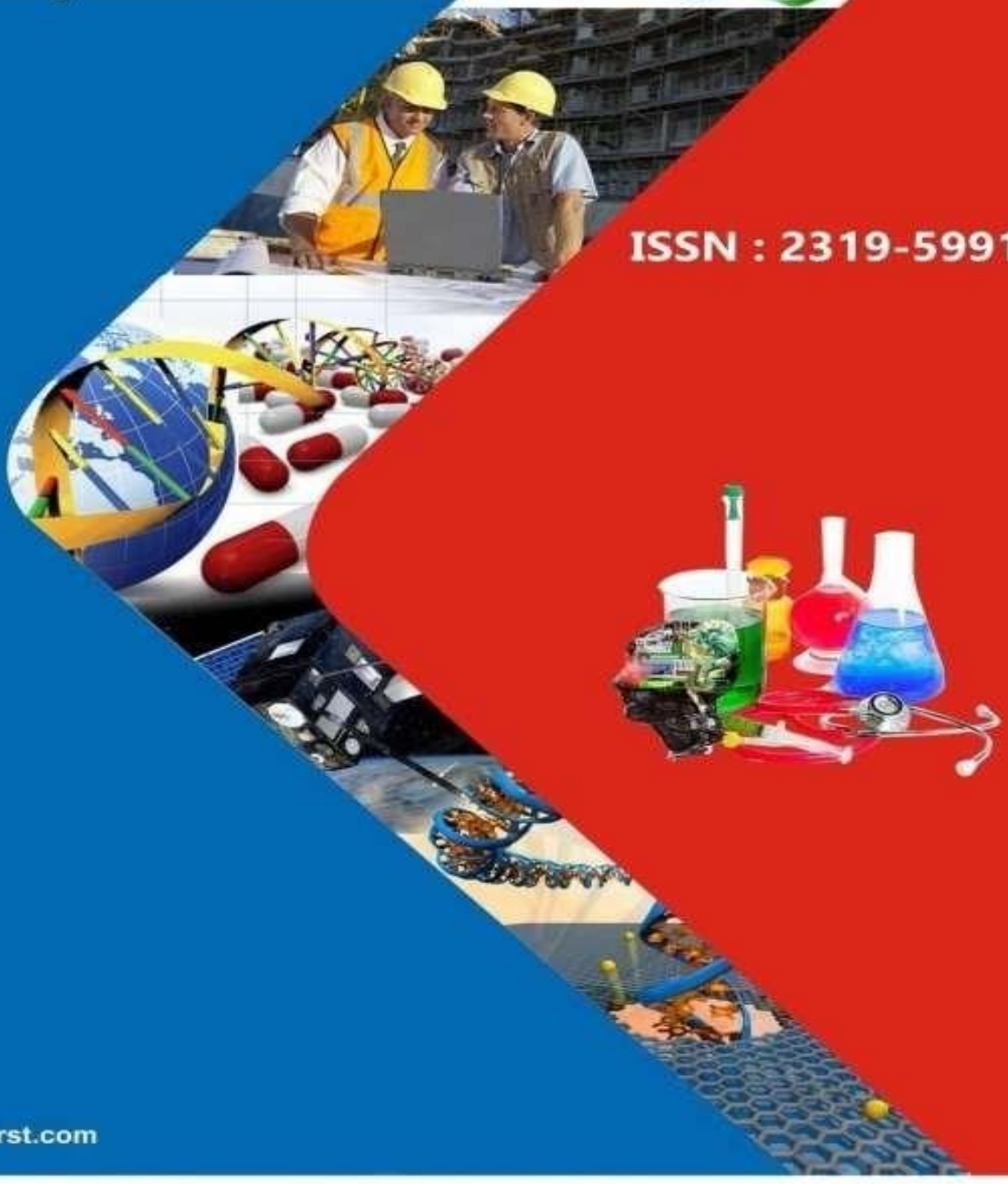
International Journal of Engineering Research and Science & Technology

IJERST

ISSN : 2319-5991



www.ijerst.com

Email: editor@ijerst.com or editor.ijerst@gmail.com

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 21, Issue 2, 2025

IMAGE BASED FAKE CURRENCY DETECTION USING EXPLAINABLE AI

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ABSTRACT

sCounterfeit currency poses a serious and persistent threat to a nation's economic stability, as these unauthorized notes can infiltrate the financial system and circulate without detection, leading to inflation, reduced trust in the monetary system, and economic losses. While financial institutions and banks are equipped with advanced detection mechanisms, such technologies are largely inaccessible to the general public, leaving everyday individuals vulnerable to accepting fake currency unknowingly. This gap highlights the urgent need for accessible and reliable verification methods. In response, this research proposes an innovative solution leveraging deep learning techniques, specifically Convolutional Neural Networks (CNNs), to develop an intelligent system capable of analyzing and distinguishing genuine currency notes from counterfeits with high accuracy, thereby empowering users with a practical tool for real-time currency authentication.

INTRODUCTION

Counterfeit currency remains a major concern for governments and financial institutions, causing economic damage as criminals deceive individuals and businesses with fake notes. While various detection methods have been developed, their limitations hinder effectiveness. To address this, we propose a new model using Convolutional Neural Networks (CNNs), a Deep Learning algorithm, to accurately distinguish between real and counterfeit currency, enhancing security for both financial institutions and law enforcement.

EXISTING SYSTEM

SVM (Support Vector Machine) is a widely used supervised learning algorithm designed for both classification and regression tasks. It works by finding the optimal hyperplane that separates data points of different classes in a high-dimensional space, maximizing the margin between them. SVM is known for its effectiveness in handling complex and non-linear data patterns, often utilizing kernel functions to transform the data into

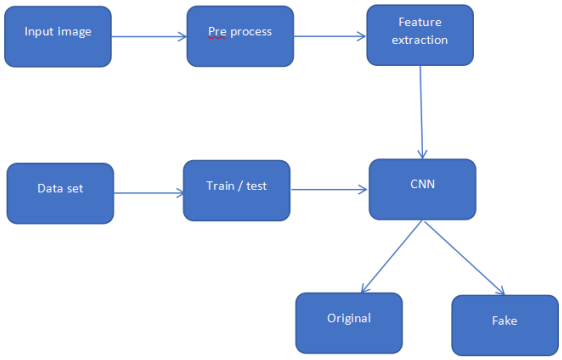
International Journal of Engineering Research and Science & Technology
ISSN 2319-5991 www.ijerst.com
Vol. 21, Issue 2, 2025

higher dimensions for better separation.

PROPOSED METHOD

Preprocessing involves preparing the data by cleaning and transforming it for analysis, typically through normalization or augmentation. Feature extraction focuses on identifying and isolating the most relevant information from raw data, reducing complexity. Convolutional Neural Networks (CNNs) are then applied to automatically detect patterns and learn hierarchical features from the processed data, making them especially effective in tasks like image recognition and classification.

BLOCK DIAGRAM



The Image-Based Fake Currency Detection using Explainable AI system works by capturing high-resolution images of currency notes using a camera, then processing them through a trained convolutional neural network (CNN) model that has been optimized for currency feature recognition. The model is trained on a dataset containing both genuine and counterfeit notes, learning to distinguish subtle differences in patterns, textures, colors, and embedded security features. Explainable AI (XAI) techniques like Grad-CAM or LIME are used to visually highlight the regions of the note that influenced the model's decision, offering transparency and trust in the detection process. The result is displayed on a screen, showing whether the currency is real or fake along with an explainable heatmap indicating critical features used in the classification.

SOFTWARE REQUIREMENTS

1. Operating System: Windows
2. Version: Anaconda navigator: 3.9.2
3. Programming language: Python

HARDWARE REQUIREMENTS

1. system: windows Operating
2. Processor: i5 and above
3. Ram: 4GB and above
4. Hard disk: 50GB

CONCLUSION

Integrating Explainable AI (XAI) into fake currency detection enhances both accuracy and transparency by addressing the "black box" nature of traditional machine learning models. XAI not only improves the model's performance but also makes its decision-making process more understandable to stakeholders like banks, law enforcement, and users, fostering trust and validation. This approach strengthens counterfeit detection through visual and statistical analysis, while providing clear explanations for each decision. As counterfeit methods evolve, combining deep learning with explainability ensures the system remains adaptive, reliable, and accountable, with future improvements focusing on real-time deployment, broader currency support, and continuous learning.

FUTURE SCOPE

Future counterfeit detection systems can be deployed in real-time at cash counters, ATMs, and retail outlets through embedded systems or mobile apps for

International Journal of Engineering Research and Science & Technology
ISSN 2319-5991 www.ijerst.com
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instant verification. Expanding support for multiple currencies and integrating edge devices like scanners or phones for decentralized processing will enhance versatility. Incorporating continuous learning and feedback mechanisms will allow the system to adapt to evolving counterfeit methods. Advanced explainability tools, such as SHAP or LIME, will improve accessibility for non-technical users. Blockchain integration can offer secure, immutable currency authentication records, while collaboration with law enforcement can help track counterfeit trends. Expanding and standardizing datasets for benchmarking will drive further innovation in the field.

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