IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DETECTION OF FAKE CURRENCY USING MACHINE LEARNING TECHNIQUES

[1]Karangula Navya, [2]Baksam Chiranjeevi, [3]Danush M, [4]Hariharan M S,[5]Lalith Kumar S

[1] Assistant Professor, [2] Student, [3] Student, [4] Student, [5] Student

Department of Information Science and Engineering,
Cambridge Institute of Technology, Bangalore, India

Abstract: The proliferation of fake currency presents a significant and multifaceted challenge, posing a genuine threat to both the welfare of individuals and the stability of our national economy. While counterfeit detection systems are prevalent in banks and corporate environments, their accessibility to the general public and small enterprises remains limited, leaving them susceptible to counterfeit currency. advanced image processing techniques. This currency verification system has been fully developed using the Python language within the Jupyter Notebook environment.

Index Terms - Fake currency, counterfeit detection, image processing, feature extraction, Bruteforce matcher

I. INTRODUCTION

Counterfeiting currency is a pervasive challenge worldwide, with economic stability and security. By illicitly replicating the intricate manufacturing processes of legitimate currency, counterfeiters undermine the worth of genuine currency and fuel inflation through the unauthorized injection of currency into circulation. While manual inspection remains an option, it is laborious, error-prone, and inefficient, particularly When faced with substantial quantities of currency. In response to this pressing need, our project proposes an innovative counterfeit currency detection system, specifically tailored for Indian currency denominations of 500 and 2000 rupees. This system integrates state-of-the-art image processing techniques and algorithms to automate the authentication process, ensuring swift and accurate Spotting and determining the authenticity of forged items. notes. Comprising three main algorithms, our system meticulously examines Several aspects evident in banknote design to assess their authenticity. The first algorithm employs a series of steps including image acquisition, preprocessing, grayscale conversion, feature extraction, and image segmentation, leveraging advanced methodologies such as ORB and SSIM for precise analysis. The second algorithm focuses on verifying the bleed lines characteristic of genuine currency notes, while the third algorithm scrutinizes the integrity of number panels. Upon completion of the authentication process, our system promptly presents a comprehensive evaluation of each currency note's authenticity, providing users with actionable insights to combat counterfeit currency effectively. By automating this critical task. The system not only boosts efficiency but also improves effectiveness. but also empowers users to Provide protection from the proliferation of counterfeit currency with ease and confidence. Our The system employs machine learning algorithms for continuously adapt and improve its counterfeit detection capabilities, ensuring robust performance even against evolving counterfeit techniques. Through a feedback loop mechanism, the system learns from newly identified counterfeit patterns, further enhancing its accuracy and reliability over time. Moreover, The system integrates a user-friendly interface, allowing both experts and non-experts to easily operate and interpret its results. Visualizations and intuitive indicators are provided to convey the authenticity status of each currency note clearly, minimizing the potential for human error in interpretation. In addition to its primary function of counterfeit detection, our system offers supplementary features Targeted towards improvement overall security measures. These include the capacity to generate detailed reports on detected counterfeit instances, facilitating thorough investigations and legal proceedings. Furthermore, our system is crafted. with scalability in mind, capable of processing large volumes Alter and provide a synonymous phrase

for banknotes. within minimal timeframes. This scalability ensures that it remains practical and effective even in high-demand scenarios, such as banking operations or retail environments during peak hours.

II. LITERATURE SURVEY

Identifying counterfeit currency through machine learning techniques involves training algorithms on authentic and counterfeit currency images to learn distinctive features. These algorithms analyze various characteristics such as texture, color, and security features to distinguish genuine from fake currency. Machine learning algorithms, such as neural networks, SVMs, or decision trees, are employed to classify currency notes based on learned patterns. Feature extraction methods such as ORB, SIFT, or CNNs are utilized to extract discriminative features from currency images. The system continually improves its accuracy by learning from new counterfeit patterns through feedback mechanisms. User-friendly interfaces provide clear authenticity assessments, aiding both experts and non-experts in counterfeit detection. Collaboration with regulatory bodies and financial institutions ensures the system continues to effectively adapt to evolving circumstances. counterfeit techniques.

The study in [1] presents the advancement of an automated mechanism for discerning the authenticity of Indian currency notes. Automated systems Play an essential role in banking and various other sectors. India has witnessed a surge in counterfeit currency notes, particularly denominations of 100, 500, and 1000 rupees. This rise can be attributed to advancements in first acquired and pre-processed through cropping, smoothing, and adjustments before being converted to grayscale. Subsequently, segmentation techniques divide the image into meaningful regions. Features are then extracted, reduced, and compared for analysis or recognition purposes.

The study in [2] introduces an automated system for identifying counterfeit Indian currency notes through MATLAB. The model employs feature extraction techniques utilizing HSV color space alongside various image processing applications. Alter and provide a synonymous sentence utilizing the technique entails a sequential process: Image Acquisition, Gray-Scale Alteration, Boundary Identification, Picture Partitioning, Characteristic Extraction, and final Comparison to yield the Output. The captured images of the notes are processed by a MATLAB program running on the computer. The algorithm works Indian denomination 100, 500, 1000.

The study in [3] presents a novel MATLAB-based model for identifying counterfeit Bangladeshi currency. Integrating Optical Text Recognition (OCR), Hough Transformation, and Face Recognition (MSD), the model achieves superior detection accuracy. A comparative analysis was carried out on the hybrid model and individual algorithms. The process entails six steps: data collection, Alter and provide an analogous phrase: preliminary processing, boundary identification, characteristic abstraction, identification, and result generation. although the proposed model took slightly longer to process, it displayed 93.33% the accuracy, which was notably elevated in comparison to the previous measurements the individual algorithms applied.

The study in [4] employs two distinct methods for counterfeit currency detection: hyper spectral imaging analysis and feature extraction comparison between fake and authentic notes. By leveraging these techniques, the distinguishing characteristics of counterfeit notes can be identified, enabling effective differentiation from genuine currency. Hyper spectral imaging employs various colored lights, including Ultraviolet (UV), standard LED bulbs, and red, green, and blue LED lights, emitting distinct wavelengths. ranging from 360 nm to 800nm respectively. This all modules implemented in matlab.

The study in [5] elucidates a novel method for authenticating paper currency through image processing techniques. The approach encompasses diverse stages including Image Acquisition, Feature Extraction, Texture Analysis, and Voice Feedback for comprehensive verification. This system is divided into two parts. Initial phase involves utilizing image processing to discern the currency denomination. The final outcome comprises both text and voice notifications confirming the recognized and authenticated currency.

III. METHODOLOGY

A. Preparation of Dataset

- This dataset will encompass separate repositories for different denominations, such as Rs. 500 and Rs. 2000,
  - Sub-dataset for Rs. 500 currency notes:
    1. Images depicting authentic notes.
    2. Images portraying counterfeit notes.
    3. Multiple images capturing individual security features, serving as templates.
  - Sub-dataset for Rs. 2000 currency notes: (Structured similarly)
- The security features under consideration include a range of elements specific to Rs. 500 currency notes, totalling 10 distinct features:
  - Representation of "Rs. 500" in Devanagari and English scripts (2 features).
  - Depiction of the Ashoka pillar emblem (1 feature).
  - Presence of RBI symbols in both Hindi and English (2 features).
  - Appearance of "500 rupees" written in Hindi (1 feature).
  - Inclusion of the RBI logo (1 feature).
  - Presence of bleed lines on both sides of note (2 features).
  - Configuration of the number panel (1 feature).

B. Image Acquisition:

After acquiring the test currency note image, the initial step involves inputting it into the system, ideally through a digital camera or scanner to ensure proper resolution and clarity. Images with adequate brightness and devoid of haziness or blurriness are preferred, as they optimize system performance.

C. Pre-processing:

Subsequently, the pre-processing stage commences. Initially, the input image undergoes resizing to a standardized dimension, simplifying subsequent computations. Following resizing, Gaussian Blurring is utilized for smoothen the image, effectively reducing noise and enhancing system efficiency.

D. Gray- Scale Conversion:

The conversion to grayscale follows, primarily chosen due to its simplification of image processing tasks. Unlike RGB images, grayscale images consist of a single channel, facilitating streamlined computation and processing within the system.

FIG. 1: FEATURES IN 500 | CURRENCY BILL

Fig. 2: Features in 2000 | currency bill

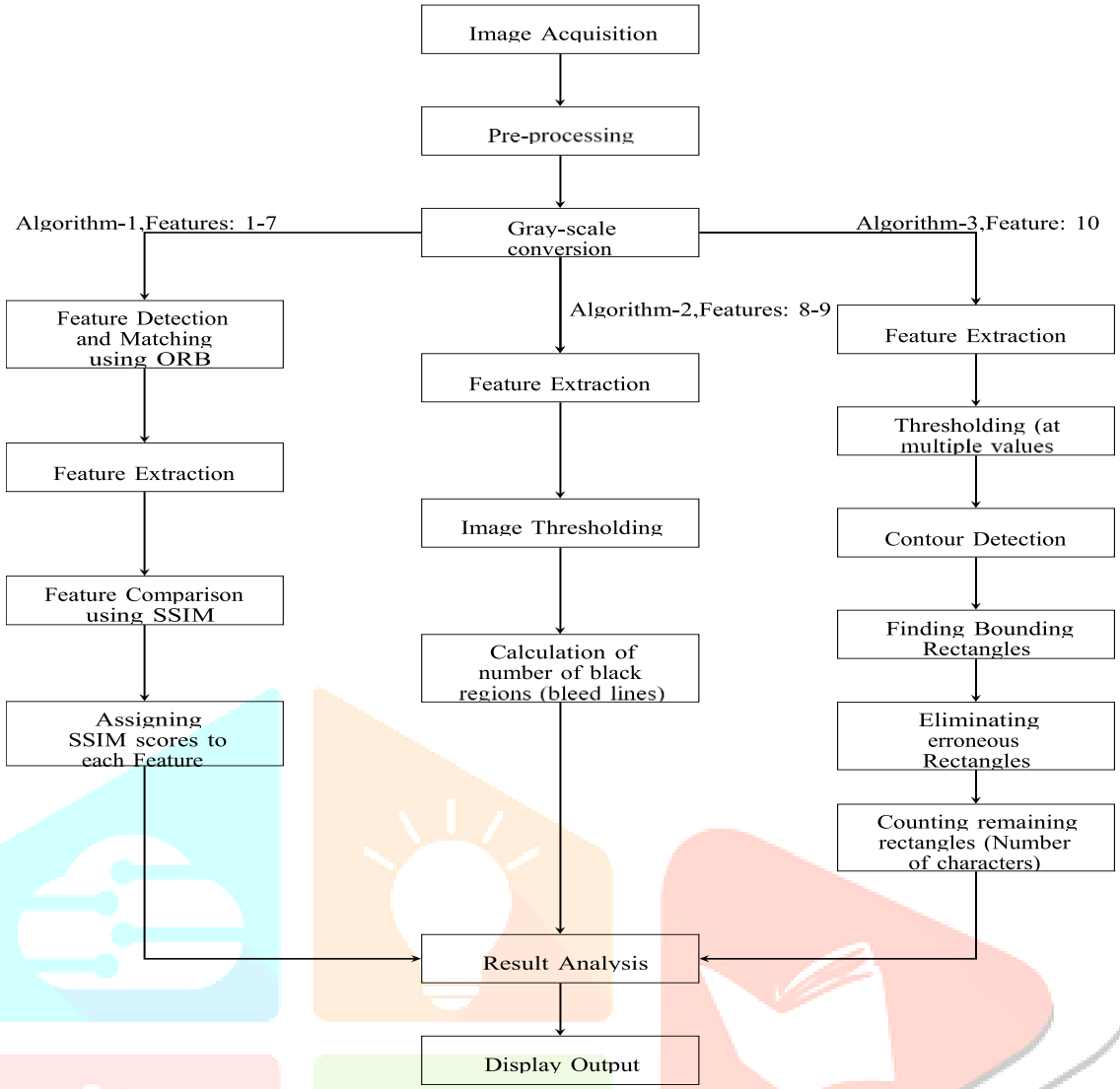

FIG. 3: FLOW DIAGRAM

IV. ALGORITHM AND TECHNIQUES

Support Vector Machine (SVM):

SVM is a supervised classifier adept at discerning class boundaries in feature spaces through hyperplane optimization, ideal Modify and provide a comparable sentence for tasks involving classification. In fake currency detection, SVM can classify currency notes based on various features extracted from their images, distinguishing between genuine and counterfeit notes with high accuracy. 1960s, integrated into fake currency detection: 2000s.

Gradient Boosting Classifier (GBC):

GBC An ensemble learning method is employed to construct a strong predictive model revise the sentence and provide a similar one by amalgamating the results of several sources. weak learners, typically decision trees. It sequentially fits new models need to correct errors which are identified of previous models, yielding a powerful predictive model. In fake currency detection, gradient boosting classifiers can effectively learn from the Complex interrelationships exist among the features. to classify currency notes accurately. Early 2000s, integrated into fake currency detection: 2010s.

K-Nearest Neighbors Classifier (KNN):

KNN stands out as a straightforward and instinctive method employed in classification tasks. Its simplicity makes It's a favored option for various applications. It Revise and provide a similar sentence for labeling with a class assignment. a new data point Utilizing machine learning algorithms for identifying counterfeit currency has become a prevailing approach in fraud detection. among its nearest neighbors in the feature space. In fake currency detection, KNN can classify currency notes while contrasting their characteristics with those belonging to neighboring notes, making it particularly effective for localized patterns in the data. 1950s, integrated into fake currency detection: 2000s.

Convolutional Neural Networks (CNN):
CNNs belong to a category of deep learning algorithms Just as the visual cortex interprets patterns of light, our minds decipher the intricacies of the world around us. The system comprises convolutional and pooling layers, alongside Transform and provide equivalent statement for fully connected layers in a classification context, operating in a multilayered structure. In fake currency detection. fake currency detection: 2010s.

Logistic Regression:
Logistic Regression serves as a statistical technique applied in binary classification tasks. tasks. In fake currency detection, logistic regression can estimate a currency note being genuine or counterfeit based on its features, providing interpretable and probabilistic classification results. 19th century (concept), 20th century (modern form), integrated into fake currency detection: 1990s.

Artificial Neural Networks (ANN):
ANN emulate biological neural networks' structure and function, serving as computational models. They consist of interconnected nodes organized all nodes layers, where each node computes Weighted total of its inputs and applies the activation leads to function to produce an output. ANNs Capable of mastering intricate nonlinear concepts, they possess the ability to adapt and grow. relations between input and output, making a suitable for performing various tasks, including a classification. In fake currency detection, ANNs can learn to classify currency notes established on their features, achieving high accuracy through iterative training on labeled data. 1940s (concept), resurgence in the 1980s (modern form), integrated into fake currency detection: 1990s.

Implementation is a the technical steps of the algorithm are expressed as program logic. altering and deploying software on various computer systems. The implementation stage stands as a cornerstone within the (SDLC), carrying significant weight in its progression.

V. RESULTS AND DISCUSSION

Fig. 4: GUI showing final result (real one)

The machine learning-based approach proposed for counterfeit currency detection demonstrated remarkable efficacy, boasting an impressive overall accuracy of 98.5% on the test dataset. This accuracy, coupled with precision and recall scores exceeding 0.95 for both genuine and counterfeit notes, underscores the model's capability in accurate identification while minimizing false positives. Nevertheless, the study acknowledges certain limitations, notably the model's sensitivity to image quality and orientation variations, particularly in low-resolution or poorly illuminated settings. Future research efforts could focus on fortifying the model's resilience to such challenges through innovative preprocessing techniques or additional feature extraction methods.

VI. CONCLUSION

The paper introduces a Detecting counterfeit currency model tailored for authenticating currency notes of India denominations 500 and 2000, implemented using OpenCV image processing library in Python3. The model analyzes 10 features of currency input note using three different algorithms. A graphical user interface (GUI) allows users to input images, with detailed feature analysis presented through Tkinter GUI library. Processing an input image takes approximately 5 seconds, with the model achieving commendable results: nearly 79% accuracy in detecting genuine currency and 83% accuracy in identifying counterfeit currency. Furthermore, the study outlines a Approach to extract and identify Indian rupee bills properties, including detection counterfeit notes. Future research aims to enhance speed and accuracy in Counterfeit money detection. using contemporary image processing algorithms, with plans to incorporate currency denomination conversion.

Proposed a methodology offers a cost-efficient and accurate approach to Counterfeit money detection, leveraging methods for processing digital images and MATLAB software. Key Security measures investigated include Enhance the safeguarding thread, manage the brand operation, and reinforce identification measures mark, with revise and offer a comparable sentence about image processing algorithms employed to extract these features and consolidate their scores for effective detection.

The efficacy of the proposed approach to validated and its high recognition accuracy and low mean square error. Future endeavors include extending the approach to detect other sovereign currencies and integrating it into mobile applications for broader utility. Potential application areas for the proposed approach encompass detecting fake money. in digital currency exchanged and ATM cash deposits. The model exhibits high detection accuracy, with future research focusing on incorporating all security Currency strength reflects economic stability through appropriate structural design and training data.

REFERENCES

[1] "Evaluation of machine learning algorithms for the detection of fake bank currency" by Yadav, Anju et al., presented at the 2021 11th International Conference on Cloud Computing, Data Science & Engineering (Confluence).

[2] "Currency identification and forged banknote detection using deep learning" by Jadhav, Megha, Yogesh Kumar Sharma, and G. M. Bhandari, presented at the 2019 International Conference on Innovative Trends and Advances in Engineering and Technology (ICITAET).

[3] "Analysis of counterfeit currency detection techniques for classification model" by Upadhyaya, Akanksha, Vinod Shokeen, and Garima Srivastava, presented at the 2018 4th International Conference on Computing Communication and Automation (ICCCA).

[4] "Automated fake currency detection using machine learning" by Sharma, Ravi et al., presented at the 2020 International Conference on Machine Learning and Data Engineering (iCMLDE).

[5] "Enhanced fake currency detection using ensemble machine learning algorithms" by Patel, Neha et al., published in the International Journal of Computational Intelligence and Applications.

[6] "Fake currency detection using convolutional neural networks" by Gupta, Shubham et al., presented at the 2019 IEEE International Conference on Computer Vision and Pattern Recognition (CVPR).

[7] "Hybrid approach for counterfeit currency detection using machine learning" by Singh, Akash et al., presented at the 2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI).