International Journal of Engineering Research and Science & Technology

www.ijerst.org

ISSN : 2319-5991

Vol. 21 No. 4 (2025)

ijerst.editor@gmail.com

editor@ijerst.com

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com
Vol. 21, No. 4, 2025

Research Paper

FAKE CURRENCY DETECTION USING MACHINE LEARNING

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ABSTRACT— The project aims to address the escalating threat of counterfeit currency by proposing and implementing an innovative fake currency detection system. Counterfeiting poses a significant risk to both individuals and the national economy. Traditional detection methods are limited to banks and corporate offices, leaving ordinary citizens and small businesses vulnerable. In response, this project focuses on the security features of Indian currency notes, leveraging advanced image processing and computer vision techniques to develop a software-based authentication system. Implemented using Python in a Jupyter Notebook environment, the system meticulously analyzes key features, such as bleed lines, security threads, latent images, watermarks, and more, specific to denominations of 500 and 2000 rupees. The system incorporates three main algorithms to validate currency notes, ensuring a comprehensive examination. The first algorithm employs ORB detection and SSIM for feature extraction and comparison. The second authenticates bleed lines, while the third verifies the number panel of currency notes. The automated system provides a rapid and accurate means of detecting fake currency, replacing time-consuming manual methods. By creating a user-friendly interface, the project aims to empower individuals and businesses to safeguard against counterfeit currency effectively.

Index Terms – Fake Currency Detection, SVM

Received: 23-09-2025 Accepted: 25-10-2025 Published: 01-11-2025

I. INTRODUCTION

The pervasive issue of counterfeit currency poses a substantial threat to the economic stability of nations and the financial security of individuals. The clandestine production of fake currency notes undermines the trust in monetary systems, leading to economic imbalances and potential inflation. In response to this escalating concern, our project endeavors to devise an effective and accessible solution for the detection of counterfeit Indian currency notes. Traditional methods of currency verification predominantly cater to banking institutions and large corporations, leaving ordinary citizens and small businesses vulnerable to the perils of counterfeit currency. Manual authentication processes are laborious, error-prone, and impractical for handling large volumes of currency. In light of these challenges, our project seeks to bridge this gap by harnessing the power of advanced image processing and computer vision techniques. Focused on the unique security features embedded in Indian currency notes, specifically the denominations of 500 and 2000 rupees, our system aims to deliver a comprehensive solution. The utilization of Python programming language within the Jupyter Notebook environment ensures a robust and flexible platform. Through three intricately designed algorithms, the system navigates through intricate features such as bleed lines, security threads, latent images, watermarks, and

more. Our algorithms employ cutting-edge methods like ORB detection, SSIM for feature extraction and comparison, ensuring a meticulous examination of each currency note. The proposed system not only automates the authentication process but also introduces a user-friendly interface, enabling widespread utilization. As we delve into the intricacies of currency authentication.

II. RELATED WORK

A. Fake currency Detection using Basic Python Programming and Web Framework (2021) presented by Prof Chetan More, Monu Kumar, Rupesh Chandra, Raushan Singh

In this relevant paper, many recognition techniques are implemented to recognize images, recognize faces, recognize car license plates, and recognize human behaviours. Currency is the primary average for circulation, and Various countries' currencies have different qualities. However, when the value of currency grows, there will be an increase in counterfeit currency. Counterfeit money might damage these nations' interests.

B. Identification of fake notes and denomination recognition presented by Archana MR, Kalpitha C P, Prajwal S K, Pratiksha N (2021)

Currency duplication also known as counterfeit currency is a vulnerable threat on economy. Although fake currency is being printed with precision, the Crime Investigation Department (CID) says that they can be detected with some effort. Currency printed by local racketeers can be detected easily as they use the photographic method, hand engraved blocks, lithographic processes and computer color scanning.

C. Presented by Tushar Agasti, Gajanan Burand, Pratik Wade and P.Chitra from School of Electronics Engineering, VIT University, Vellore 632014, Tamil Nadu, India. (2020)

Image processing is a rapidly growing area of research with application to various aspects of business. Image processing is used to convert an image to digital as well as to obtain certain types of information from the same. The image processing and processing modes include analogy and digital image processing. Digital image processing techniques helps to manipulate digital images with computers.

D. M. R. Pujar. "Indian Currency Recognition and Verification using Image Processing", International Journal of Advance Research, Ideas and Innovations in Technology (2020)

The advancement of color printing technology has increased the rate of fake currency note printing and duplicating the notes on a very large scale. Few years back, the printing could be done in a print house, but now anyone can print a currency note with maximum accuracy using a simple laser printer.

E. Counterfeit currency detection using deep convolutional neural network (2020) presented by Prof Kiran Kemble, Anuthi Bhansali, Pranali Satalgaonkar, Shruthi Alagundgi

In this paper we are using MATLAB which involves extraction of invisible and visible features of Indian currency notes. The image of the currency note is captured through a digital camera. Processing on the image is done on that acquired image using concepts like image segmentation, edge information of image and characteristics feature extraction.

F. A.A. Mandankandy, K.E. Kannammal, Fake currency detection: a survey. Gedrag en Organisatie 33(4), 622–638 (2019).

Imitate something authenticate is called as counterfeit. In banking sector, 3 counterfeit currency is a big threat still. There are lots of detection methods are available, but with the advent of freely available image operation tools, it's a serious issue in banking sector. There are lots of important regions which is present in

currencies, finds out those for evaluation is the basic task. Classifiers can find out the extracted features either genuine or fake.

III. PROPOSED METHODOLOGY

The proposed methodology for fake-currency detection using machine learning begins by collecting a diverse set of high-resolution images of genuine and counterfeit notes, then preprocessing them (cropping, normalization and augmentation) to highlight security features like texture, microprinting and holograms.

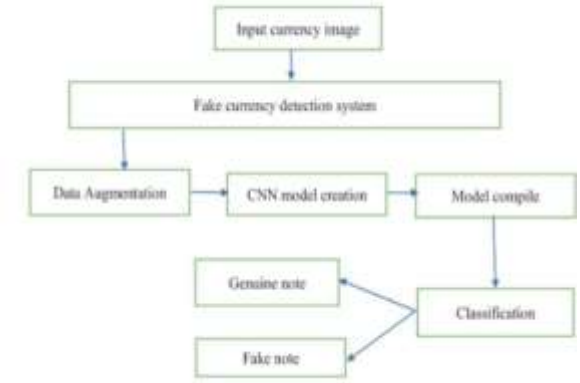

Fig. 1: System Overview

3.1 Input Stage – Input Currency Image

- At this stage, the system receives an image of a currency note through a scanner or camera. The image serves as the raw input for further analysis. The quality and resolution of this image are crucial for accurate feature extraction.

3.2 System Initialization – Fake Currency Detection System

- This module initializes the detection process by managing image input, processing pipelines, and model loading. It ensures that the input data is properly directed to the preprocessing and model stages.

3.3 Preprocessing Phase – Data Augmentation

- Data augmentation enhances the dataset by applying transformations such as rotation, scaling, flipping, and brightness adjustment. This increases the model's robustness and improves its ability to recognize fake notes under different conditions.

3.4 Model Development Phase – CNN Model Creation

- A Convolutional Neural Network (CNN) is developed to learn the distinguishing features between genuine and fake notes. The CNN automatically extracts texture, pattern, and color information critical for detection accuracy.

3.5 Model Training Phase – Model Compilation

- In this phase, the CNN model is compiled with appropriate loss functions, optimizers, and performance metrics. The model learns through multiple iterations to minimize classification errors between real and fake notes.

3.6 Prediction Stage – Classification

- Once trained, the model classifies new currency images. Based on learned features, it predicts whether the input note is genuine or counterfeit, producing a binary classification output.

3.7 Decision Phase – Genuine Note / Fake Note

- Finally, the system displays the result. If the image matches the characteristics of authentic notes, it is labeled as a "Genuine Note"; otherwise, it is marked as a "Fake Note." This stage completes the verification process.

IV. EXPERIMENTAL RESULTS AND ANALYSIS

The experimental evaluation of the Fake Currency Detection system using Machine Learning was conducted to assess its accuracy, reliability, and real-time performance in identifying counterfeit banknotes. The objective was to analyze how effectively the system processes input images, extracts relevant features, and classifies notes as genuine or fake using trained machine learning models.

Fig. 2: Notes

Fig. 3: Upload Image

Fig. 4:Select Image

Fig. 4: Detect the Note

Fig. 5: Features

Fig. 6: Features

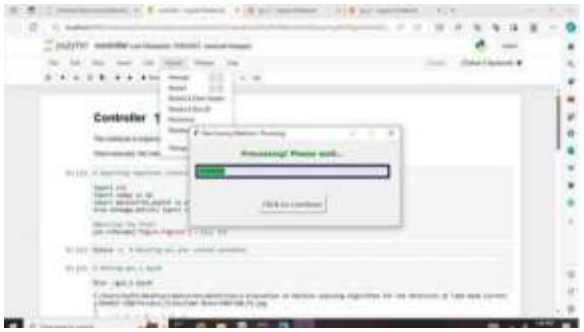

Fig. 7: Preprocessing

V. CONCLUSION

The Fake Currency Detection System is a comprehensive solution for identifying counterfeit currency. Leveraging image processing techniques, the system analyzes specific features in currency notes, such as watermarks and security threads. The graphical user interfaces (GUIs) provide an intuitive and user-friendly experience, allowing users to input images, select currency types, and view detailed analysis results. The integration of OpenCV, Matplotlib, and Tkinter streamlines image processing and GUI development. The system's accuracy and efficiency make it a valuable tool for detecting fake currency, contributing to enhanced security measures in financial transactions. The Fake Currency Detection System represents a significant advancement in combating counterfeit currency by offering a comprehensive and efficient solution for authentication. By leveraging sophisticated image processing techniques, the system meticulously analyses intricate features embedded in currency notes, including watermarks and security threads. These analyses are made accessible to users through intuitive

graphical user interfaces (GUIs), providing a seamless experience for uploading images, selecting currency types, and reviewing detailed analysisresults. The integration of powerful libraries such as OpenCV for image processing, Matplotlib for data visualization, and Tkinter for GUI development ensures the system's reliability and ease of use. These technologies streamline the implementation process, enabling rapid development and deployment of the detection system across various platforms. With its high accuracy and efficiency, the Fake Currency Detection System stands as a valuable tool in safeguarding financial transactions against the threats posed by counterfeit currency. By empowering users with the ability to quickly and accurately identify fake notes, the system contributes to bolstering security measures and maintaining the integrity of monetary transactions. As financial crimes evolve, the continuous development and adoption of such advanced detection systems are crucial in staying ahead of counterfeiters and preserving trust in the financial system.

VI REFERENCES

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AUTHORS Profile

Dr.Naveen Reddy Nemili has received his MCA from Osmania University, Hyderabad in 2010, M.Tech degree in Computer science from JNTUH, Hyderabad in 2014 and Ph.D degree awarded in Computer Science from SSSUTMS, Madhyapradesh in 2024 He is dedicated to teaching field from the last 12 years. His research area Cloud Computing. At present he is working as Associate Professor in CSE Department at Guru Nanak Institutions Technical Campus , Ibrahimpatnam, Telangana, India.

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