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A Secure Machine Learning Model for Drug Authentication

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Abstract: *This study presents a secure machine learning model for drug authentication to combat the proliferation of counterfeit pharmaceuticals. A web-based system was developed by integrating a FastTree binary classification model in ML.NET with biometric facial recognition for user authentication. The system enables real-time verification of pharmaceutical products using structured metadata, including batch numbers, expiration dates, manufacturer identifiers, and barcodes. A dataset obtained from the U.S. Food and Drug Administration's OpenFDA repository was used for model training and evaluation, with preprocessing implemented through a C# schema class. To enhance system security and prevent unauthorized access, a facial recognition module was incorporated as an additional authentication layer. Performance evaluation using 10-fold cross-validation yielded strong results, achieving 97.8% accuracy, an F1-score of 96.8%, and an AUC of 0.981. The proposed system provides a lightweight, scalable, and secure framework that integrates machine-learning-based drug authentication with biometric access control. This approach enhances the reliability, integrity, and security of pharmaceutical verification systems. Future work may explore larger datasets and blockchain integration for improved traceability.*

Keywords: Drug Authentication, Counterfeit Drug Detection, Machine Learning, Biometric Authentication, Pharmaceutical Supply Chain

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