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Fake Currency Detection Using Deep Learning

S Sravani*[1], P V Varshitha*[2]
*[*1]Assistant Professor, Department of ECE, Dr. Lankapalli Bullayya College of Engineering, Visakhapatnam, Andhra Pradesh, India.*
*[*2]Department of ECE, Dr. Lankapalli Bullayya College of Engineering, Visakhapatnam, Andhra Pradesh, India.*

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Abstract: *One of the most important assets of our country is its bank currency. However, to create discrepancies in the financial market, criminals introduce counterfeit notes that closely resemble the original ones. During the demonetization period, a significant amount of fake currency was observed circulating in the market. Generally, it is quite challenging for a person to distinguish between a forged note and a genuine one, despite various identification parameters, as many features of counterfeit notes are similar to those of authentic currency. Differentiating between fake banknotes and real ones is a difficult task. Therefore, there is a need for an automated system that can be implemented in banks or ATM machines. To create such a system, an efficient algorithm must be designed to determine whether a banknote is genuine or counterfeit, as fake notes are crafted with high precision. In this paper, we utilize the Convolutional Neural Network (CNN) algorithm on a dataset available from the UCI Machine Learning Repository for the purpose of bank currency authentication. We have applied machine learning algorithms and evaluated their performance based on various quantitative analysis parameters.*

I.INTRODUCTION

The impact of counterfeit currency on our economy. To understand the issue of counterfeit currency, we first need to define what constitutes counterfeit currency and where it comes from. Many of us think of counterfeit bills when we hear about counterfeit currency, but in reality, counterfeiting includes anything that resembles an art form, currency, or any type of financial instrument. As we see in more cases every day, counting cash by hand will never solve the problem of counterfeit currency. Counterfeit currency has created instability within our economy and the loss of public faith in our financial institutions. The Counterfeit Currency Problems are Economic and Financial Instability. Because of the cost of supporting an industry that is capable of producing counterfeit products and the resultant economic downturns that will occur, I propose a full automation process for identifying counterfeit banknotes. My Project is designed to provide an Automated Recognition of Counterfeit Currency through utilizing Deep Learning technologies. This plan includes using Convolutional Neural Network (CNN) and Image Pre-processing Methods and Feature Extraction Techniques to recognize & detect counterfeit banknote images based on their security features. The data sets of Authentic vs. Counterfeit Currency and the automated training of such data sets will allow an accurate classification of each banknote as to whether it is real or counterfeit, therefore providing a higher confidence level of automatically identifying counterfeit currency. The potential application areas will include Banking and ATM and Retail Transaction Processing, thus increasing the overall Security of our Financial Systems and Decreasing the Negative Effects of Counterfeit Currency on our Economy.

II.METHODOLOGY

The methodology of the project involves the application of Image Processing Technology and Machine Learning to classify Indian rupee notes into either genuine or counterfeit. The methodology is as follows:

Step 1 - Collection of images of genuine and counterfeit notes.

Step 2 - Dataset splitting into 90% training data and 10% testing data.

Step 3 - Preprocessing the images (grayscale conversion, rescaling, denoising, normalizing.)

Step 4 - Extraction of features from the images (watermark areas, microtext patterns, edges, texture, etc.) Step 5 - Training of the CNN model based on the extracted features.

Step 6 - Evaluation of model performance based on unseen currency images.

III.WORKING

Hardware Requirements

- **Processor:** Must have a dual-core processor, preferably an i3 processor or better.
- **RAM:** Minimum required RAM of 2 GB
- **Storage:** 5–10 MB to store the required datasets and the model files

Software Requirements

- **Python:** The complete system is implemented using the Python programming language.
- TensorFlow and Keras, NumPy and OpenCV libraries were used for developing and testing the model that classified the banknote images.

Dataset Description

The dataset for this project consists of images of real and fake Indian banknotes that were all collected manually. The dataset is classified and labelled before the model is trained. To make the model more robust to various real- world scenarios, the dataset also contains variations in lighting, angle of photographing, and the quality of the picture.

Feature-Analysis

In order to learn about what makes a banknote a real banknote or a counterfeit banknote, the features of the banknotes were extracted from the texture of the banknote and the edges of the banknote before training the model. Printed micro-text, watermarks, ink patterns and security strips are some of the features extracted from the banknote and used to assist the model in identifying the very subtle differences between genuine banknotes and counterfeit banknotes.

Modelling

The proposed model for classification is a convolutional neural network (CNN). Input images of banknotes are fed into the model through multiple convolutional and pooling layers where meaningful features are extracted, identified and classified. The extracted features are then flattened before being analysed through fully connected (FC) layers. Based on the analysis of the features, the banknote image will be classified as either a real or a counterfeit banknote.

Analysis

The performance of the trained model was evaluated based on the metrics of accuracy, precision and recall using the prepared test set.

IV.FLOW CHARTS

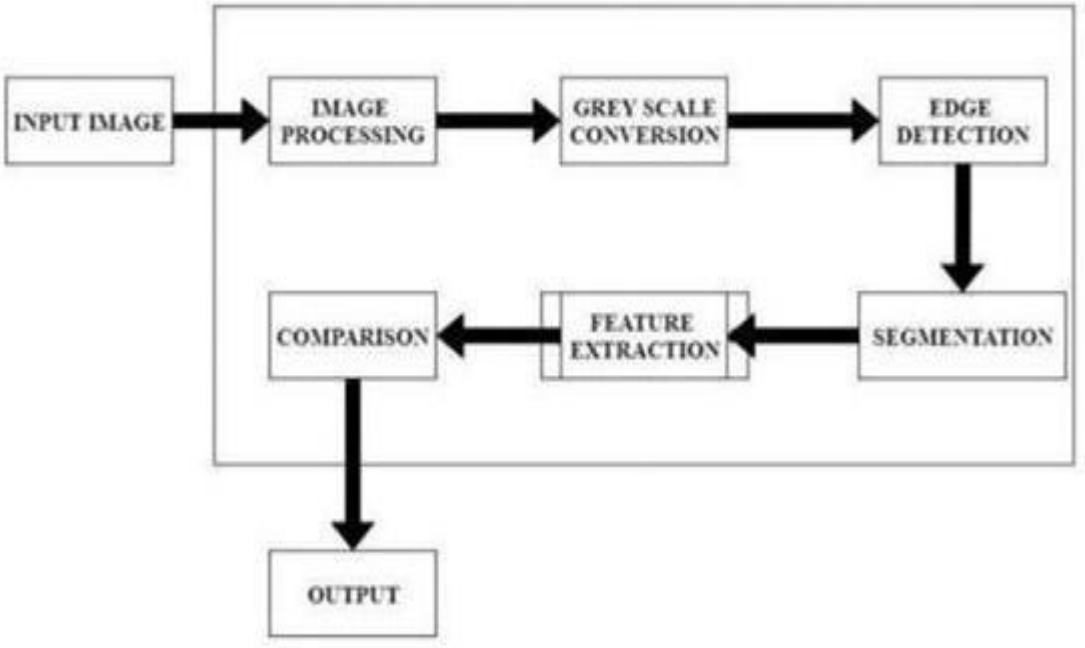

Figure 1: Data Flow Diagram

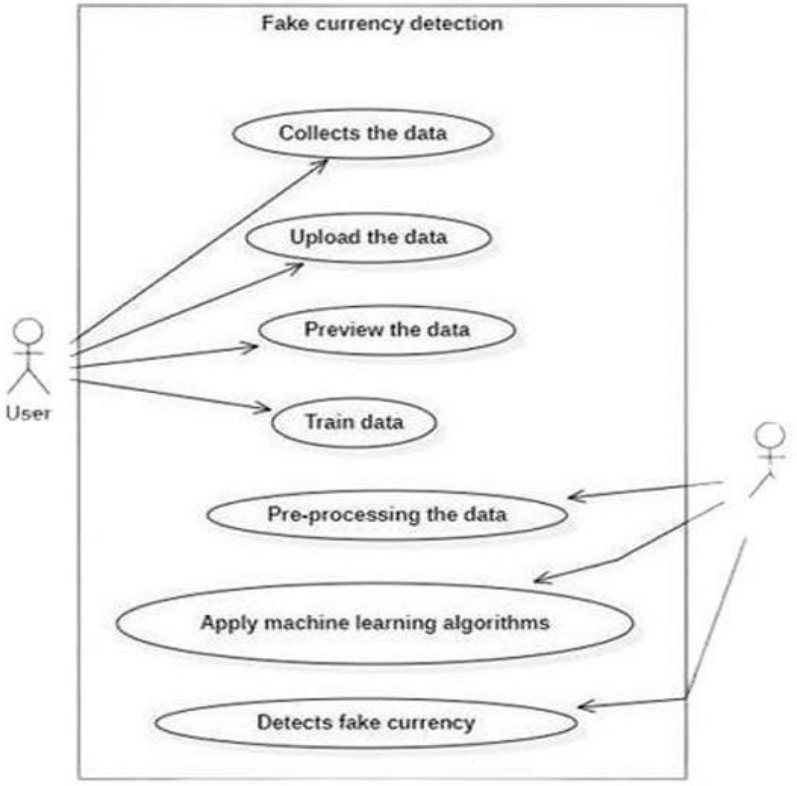

Figure 2: Use Case Diagram

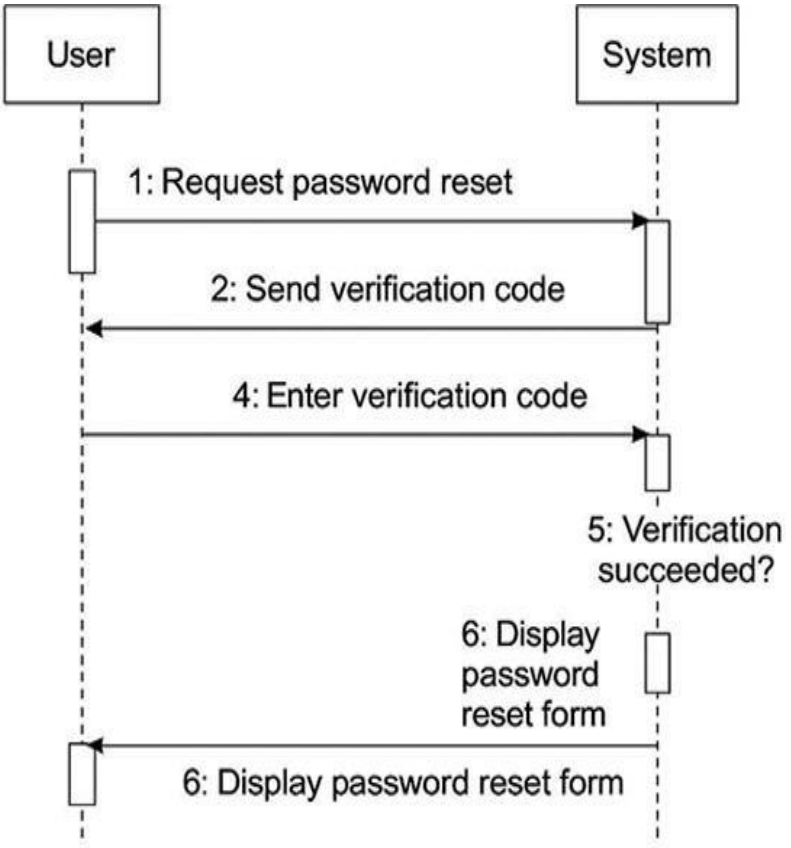

Figure 3: Sequence Diagram

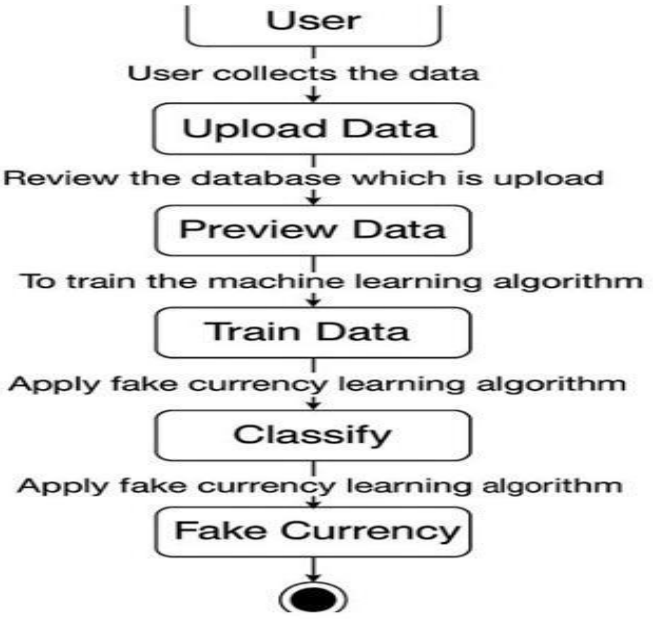

Figure 4: Activity Diagram

V.OUTPUTS

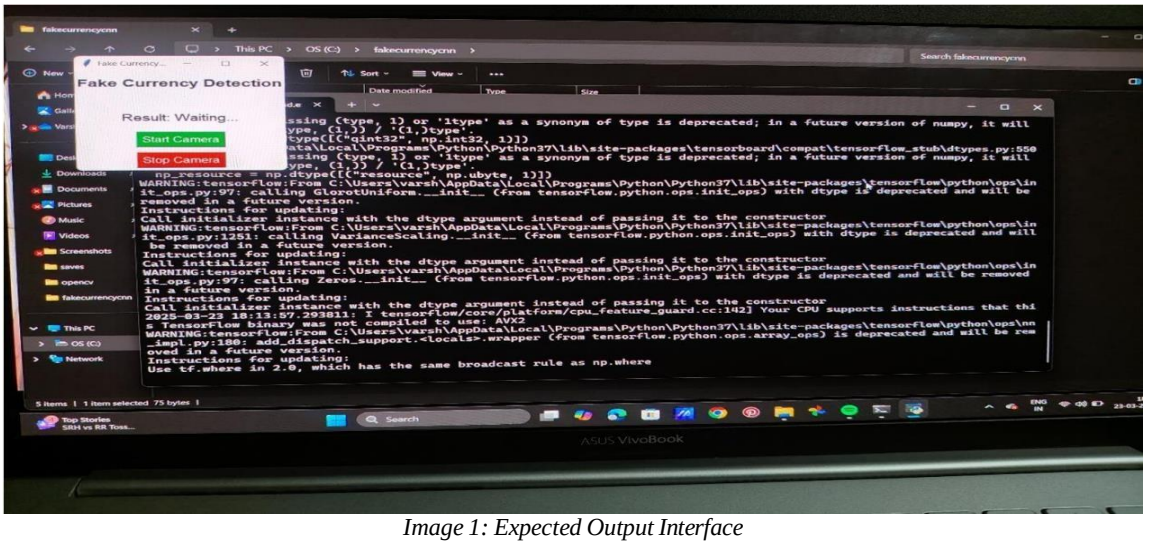

Image 1: Expected Output Interface

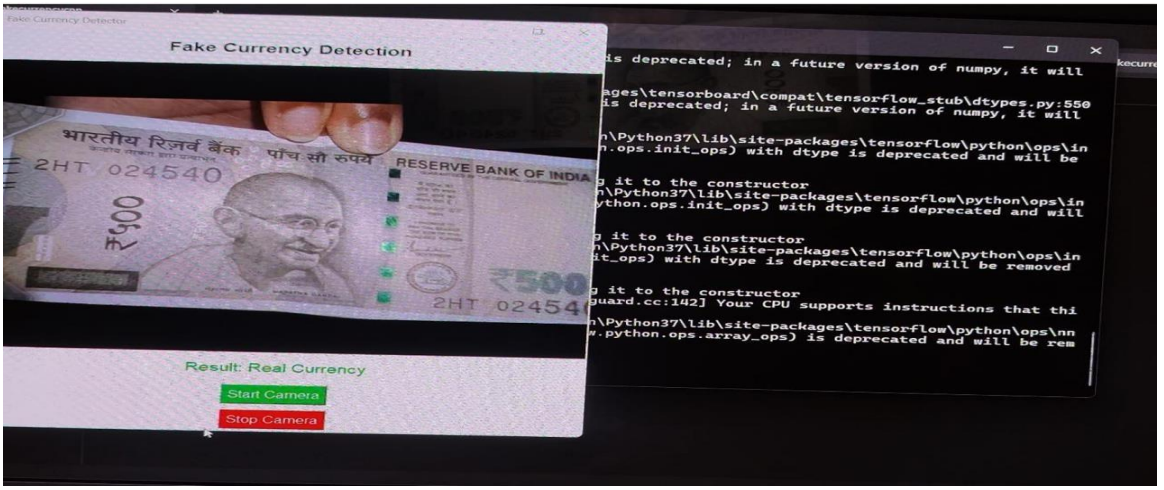

Image 2: Original Output

VI.RESULT AND DISCUSSION

The system created contains a web-based currency verification application developed using image processing and a Convolutional neural network-based classification model (CNN). For every image of the note during testing, the image was first selected, and then pre-processed using various techniques until a prediction was made on the validity of the note. It was through this sequence of stages that the different aspects associated with the image of the note could be reviewed by the CNN before it provided us with our prediction. The results observed indicate that the features used to classify the notes were good enough for correct classification since the results demonstrated that it correctly classified counterfeit notes based on texture, edge patterns, and watermark patterns.

The current implementation of this detection system can be executed with the use of Python code that analyses the taken video feed of a webcam in real-time. Each frame received into the CNN is independently assessed, and the results are updated in real-time as long as the subject is present in view of the camera. Consequently, it is evident that this type of detection system could be applicable for use in instances requiring rapid assessment of the validity of currency. Additionally, the detection image provided within our detection frame clearly displays the processed image as well as the predicted category, making the information easy to read for the user.

Lastly, it can be concluded from the results generated from our laboratory experiments that our currency classification model is a consistent means of differentiating between genuine and counterfeit notes compared to using a human being to assess the validity of notes.

VII.CONCLUSION

Counterfeit This report concludes that counterfeiting currency has an ongoing adverse impact to the reliability of finance-related transactions and consumers' confidence in the overall economy. Computer-assisted verification of banknotes via image analysis and machine learning will help alleviate the limitations of manual verification that currently plagues both consumers and banks. Furthermore, image analysis utilizes advanced convolutional neural network (CNN) technology to identify counterfeit notes more accurately than the conventional method of visual inspection.

The testing results indicate that this system will be effective if employed at various cash handling points, including banks, ATMs, retail stores, and similar businesses. This automated system removes the human element from the detection of counterfeit notes, thereby greatly reducing the potential for error on the part of humans and increasing the reliability and accuracy of detecting counterfeit banknotes. Improvements to this technology, such as the addition of more sample images of higher and lower denominations and further refining the detection process for complex counterfeit techniques, would enhance the overall reliability of this system. This automated technology has the potential to greatly decrease the availability of counterfeit banknotes in our economy and improve financial security.

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