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# Currency Recognition System Using Image Processing

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**Abstract**—This paper presents a currency recognition system developed using image processing and machine learning techniques to address the challenges faced by visually impaired individuals and in situations involving worn or damaged currency notes. The system captures images of currency notes and preprocesses them using techniques such as noise removal, grayscale conversion, and image enhancement. Feature extraction is performed using methods like Scale-Invariant Feature Transform (SIFT), Speeded-Up Robust Features (SURF), and ORB. The core of the system is built using the EfficientNet-B0 deep learning architecture, implemented with PyTorch and TensorFlow, and integrated with a user-friendly interface using Streamlit. The system aims to provide real-time, accurate classification of currency denominations, supporting multiple currencies and varying note conditions. Testing confirms successful functionality across unit, integration, and acceptance phases. The system offers a scalable, cost-effective, and portable alternative to traditional hardware-based solutions.

**Keywords**—Currency Recognition; Image Processing; EfficientNet-B0; Deep Learning; Streamlit; Feature Extraction; Real-Time Classification.

## I. INTRODUCTION

Identifying currency notes manually can be challenging, especially for visually impaired individuals or in situations where notes are worn, folded, or damaged. Traditional methods rely on human recognition, which may lead to errors, delays, and inconvenience. Existing systems for currency recognition are either limited in accuracy or not easily accessible to common users. They may also struggle with variations in lighting conditions, image quality, and note conditions. Additionally, there is a lack of efficient systems that can recognize multiple currencies in real time. This project proposes an AI-driven currency recognition system that leverages image processing and deep learning techniques to overcome these limitations.

## II. LITERATURE SURVEY

Several studies have explored the use of image processing and machine learning for currency recognition. Rafael C. Gonzalez and R. E. Woods discuss fundamental image processing techniques in their book 'Digital Image Processing'. David G. Lowe introduced Scale-Invariant Feature Transform

(SIFT) for robust image feature detection. Herbert Bay et al. proposed SURF as a faster alternative to SIFT. Viola and Jones developed a framework for rapid object detection using cascaded features. Deep learning models such as those described by Krizhevsky et al. and Simonyan and Zisserman have shown significant performance in image recognition tasks. These foundational works inform the design and implementation of the proposed system.

### III. EXISTING SYSTEM AND PROPOSED SYSTEM

The existing systems used for currency recognition, verification, and authentication are primarily based on manual inspection, traditional image processing techniques, hardware-based detection machines, and early-stage machine learning algorithms. These systems have been in place for many years across banking, retail, and commercial sectors. However, rising transaction volumes, advanced counterfeit technologies, and the need for automation have exposed several limitations within the existing methods.

The proposed system introduces an AI-driven Currency Recognition Application designed to overcome the major limitations of existing manual, hardware-based, and traditional image-processing systems. It leverages deep learning, EfficientNet-B0 architecture, and a Streamlit user interface to deliver a fast, accurate, and scalable currency identification solution. This system provides real-time classification of currency note images uploaded by the user and outputs the predicted denomination along with confidence scores and top-three predictions.

### IV. SYSTEM DESIGN AND ARCHITECTURE

The system architecture is designed to support real-time currency recognition using image processing and deep learning. The architecture integrates preprocessing modules, feature extraction techniques, and a classification model based on EfficientNet-B0. The system is implemented using Python, with libraries such as OpenCV, TensorFlow, and PyTorch. A user-friendly interface is developed using Streamlit to facilitate easy interaction.

#### *A. Preprocessing*

- Noise reduction
- Image resizing
- Contrast enhancement
- Grayscale conversion
- Image normalization
- Tensor conversion

#### *B. Feature Extraction*

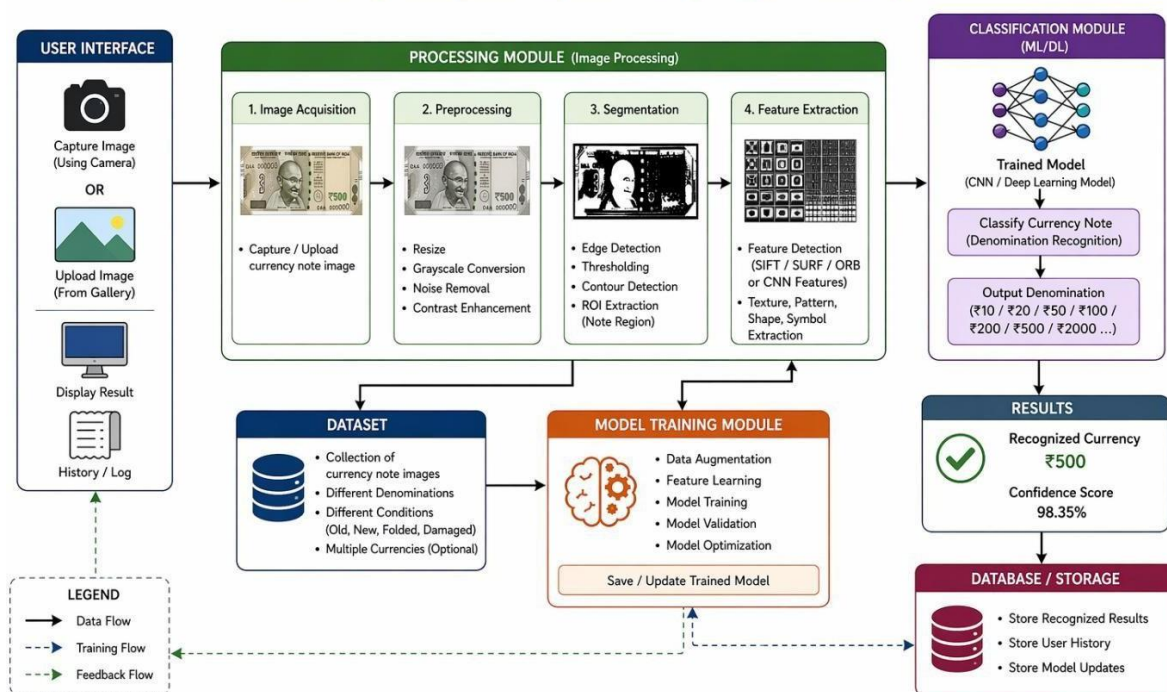
- Scale-Invariant Feature Transform (SIFT)
- Speeded-Up Robust Features (SURF)
- ORB

- Edge detection
- Thresholding
- Region of Interest (ROI) extraction

### C. Classification

- EfficientNet-B0
- Convolutional Neural Networks (CNNs)

## SYSTEM ARCHITECTURE Currency Recognition System Using Image Processing



## V. SYSTEM IMPLEMENTATION

The system is implemented using Python and several open-source libraries including OpenCV for image processing, TensorFlow and PyTorch for deep learning, and Streamlit for the user interface. The implementation involves capturing images of currency notes, preprocessing them, extracting features, and classifying the notes using the EfficientNet-B0 model. The system is designed to be scalable and portable, with no dependency on expensive hardware.

## VI. RESULTS AND DISCUSSION



The system was tested using unit testing, integration testing, and acceptance testing. Unit testing was conducted as part of the combined code and unit test phase. Integration testing ensured that components interacted without error. Acceptance testing confirmed that the system meets functional requirements. All test cases passed successfully, with no defects encountered. The system demonstrated reliable performance in identifying currency denominations under various conditions.

## VII. CHALLENGES AND LIMITATIONS

Despite the successful implementation, the system faces certain challenges. Handling extremely damaged notes remains a limitation, as feature extraction becomes difficult. Improving recognition accuracy under poor lighting conditions is another area requiring attention. Additionally, expanding support to include multiple currencies presents ongoing complexity.

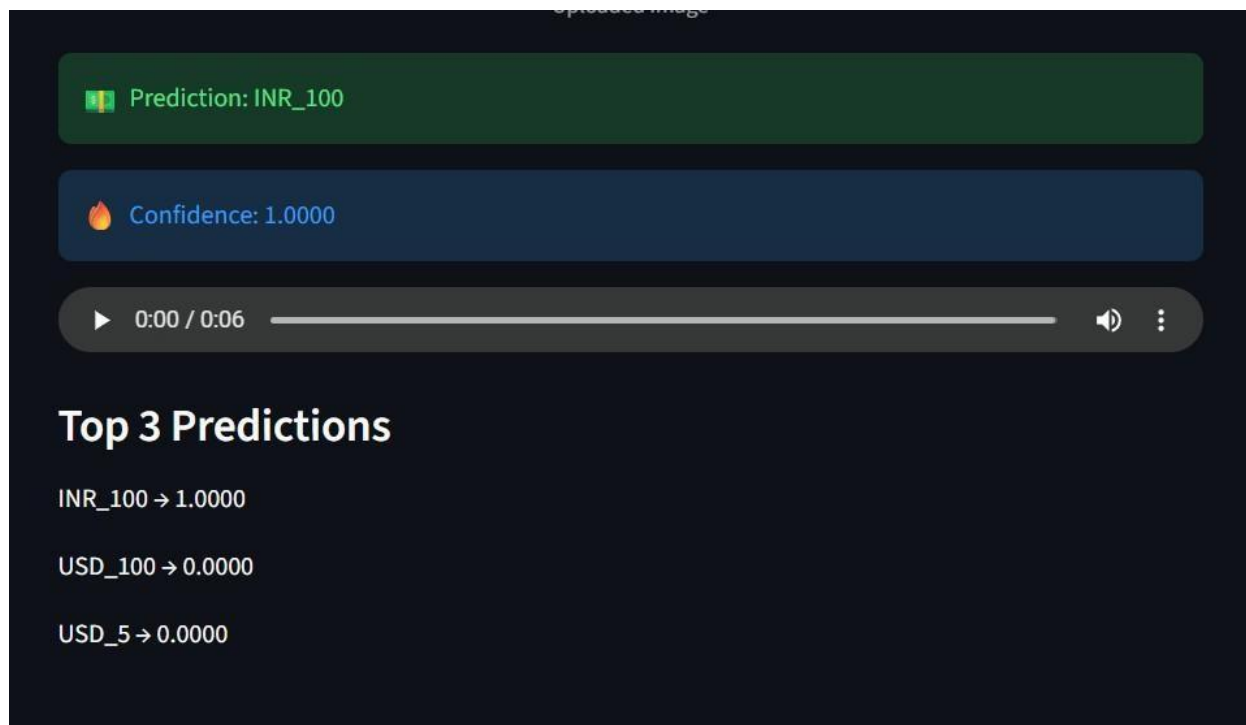
## VIII. CONCLUSION AND FUTURE SCOPE

The proposed system offers a robust, automated solution for currency recognition using image processing and deep learning. It addresses the limitations of traditional systems by providing a scalable, cost-effective, and portable alternative. Future enhancements include the adoption of advanced deep learning models, development of a mobile application, integration of voice assistance, and support for real-time video processing. Cloud-based deployment and AI-based continuous learning are also considered for improved performance and adaptability.

*Representative figures from the system are listed below:*



Fig. 1. Input page



*Fig. 2. Output page*

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