diagnosis categories and hospital classes. The accuracy and AUC values indicated good to excellent classification performance. Furthermore, the claim pattern analysis revealed distinct differences in cost and clinical indicators between normal and anomaly-labeled claims, supporting the presence of potential upcoding. Conclusion: Machine learning models, particularly Random Forest, proved to be effective in detecting potential upcoding fraud in cardiovascular disease claims within the JKN program. The implementation of algorithm-based fraud detection systems can serve as a decision-support tool for auditors, enabling more accurate and efficient claim monitoring. This study provides a foundation for the future development of integrated fraud detection systems to enhance accountability and efficiency in national health financing.