

Identification Of Indian Fake Currency Using Convolutional Neural Network

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Abstract- The "Currency Detection System" is an innovative application designed to distinguish between genuine and counterfeit currency notes. Leveraging advanced deep learning models, feature matching techniques, and an intuitive user interface, the system provides an efficient and user-friendly approach to detecting fake currency. With applications in retail, banking, and public sectors, this project aims to reduce the prevalence of counterfeit notes and promote financial security.

Keywords- Tensor flow , Open CV, Visual studio code, Java script.

I. INTRODUCTION

The "Currency Detection System" is an innovative solution designed to tackle the increasing problem of counterfeit currency in financial systems globally. The project employs a combination of advanced deep learning algorithms, computer vision techniques, and state-of-the-art feature matching to identify whether a currency note is "Genuine" or "Fake." This system ensures precision and reliability by integrating the MobileNetV2 architecture for visual analysis and the SIFT (Scale-Invariant Feature Transform) algorithm for robust feature extraction and matching.

The project provides a user-friendly interface that allows users to either upload an image or capture it directly via a webcam. The system then processes the input to determine the authenticity of the currency note. This application holds significant potential in sectors like banking, retail, and law enforcement, where counterfeit detection is critical. The proposed system not only minimizes human error but also enhances operational efficiency, offering a scalable and adaptable solution to address the dynamic challenges of counterfeit detection.

II. LITERATURE SURVEY

Literature Survey is most important step in the software development process. Before developing the tool, it is necessary to determine the time factor, economy and

company strength. Once these things are satisfied, the next step is to determine which operating system and language can be used in developing the tool.

[1] "A Deep Learning for Currency Authentication"– IEEE

Transactions, 2020 This paper explores the use of Convolution Neural Networks (CNNs) for currency authentication. It emphasizes feature extraction from visual patterns, such as watermarks, textures, and micro-lettering, achieving an accuracy rate of 96%. The study highlights CNNs effectiveness in automating detection processes while reducing reliance on manual inspection. Currency authentication is a critical area of research to combat the increasing problem of counterfeit currency. The advent of deep learning has significantly enhanced the efficiency and accuracy of currency authentication systems. Early works in this domain relied on traditional image processing techniques, which required manual feature extraction and were prone to errors under varying lighting and orientation conditions.

[2] "Automated Counterfeit Detection Using Image Processing"–Springier, 2019

This research investigates image processing methods for detecting counterfeit notes by analyzing holograms, watermark presence, and ink integrity. While the approach effectively identifies specific counterfeit markers, it struggles with counterfeit notes that mimic genuine features. The paper advocates integrating AI to enhance adaptability. Counterfeiting poses significant challenges across industries such as currency, pharmaceuticals, and luxury goods, necessitating efficient and reliable detection systems. The study emphasizes the limitations of traditional manual methods and highlights the advantages of automated systems, particularly in terms of speed, accuracy, and scalability. Image processing techniques leverage the ability to extract and analyze subtle features in visual data, such as texture, color, and patterns, which are often imperceptible to the human eye.

[3] "Machine Learning Approaches in Currency Validation"– Journal of AI Research

This comparative study evaluates the performance of various machine learning

algorithms, including Decision Trees, SVMs and CNNs , for currency validation. Results indicate that deep learning significantly outperforms traditional methods due to its ability to handle complex datasets. CNNs achieve over 90% accuracy compared to 75% for SVMs. Machine learning approaches have been increasingly used in currency validation to improve the accuracy and efficiency of traditional methods. Traditional methods, such as manual inspection, magnetic sensors, and ultraviolet (UV) light detection, have limitations, including high false acceptance rates and limited detection capabilities for sophisticated counterfeits. To address these limitations, researchers have explored various machine learning approaches, including convolutional neural networks (CNNs), transfer learning, support vector machines (SVMs), and deep learning-based approaches. Deep learning-based approaches, such as recurrent neural networks (RNNs) and long short-term memory (LSTM) networks, have also been explored for currency validation tasks.

[4] “Real-Time Systems for Counterfeit Currency Detection”-ACM Digital Library, 2021 The paper presents a real-time system that integrates hardware sensors and AI-based algorithms for detecting counterfeit currency. While the system achieves high accuracy, the reliance on hardware components increases costs, making it less accessible to individuals and small businesses. The study calls for software-only solutions to improve affordability. Real time systems for counterfeit currency detection have gained significant attention in recent years due to the increasing prevalence of counterfeit currency. Researchers have proposed various real-time systems that utilize machine learning, computer vision, and sensor technologies to detect counterfeit currency. These systems typically consist of three stages: image acquisition, feature extraction, and classification. In the image acquisition stage, images of the currency note are captured using cameras or scanners. In the feature extraction stage, relevant features such as texture, color, and shape are extracted from the images.

III. METHODOLOGY

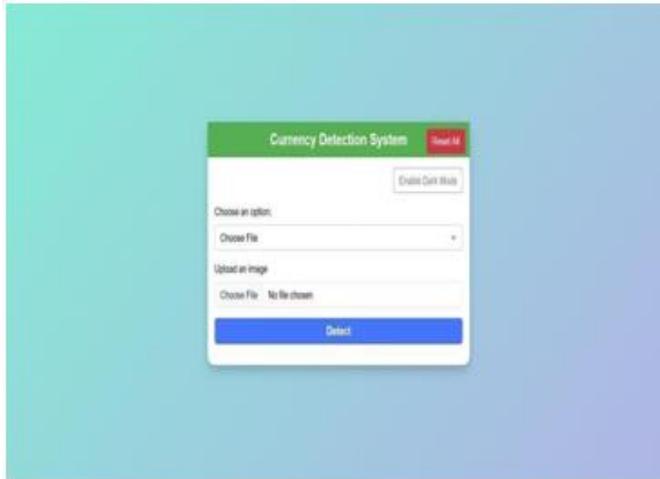
The system employs a dual-input deep learning model, combining image analysis through MobileNetV2 and feature matching using SIFT (Scale-Invariant Feature Transform). Features extracted from genuine currency samples are stored in a structured database and used to compute feature similarity scores for uploaded or captured images. A focal loss function is utilized to optimize the model's performance, addressing class imbalances in the dataset. The application interface is built using Flask for backend processing and HTML/CSS with JavaScript for a responsive and dynamic frontend. The user can upload a currency image or capture it

via a webcam, and the system processes the input to classify it as "Genuine" or "Fake."

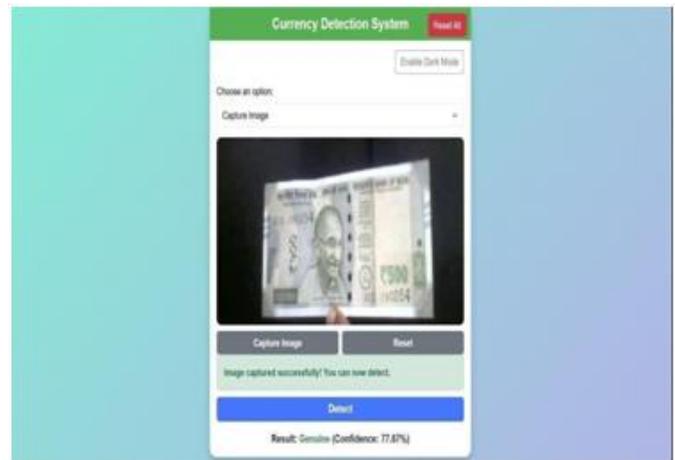
“Identification of Indian Fake Currency Using Deep Learning”

- 1. Dataset Collection:** Collect images of genuine and fake Indian currency notes. Preprocess images by resizing them to 128x128 pixels and normalizing pixel values. Augment the dataset to introduce variations, such as changes in brightness and rotation, improving model robustness.
- 2. Data Preprocessing:** images by resizing, normalizing pixel values, and augmenting to improve robustness. To prepare the dataset for training, we applied several data preprocessing techniques to the images of Indian currency notes. Firstly, we resized the images to a uniform size to ensure consistency and reduce computational complexity. This step helps in reducing the dimensionality of the input data and makes it easier to process.
- 3. Building a model:** Design a deep learning model that accurately classifies Indian currency notes as genuine or fake with high precision and recall. To accurately classify Indian currency notes as genuine or fake, we designed a deep learning model that leverages the power of convolutional neural networks (CNNs). Our model architecture consists of multiple convolutional layers, followed by pooling layers, and finally, fully connected layers.
- 4. Model Training:** Design and train a CNN using TensorFlow/ Keras. Optimize the model for binary classification (Fake vs. Genuine). Validate the model using a separate dataset to ensure generalizability.
- 5. Testing:** Test the application in various scenarios, including different lighting and note conditions. We tested the application under different lighting conditions, such as bright, dim, and natural light, to evaluate its performance in real-world settings. Additionally, we tested the application with notes that were worn out, torn, or partially damaged to assess its ability to accurately classify them.

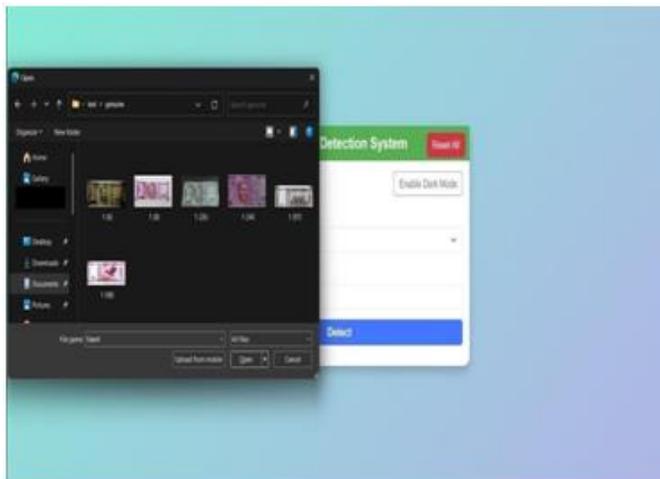
IV. SNAPSHOTS



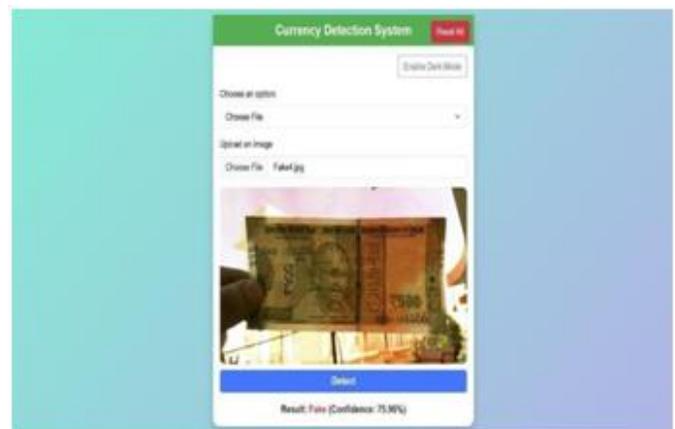
Snapshot 1: Homepage Interface



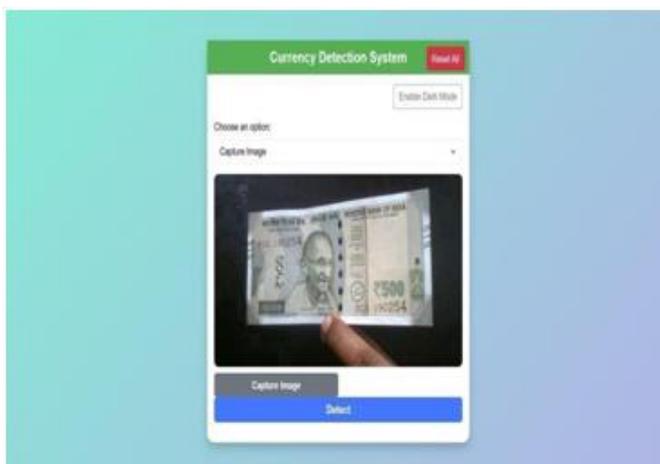
Snapshot 4: Detection Results



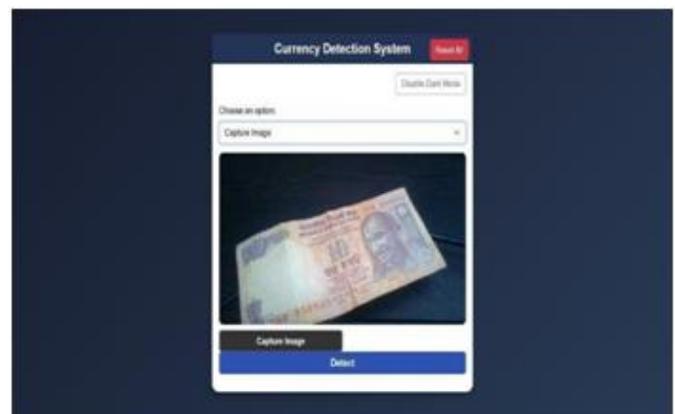
Snapshot 2: File Upload Option



Snapshot 5: showing whether the currency is "Genuine" or "Fake" along with the confidence score



Snapshot 3: Camera Capture Interface



Snapshot 6: Dark Mode Interface

V. CONCLUSION

The Currency Detection System demonstrates the successful integration of deep learning and computer vision techniques for counterfeit detection. The system effectively preprocesses and analyzes input images, achieving accurate results in real-time. By leveraging the MobileNetV2

architecture and SIFT-based feature matching, it provides robust detection capabilities even in challenging scenarios. The user-friendly web interface enhances accessibility, allowing users to seamlessly upload or capture images for analysis. This project is a significant step toward automating and modernizing counterfeit detection, reducing manual errors, and ensuring efficient operations in sectors like banking and retail. The modular design and adaptability make it a scalable solution, capable of accommodating new features and updates as needed.

Furthermore, deep learning models can significantly improve over traditional methods of currency detection, such as manual inspection or using basic algorithms. These conventional methods often rely on visible characteristics like watermarks, security threads, and UV light reactions, which counterfeiters can mimic with increasing sophistication. Deep learning, however, enables a more holistic analysis of the entire currency note, incorporating complex features such as microscopic texture patterns and even subtle shifts in color or design that could indicate forgeries. This advancement can make currency validation more robust and less susceptible to human error or counterfeiters' evolving tactics. In conclusion, the use of deep learning for fake currency detection holds immense potential for enhancing security measures in financial systems. It not only increases accuracy and efficiency but also offers a scalable solution that can be integrated into various financial institutions and devices, such as ATMs and vending machines.

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