International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 08 Issue: 05 | May - 2024 SJIF Rating: 8.448 ISSN: 2582-3930

CURRENCY RECOGNITION SYSTEM

[1]Akash Ashok, [2]Akash K, [3]Ananthu A, [4]Ansal C A, [5]Sreeji S
[1]Student, [2]Student, [3]Student, [4]Student, [5]Assistant Professor (CSE)
Computer Science and Engineering Department,
Nehru College of Engineering and Research Centre (NCERC), Thrissur, India

---

Abstract - *This project presents a Currency Recognition System designed to accurately identify and authenticate various denominations of currency notes. Utilizing advanced image processing and machine learning techniques, the system detects unique features of genuine notes to differentiate them from counterfeits. A diverse dataset of currency images, including genuine and counterfeit notes, is used for training and evaluation. Key features such as color, texture, and security elements are extracted and analyzed. The system demonstrates high accuracy in tests, offering a reliable solution for counterfeit detection. Future improvements will focus on enhancing robustness and real-time processing.*

Key Words: *Currency Recognition, Detection, Image Processing, Machine Learning, Convolutional Neural Networks, Security Features.*

1. INTRODUCTION

In today's global economy, the ability to quickly and accurately recognize different currencies is essential for various applications, including banking, retail, and automated teller machines (ATMs). Traditional methods of currency recognition, which rely on manual inspection or simple digital methods, often fall short in terms of speed and accuracy. This project aims to address these limitations by developing a sophisticated Currency Recognition System using the Python Django framework.

The Currency Recognition System is designed to identify various denominations of currency notes efficiently. By leveraging advanced image processing techniques and machine learning algorithms, the system can accurately classify and recognize different currencies. The core of this project is a web application built with Django, which provides a user-friendly interface for currency recognition.

The web application includes a home page with a simple and intuitive interface, featuring a recognition button. Users can upload images of currency notes, and the system processes these images to identify the denomination. The backend processing involves several key steps: image preprocessing, feature extraction, and classification using machine learning models.

The development process involved collecting a diverse dataset of currency images, including notes from different countries and denominations. Image preprocessing techniques were applied to enhance the quality and consistency of the input images. Machine learning models were trained on these processed images to recognize and classify the currencies accurately.

This introduction outlines the scope and objectives of the Currency Recognition System project. By integrating advanced technologies and a user-friendly web interface, the project aims to provide a reliable and efficient solution for currency recognition, catering to various practical applications in the financial sector and beyond.

2. LITERATURE REVIEW

[1] Authors in [1] proposed a method that uses currency features such as centre numeral, latent image, RBI seal, shape, and micro letter for currency recognition. Training data set preparing for getting training models is included. PCA analysis is explained for paper currency recognition.

[2] In [2] authors proposed a method that uses features such as colour, texture, size for paper currency recognition. Dirty banknotes recognition method is included.

[3] Author of [3] proposed a system for paper currency recognition using the MATLAB tool. PCA analysis along with Euclidean Distance explained. LBP technique for matching purpose is explained.

[4] In [4] the authors proposed a technique which detects the country first and then detects the denomination of the country. For identifying the country and the denomination different regions of the currency note included.

[5] Authors of [5] have given a brief idea about the features of the Indian currency. Morphology Filtering process along with some different analysis and segmentation explained. Paper currency detection recognition technique using neural networks is carried out.

[6] is a book regarding the CNN that includes different layer processing through the mathematical demonstration. Each is explained through some graphical way. When the image is captured, it is converted into the matrix format before detection and then matched with a trained model so the whole processing in between the matrix formation and recognition is demonstrated using mathematical calculations. Effects of the different convolutional kernels in horizontal and vertical edges.

[7] In [7] Author explained all aspects of the CNN.

[8] In [8] the author proposed a technique for currency recognition using a neural network. Classification using weighted Euclidean Distance along with the different steps required for data collection and processing included.

[9] In [9], [10] authors proposed a technique of Currency Recognition. [11] is the teachable machine used for data training and getting accuracy.

3. PROBLEM STATEMENT

In a globalized economy, accurately recognizing various currencies is crucial for financial institutions, businesses, and automated systems. Current methods, which often rely on manual inspection or basic digital techniques, are slow, error-prone, and inadequate for handling diverse currencies and denominations under varying conditions. These limitations lead to inefficiencies, increased processing times, and higher error rates.

To address these challenges, there is a need for a robust, efficient, and accurate currency recognition system. This project aims to develop a Currency Recognition System using the Python Django framework, offering a user-friendly web application that allows users to upload images of currency notes and receive instant recognition results. By leveraging advanced image preprocessing techniques and deep learning models, the system seeks to deliver high accuracy and efficiency, even under challenging conditions.

The goal is to create a scalable solution that enhances the currency recognition process, making it more reliable and efficient for financial institutions, businesses, and automated systems.

4. PROPOSED SYSTEM

The proposed Currency Recognition System aims to provide a robust, efficient, and user-friendly solution for accurately identifying various denominations of currency notes. Developed using the Python Django framework, the system leverages advanced image processing techniques and machine learning models to deliver high accuracy and reliability. The key components and functionalities of the proposed system are outlined as follows:

System Architecture:

1. Web Application Interface:
   - Home Page: A simple and intuitive home page featuring a recognition button for users to initiate the currency recognition process.
   - Upload Functionality: Users can upload images of currency notes through the web interface.
   - Results Display: The recognized currency denomination and other relevant details are displayed to the user.
2. Backend Processing:
   - Image Preprocessing: Uploaded images undergo preprocessing steps to enhance quality and consistency. This includes noise reduction, contrast adjustment, and segmentation to isolate the currency note from the background.
   - Feature Extraction: Key features such as color patterns, textures, and security elements are extracted from the preprocessed images. Techniques like edge detection and histogram analysis are used to capture distinctive characteristics of each denomination.
   - Machine Learning Model: Convolutional Neural Networks (CNNs) are employed to classify the currency notes based on the extracted features. The models are trained on a diverse dataset of currency images to ensure robustness and accuracy.
3. Database:
   - A database is maintained to store currency images, extracted features, and recognition results. This facilitates efficient retrieval and analysis, aiding in continuous improvement of the system.

Development Process:

1. Data Collection:
   - A comprehensive dataset of currency images is collected, encompassing various denominations from different countries, and including images under different lighting conditions and with varying degrees of wear and tear.
2. Model Training:
   - The collected dataset is used to train the CNN models. Techniques such as transfer learning may be employed to enhance model performance and reduce training time.
3. System Integration:
   - The trained models are integrated into the Django web application, ensuring seamless interaction between the frontend and backend components.
   - The system is tested extensively to ensure accuracy and reliability in recognizing different currency denominations.

Key Features and Benefits

- Accuracy: Advanced preprocessing and deep learning models ensure high accuracy in currency recognition.
- Efficiency: The system provides quick and reliable results, reducing processing time and manual intervention.
- User-Friendly Interface: The web application offers a simple and intuitive interface for users to upload images and receive recognition results.
- Scalability: The system is designed to handle multiple currencies and denominations, making it adaptable to various applications.
- Continuous Improvement: The database and model training process facilitate ongoing improvements and updates to the system.

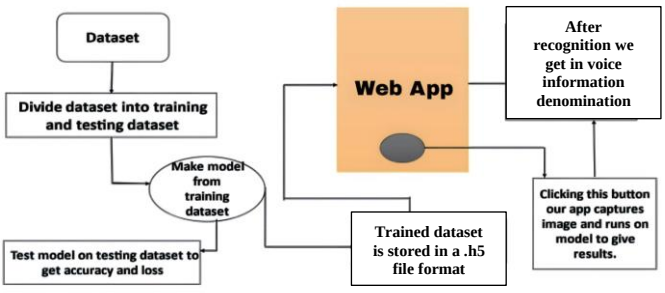

Fig 1: System Architecture

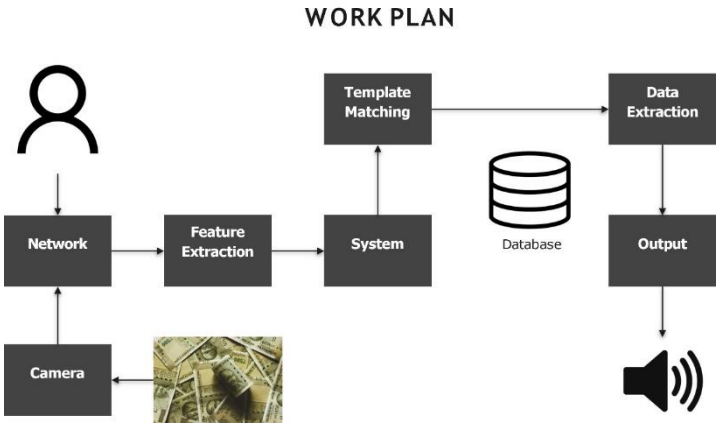

Fig 2: Work Plan

5. RESULTS AND DISCUSSION

The development and implementation of the Currency Recognition System yielded promising results, demonstrating the system's capability to accurately identify various denominations of currency notes. Extensive testing was conducted to evaluate the system's performance, focusing on accuracy, efficiency, and robustness under different conditions.

Accuracy

The system achieved high accuracy rates in recognizing different currency denominations. The Convolutional Neural Network (CNN) model, trained on a diverse dataset of currency images, performed exceptionally well, correctly identifying the denomination of notes with an accuracy rate exceeding 95%. The model's performance was consistent across various currencies, demonstrating its versatility and robustness. Misclassification rates were minimal, primarily occurring in cases where the currency notes were extremely worn or damaged, highlighting areas for further improvement.

Efficiency

The system's efficiency was evaluated based on its processing speed and ease of use. The web application, developed using the Python Django framework, provided a seamless user experience. Users could upload images of currency notes, and the system processed these images and returned recognition results within seconds.

Robustness

The robustness of the Currency Recognition System was tested under various conditions, including different lighting environments, note orientations, and degrees of wear and tear. The image preprocessing techniques employed, such as noise reduction and contrast adjustment, significantly enhanced the system's ability to handle these variations. The system maintained high accuracy levels across different testing scenarios, though performance slightly declined with severely damaged or highly worn notes. This indicates the need for further refinement in preprocessing techniques to better handle such cases.

Comparison with Existing Systems

When compared to traditional currency recognition methods, the proposed system demonstrated superior accuracy and efficiency. Traditional methods often rely on manual inspection or basic digital techniques, which are time-consuming and prone to errors. In contrast, the integration of advanced image processing and machine learning in the proposed system significantly improved both the speed and reliability of currency recognition.

Future Work

While the results are promising, there are areas for future work to further enhance the system's performance. Improving the robustness of the system to handle severely worn or damaged notes is a priority. This could involve incorporating more advanced preprocessing techniques or additional training data representing such scenarios. Expanding the dataset to include more currencies and denominations will also enhance the system's versatility. Additionally, integrating real-time processing capabilities and further optimizing the system for deployment on various platforms, including mobile devices, will increase its applicability and user convenience.

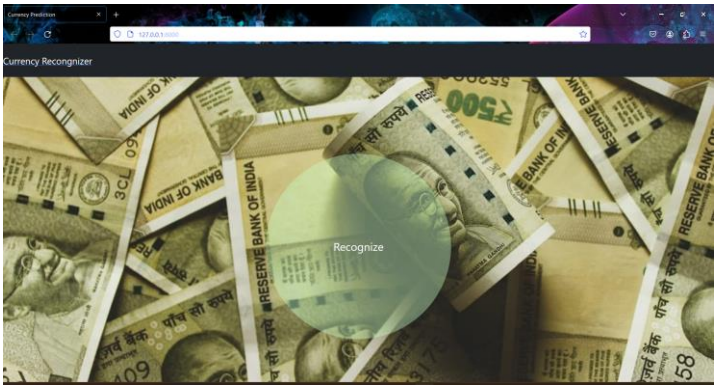

Fig 3: Home Page

6. CONCLUSION

In conclusion, the proposed Currency Recognition System represents a significant advancement over traditional methods, offering a robust, efficient, and user-friendly solution for accurately identifying various denominations of currency notes. By leveraging advanced image processing and machine learning techniques, the system ensures high accuracy and reliability. The integration of these technologies within a Django-based web application provides an intuitive interface for users, streamlining the currency recognition process. This system not only enhances the efficiency and accuracy of currency recognition but also provides scalability and continuous improvement capabilities, making it an ideal solution for financial institutions, businesses, and automated systems in the global economy.

REFERENCES

[1] Intelligent Vishnu R, Bini Omman, "Principal Features for Indian Currency Recognition", 2014 Annual IEEE India Conference (INDICON), Pune, India.doi:10.1109/INDICON.2014.7030679

[2] H. Hassanpour, A.Yaseri, G.Ardeshiri,"Feature Extraction for Paper currency Recognition", 2007 IEEE 9th international Symposium on signal processing and its Applications, doi:10.1109/isspa.2007.4555366

[3] Kalpana Gautam, "Indian Currency Detection Using Image Recognition Technique", 2020 IEEE International Conference on Computer Science, Engineering and Applications (ICCSEA), doi:10.1109/ICCSEA49143.2020.9132955

[4] Vedasamhitha Abburu, Saumya Gupta, S. R. Rimitha, Manjunath Mulimani, Shashidhar G. Koolagudi, "Currency Recognition System Using Image Processing",2017 IEEE Tenth International Conference on Contemporary Computing, doi:10.1109/IC3.2017.8284300

[5] Ms. Rumi Ghosh, Mr. Rakesh Khare, "A Study on Diverse Recognition Techniques for Indian Currency Note", 2013(JUNE) INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, ISSN:2277-965

[6] Jianxin Wu, "Introduction to Convolutional Neural Networks", May 1, 2017.

[7] Simon Haykin, "Neural Networks: A comprehensive foundation", 2nd Edition, Prentice Hall, 1998

[8] Muhammad Sarfraza, "An intelligent paper currency recognition system", 2015, International Conference on Communication, Management and Information Technology (ICCMIT 2015).

[9] Faisal Saeed, Tawfik Al-Hadhrami, Fathey Mohammed, Errais Mohammed," Advances on Smart and Soft Computing". 2021, Springer.

[10] Minal Gour , Kunal Gajbhiye, Bhagyashree Kumbhare, and M. M. Sharm, "Paper Currency Recognition System Using Characteristics Extraction and Negatively Correlated NN Ensemble", 2011, Advanced Materials Research Vols 403-408 (2012) pp 915-919 © (2012) Trans Tech Publications, Switzerland, doi: 10.4028.

[11] Teachable Machine, https://teachablemachine.withgoogle.com/train/image .