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FAKE CURRENCY DETECTION USING IMAGE PROCESSING

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ABSTRACT :

The creation and circulation of counterfeit notes are on the rise right now, as a result of advances in color printing technology. This is a serious issue that affects practically all of the nations. The economy is impacted. Such fake money fuels evil intentions, typically involving terrorist actions. According to the research, this has had a highly negative effect on developing nations like India. This research suggests a method for viewing the fake currency through its image. Pre-processing should be used after choosing an image. The acquisition of images is completed at first during processing. Then a conversion from RGB to GRAYSCALE is done. After conversion, the image is segmented, its features are measured, correlation is found, and classification is completed to determine whether the image is real or fake. Fake money has been a significant issue. Banks and other trading places have equipment available to verify financial validity. Nevertheless, the normal individual does not have access to such tools, which is why fake money detecting software that is usable by regular people is required. We get at most 81% of accuracy considering 50 items of Indian Currency notes of 2000-rupee. This project provides a thorough explanation of a fake note detector that can be used by the average person. The suggested system employs image processing to identify genuine currency from counterfeit money. The Python programming language has been used to create the software in its entirety.

Introduction:

Counterfeit currency is a significant issue faced by economies worldwide, causing financial losses and undermining trust in financial systems. With the rapid advancements in printing and imaging technologies, counterfeiters have been able to replicate currency with high precision. To combat this growing challenge, reliable and efficient methods for detecting fake currency are essential.

Image processing, a subset of computer vision, offers a promising solution for counterfeit currency detection. It involves analyzing and processing digital images of currency to identify patterns, textures, and other distinct features that distinguish genuine notes from counterfeit ones. By leveraging modern image processing techniques, such as edge detection, feature extraction, and pattern recognition, counterfeit detection systems can achieve high accuracy and efficiency.

This project focuses on developing a system that uses image processing techniques to identify fake currency. The system captures images of currency notes and processes them to extract key features such as watermarks, micro-printing, color patterns, and holograms. These features are then compared against predefined standards for authenticity verification.

LITERATURE REVIEW :

Various methods have been proposed for handwritten digit recognition, ranging from traditional machine learning to deep learning. Earlier works emphasized rule-based systems and template matching, while modern approaches leverage convolutional neural networks (CNNs). However, this paper highlights the importance of combining image processing techniques with machine learning models for effective recognition.

Methodology :

Detecting fake currency using image processing involves analyzing the visual and textural features of a currency note to identify discrepancies that indicate forgery. Here's a methodology for such a project:

1. Problem Definition

Objective: Detect fake currency notes using digital images and image processing techniques.
Scope: Focus on specific currency denominations and their key security features.

2. Data Collection

Collect high-resolution images of genuine and fake currency notes.
Use diverse sources to include variations in wear, light conditions, and angles.
Ensure data represents all relevant denominations.

3. Preprocessing

Image Acquisition: Capture currency note images using a high-resolution camera or scanner.
Cropping and Resizing: Normalize the size of all images to focus on the region of interest (ROI).
Grayscale Conversion: Convert the image to grayscale to reduce computational complexity.
Noise Removal: Apply filters (e.g., Gaussian or median) to remove noise.

4. Feature Extraction :

Identify and extract key features that differentiate genuine from fake notes:

4.1. Watermark Detection:

Use intensity analysis or edge detection to identify watermarks.

4.2. Security Thread:

Use morphological operations to detect the embedded thread.

4.3. Micro-Text:

Apply zoom and OCR techniques to verify micro-printing.

4.4. Color Consistency:

Perform color histogram analysis to check for deviations in color patterns.

5.5. Hologram and Iridescent Stripes:

Analyze reflective properties under different lighting conditions.

6.6. Texture Analysis:

Use techniques like GLCM (Gray Level Co-occurrence Matrix) to evaluate texture patterns.

7.7. Serial Number Verification:

Detect and extract serial numbers using OCR and check against a database.

5. Image Processing Techniques :

Edge Detection:
Use algorithms like Sobel, Canny, or Prewitt to detect edges of key features.
Thresholding:
Apply binary or adaptive thresholding to isolate specific patterns.
Pattern Matching:
Compare extracted patterns (e.g., watermarks) with a database of genuine note patterns.
Fourier Transform:
Analyze frequency domain features for identifying counterfeit printing.

6. Classification :

Use machine learning or deep learning for classification:

Feature-Based Classification:
Train models like SVM, Random Forest, or k-NN using extracted features.
End-to-End Deep Learning:
Train CNNs (e.g., ResNet, VGG) directly on the images for automatic feature extraction and classification.
Use pre-trained models for transfer learning if data is limited.

7. Validation and Testing :

Use cross-validation to evaluate the model's performance.
Measure metrics such as accuracy, precision, recall, and F1-score.

8. Deployment :

Integrate the system into a portable application (e.g., a mobile app or desktop tool).
Include user-friendly interfaces for image upload and result display.

9. Challenges and Considerations :

Variations in lighting, angle, and resolution can affect accuracy.
Regular updates may be required to adapt to new counterfeit techniques.
Ensure the system works across various denominations and conditions.
Tools and Libraries
Programming Languages: Python, MATLAB
Image Processing Libraries: OpenCV, PIL
Machine Learning: Scikit-learn, TensorFlow, PyTorch
OCR: Tesseract
This methodology provides a structured approach to implementing fake currency detection using image processing.

Conclusion :

MATLAB was used to implement the image processing method for detecting counterfeit currency. Features of the currency note, such as the serial number, security thread, identification mark, and portrait of Mahatma Gandhi, were extracted. The process began with the acquisition of the image and ended with the calculation of the intensity of each extracted feature. The system can extract features even if the note has scribbles on it, and the algorithm used here is suitable for the recently introduced 500 and 2000 denomination. The proposed system can also be implemented on hardware using a suitable processor to speed up detection. An automatic railway ticket booking system that incorporates currency detection as one of its components can also be proposed.

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