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A Systematic Review of Multi-Class Classification Techniques Across Diverse Domains

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Abstract: *This review examines the comparative performance of supervised machine learning algorithms for multi-class classification across diverse domains such as healthcare, social media analysis, and benchmark datasets. A structured literature search was conducted to identify studies that empirically evaluate and compare models including Random Forest, Gradient Boosting, Support Vector Machine (SVM), K-Nearest Neighbours (KNN), Naïve Bayes, Multinomial Logistic Regression, and Decision Tree. The findings indicate that no single algorithm consistently outperforms others; instead, performance depends on dataset characteristics, class distribution, and preprocessing techniques such as feature selection and normalization. Evaluation practices commonly rely on metrics like accuracy, precision, recall, and F1-score, though these may be insufficient for imbalanced datasets. The review highlights current methodological limitations and proposes future directions, including hybrid model development, transfer learning, and explainable AI. These insights aim to guide researchers and practitioners in selecting and optimizing classification models for multi-class problems.*

Keywords: Supervised machine learning, algorithm comparison, multi-class classification, performance evaluation

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