

## INTISARI

# PERBANDINGAN KINERJA ALGORITMA MACHINE LEARNING UNTUK KLASIFIKASI PERSENTASE CAMPURAN DAGING SAPI DAN BABI BERBASIS *ELECTRONIC NOSE*

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Daging sapi merupakan daging merah yang digemari masyarakat Indonesia, namun terbukanya pasar global mengakibatkan peningkatan signifikan arus masuk produk pangan termasuk olahan daging. Pemalsuan daging sapi dengan daging babi menimbulkan kerugian ekonomi, risiko kesehatan, dan pelanggaran keyakinan agama, sehingga penelitian ini mengembangkan sistem *electronic nose (e-nose)* berbasis *machine learning* untuk klasifikasi campuran daging sapi dan babi dengan lima kelas persentase kandungan babi (0%, 25%, 50%, 75%, dan 100%). Akuisisi data menggunakan *e-nose* dengan sensor MOS menghasilkan 250 sampel yang diproses melalui denoising dengan *Discrete Wavelet Transform (DWT)*, koreksi *baseline* metode mean, ekstraksi fitur statistik (mean, standar deviasi, skewness, kurtosis), pembagian dataset menggunakan 5-Fold Stratified Cross-Validation dengan penskalaan Min-Max Scaler, dan perbandingan tiga algoritma klasifikasi (SVM, *Decision Tree*, *XGBoost*). Hasil menunjukkan *e-nose* berhasil mengidentifikasi pola aroma berbeda untuk setiap persentase campuran dengan visualisasi PCA dan t-SNE mengonfirmasi potensi pemisahan antar kelas, di mana *Support Vector Machine (SVM)* menunjukkan performa paling unggul dengan akurasi 100%, diikuti *Decision Tree* 98% dan *XGBoost* 96%. Sehingga sistem *e-nose* yang dikombinasikan dengan algoritma SVM terbukti menjadi alat yang sangat efektif dan akurat untuk klasifikasi campuran daging sapi dan babi.

Kata kunci: *Electronic nose*, daging babi, daging sapi, adulterasi, *machine learning*, SVM, *Decision Tree*, *XGBoost*.

## **ABSTRACT**

### **PERFORMANCE COMPARISON OF MACHINE LEARNING ALGORITHMS FOR CLASSIFYING BEEF AND PORK MIXTURE PERCENTAGE BASED ON ELECTRONIC NOSE**

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*Beef is a red meat highly favored by Indonesian society, yet the opening of global markets has led to a significant increase in the inflow of food products, including processed meat. Adulteration of beef with pork causes economic losses, health risks, and violations of religious beliefs. Therefore, this research developed a machine learning-based electronic nose (e-nose) system for classifying beef and pork mixtures into five percentage content classes (0%, 25%, 50%, 75%, and 100%). Data acquisition using an e-nose with MOS sensors yielded 250 samples, which were processed through denoising with Discrete Wavelet Transform (DWT), baseline manipulation using the mean method, and statistical feature extraction (mean, standard deviation, skewness, kurtosis). The dataset was then scaled using Min-Max Scaler and divided using 5-Fold Stratified Cross-Validation. The performance of three classification algorithms (SVM, Decision Tree, XGBoost) was compared. Results showed the e-nose successfully identified distinct aroma patterns for each mixture percentage, with PCA and t-SNE visualizations confirming the potential for class separation. Support Vector Machine (SVM) demonstrated superior performance with an accuracy of 100%, followed by Decision Tree at 98% and XGBoost at 96%. Thus, the e-nose system combined with the SVM algorithm proved to be a highly effective and accurate tool for classifying beef and pork mixtures.*

*Keyword: Electronic nose, beef, pork, adulteration, machine learning, SVM, Decision Tree, XGBoost.*