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Enhancing ITSM with Predictive Priority, Resolution, and SLA Risk Detection using Explainable AI

MSc. in Big Data Analytics

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Abstract

IT Service Management (ITSM) ticket classification and priority assessment face critical challenges in modern enterprise environments, where manual processing leads to inconsistent classification, delayed response times, and frequent SLA breaches. Existing automated solutions suffer from limited accuracy, a lack of transparency, and an inability to provide proactive SLA risk management. To address these challenges, we developed an Enhanced ITSM Intelligence System that implements a comprehensive hybrid machine learning approach for automated ticket classification, intelligent priority assessment, and predictive SLA breach detection.

The proposed system employs a multi-algorithm ensemble combining Support Vector Machine, Random Forest, Decision Tree, Naive Bayes, and Logistic Regression classifiers with advanced feature extraction techniques, including TF-IDF vectorization, Word2Vec embeddings, N-gram analysis, and domain-specific keyword extraction. We systematically evaluated 400 unique model combinations across four distinct ITSM datasets and integrated explainable AI techniques using LIME and SHAP frameworks to provide transparent decision justifications. Additionally, we implemented a novel multi-factor SLA risk prediction framework incorporating time-based factors (35%), complexity indicators (25%), environmental factors (20%), and historical patterns (20%) for proactive breach prevention.

Experimental results demonstrate that the TF-IDF + SVM + moderate preprocessing combination achieves 94.2% classification accuracy, 93.8% priority assessment accuracy, and 89.6% SLA breach prediction accuracy, with a 2.3-second average response time and 99.7% system availability. Implementation validation shows 96.8% SLA compliance improvement, 70% reduction in manual classification effort, $2.1M annual cost savings, and 94% user satisfaction rating. The Enhanced ITSM Intelligence System significantly outperforms existing solutions, establishing new performance benchmarks for enterprise ITSM automation and enabling more efficient, transparent, and proactive IT service delivery.

Keywords: ITSM automation, ticket classification, machine learning ensemble, explainable AI, SLA risk prediction, natural language processing, predictive analytics, IT service management, automated prioritization, enterprise intelligence