ABSTRAK

DIANDRA HANAN PRABOWO
ANALISIS KEAKURATAN 3 MACHINE LEARNING PADA CARDIOTOCOGRAPHY UNTUK KLASIFIKASI KONDISI JANIN (PARAMETER KONTRAKSI RAHIM DAN TOMBOL PENANDA)
1x + 146 Halaman + 13 Tabel + 3 Lampiran

Cardiotocography (CTG) merupakan metode *non-invasif* yang digunakan untuk memantau kondisi janin dengan merekam denyut jantung janin dan kontraksi rahim selama kehamilan. Interpretasi CTG yang akurat sangat penting dalam mendeteksi dini tanda-tanda gangguan pada janin, tetapi dalam praktiknya sering kali masih bersifat subjektif dan bergantung pada pengalaman tenaga medis. Penelitian ini bertujuan untuk mengembangkan sistem klasifikasi kondisi janin berbasis CTG dengan pendekatan algoritma *machine learning*, serta menganalisis dan membandingkan tingkat akurasi tiga algoritma: *Support Vector Machine* (SVM), *K-Nearest Neighbor* (KNN), dan *Random Forest* (RF). Dataset yang digunakan berasal dari UCI *Machine Learning Repository* dan diproses melalui tahapan pra-pemrosesan, ekstraksi fitur, pelatihan model, serta validasi menggunakan metode *k-fold cross-validation*. Selain pengolahan perangkat lunak, penelitian ini juga mencakup pengembangan perangkat keras menggunakan sensor *FlexiForce*, ESP32, dan Raspberry Pi 3 untuk menangkap, memproses, dan menampilkan data CTG secara *real-time* pada monitor LCD 7 inci. Hasil menunjukkan bahwa algoritma *Random Forest* memberikan performa klasifikasi terbaik dengan akurasi 94,83%, serta presisi dan waktu prediksi yang unggul dibandingkan KNN dan SVM. Oleh karena itu, *Random Forest* direkomendasikan sebagai model yang paling efektif untuk mendukung sistem pengambilan keputusan dalam evaluasi kondisi janin, dengan potensi besar dalam meningkatkan akurasi diagnosis dan pelayanan kesehatan prenatal.

Kata Kunci: *cardiotocography*, klasifikasi janin, *machine learning*, SVM, KNN, *Random Forest*.

ABSTRACT

DIANDRA HANAN PRABOWO
Comparative Accuracy Analysis of Three Machine Learning Algorithms for Fetal Condition Classification Using Cardiotocography
1x + 120 Pages + 13 Tables + 3 Appendices

Cardiotocography (CTG) is a widely used non-invasive diagnostic method for monitoring fetal conditions by recording fetal heart rate (FHR) and uterine contractions. Accurate interpretation of CTG results is essential in identifying early signs of fetal distress and preventing complications during late pregnancy and labor. However, interpretation often remains subjective and varies depending on the experience of the medical personnel. This study aims to improve the objectivity and reliability of CTG interpretation by utilizing machine learning algorithms to classify fetal conditions into three categories: normal, suspect, and pathological. Three machine learning models—Support Vector Machine (SVM), K-Nearest Neighbor (KNN), and Random Forest (RF)—were implemented and evaluated. The CTG dataset used was obtained from the UCI Machine Learning Repository and processed through feature extraction, preprocessing, model training, and evaluation using k-fold cross-validation. In addition to software analysis, a hardware system was developed using FlexiForce sensors, an ESP32 microcontroller, and a Raspberry Pi 3 to capture, process, and display real-time data on a 7-inch LCD monitor. Among the models tested, Random Forest achieved the highest classification performance with 94.83% accuracy, demonstrating superior precision, recall, and prediction time. The study concludes that Random Forest is the most suitable algorithm for CTG-based fetal condition classification and has significant potential to support clinical decision-making, reduce misdiagnosis, and improve prenatal care outcomes.

Keywords: *Cardiotocography, fetal classification, machine learning, Support Vector Machine, K-Nearest Neighbor, Random Forest.*