IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.301
Volume 3, Issue 3, July 2023

Unsupervised Deep Learning for Credit Card Fraud Detection: An Autoencoder-Driven Framework with Real-Time Dash Visualization Using Tensorflow 2.X

Dheerendra Yaganti
Software Developer, Astir Services LLC, Cleveland, Ohio.
Dheerendra.ygt@gmail.com

Abstract: *The exponential growth in digital transactions has escalated the need for intelligent, real-time fraud detection mechanisms capable of handling high-volume, imbalanced datasets. This paper presents an unsupervised deep learning framework for credit card fraud detection using autoencoders, specifically tailored to isolate anomalous behavior without relying on labeled fraudulent data. The architecture leverages TensorFlow 2.x for model development, training, and evaluation, enabling precise identification of outliers within complex transactional patterns. The system incorporates a comprehensive data preprocessing pipeline using Pandas and NumPy to normalize, encode, and balance transaction records for optimized model performance. Post-training, the model is integrated with an interactive Python Dash-based dashboard, facilitating real-time visualization of anomaly scores and system metrics for analysts and security teams. The proposed solution emphasizes scalability, interpretability, and responsiveness, supporting deployment in high-throughput environments. Experimental validation on publicly available datasets demonstrates high reconstruction error sensitivity, achieving competitive performance in terms of precision and recall. This research underscores the effectiveness of autoencoder-based anomaly detection in financial fraud scenarios and contributes a modular, production-ready framework for organizations seeking to enhance digital transaction security through data-driven intelligence.*

Keywords: Credit Card Fraud Detection, Autoencoders, Unsupervised Learning, TensorFlow 2.x, Anomaly Detection, Imbalanced Datasets, Python Dash, Real-Time Visualization, Deep Learning, Data Preprocessing, Fraud Analytics, Reconstruction Error

DOI: 10.48175/IJARSCT-11978T