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AUTOMATED CURRENCY RECOGNITION SYSTEM USING IMAGE PROCESSING

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ABSTRACT

This paper proposes an automated currency recognition system employing digital image processing techniques. The system focuses on accurately identifying currency details from images or photographs, including Currency Value, Currency Name, and equivalents in INR, EURO, and US Dollar. Key characteristics such as size, color, printed text, and intra-country variations are utilized for currency notes, specifically focusing on the Indian Rupee and US Dollar denominations. The system demonstrates high accuracy and efficiency in swiftly recognizing currency notes.

Index Terms: Automatic currency recognition, Digital image processing, Currency denomination recognition, Image analysis, Color analysis, Text recognition, Currency identification system.

I. INTRODUCTION

According to the UN charter, there are approximately 195 countries globally, with 193 as UN members and two as observing states. The UN recognizes 180 different currencies worldwide, each varying in size, color, and texture. As international trade and tourism grow rapidly, accurate currency recognition becomes crucial. Many people travel abroad and use their native currency for transactions, often unaware of foreign currencies and exchange rates. Hence, there is a pressing need for an automated system that efficiently and accurately identifies currency notes.

Our proposed system utilizes image processing to automate and enhance this recognition process. Using examples such as the INR and USD, we demonstrate a methodology grounded in computer science technologies like Digital Image Processing and Python. The system, depicted in Fig. 1, follows a structured approach: it begins by inputting a currency note image for analysis. Basic image processing techniques are then applied to refine the image and prepare it for comparison with a dataset. Key features such as color and texture are extracted from the image to determine the currency's name and denomination. Subsequently, the system fetches the current exchange rate using an online API. Finally, the recognized currency details and exchange rate are displayed as the output.

This automated approach not only ensures accuracy and efficiency in currency

recognition but also supports industrial development by leveraging modern technological advancements.

II. LITERATURE SURVEY

- Rafael C. Gonzalez and Richard E. Woods conducted an extensive survey of faculty, students, and independent readers from 150 institutions across 30 countries. Their feedback led to the expansion and inclusion of topics such as deep learning, deep neural networks, convolutional neural networks (CNNs), scale-invariant feature transform (SIFT), maximally-stable extremal regions (MSERs), graph cuts, k-means clustering, superpixels, active contours (snakes and level sets), and exact histogram matching. Major improvements include a more cohesive presentation of image transforms, enhanced discussions on spatial kernels and spatial filtering, and significant revisions and additions to examples and homework exercises. MATLAB projects were added at the end of every chapter, along with support packages containing solutions, image databases, and sample code for students and faculty.
- Snehlata Sahu and Toran Verma proposed a method for currency identification using image processing techniques to recognize the currency of different countries. They emphasize that standard currency recognition systems focus mainly on identifying forged currencies, making accurate currency identification systems essential. Their approach involves preprocessing, feature extraction, and classification to improve the accuracy of currency identification. They reviewed various literature on paper currency recognition techniques and concluded that efficient preprocessing and feature extraction techniques could enhance system accuracy.
- Muhammad Sarfraz proposed a money number recognition system, which is crucial for cash-related equipment in self-service systems. The system uses gray value accumulation for quick positioning of money numbers, least square method for edge line detection, geometrical rotation, and gray adjacent interpolation for tilt correction. The recognition is based on character structure and the intersection features of imaginary lines and characters, forming a recognition judgment tree. Simulation experiments show that this algorithm achieves high recognition accuracy under rejection conditions.
- Bo-Yuan Feng, Mingwu Ren, and Xu-Yao Zhang studied RMB (renminbi banknote) serial number recognition to reduce financial crime and improve financial market stability and social security. Their system uses skew correction and orientation identification to detect the RMB serial number region, followed by a combined thresholding technique for binarization. A local contrast average method is used for character extraction. Experiments show that their binarization method outperforms other methods, achieving an overlap-recall rate of 79.68% and an overlap-precision rate of 98.10%.
- Paul H. King authored a book on digital image processing and analysis, divided into four sections and thirteen chapters. It is written for junior-year or above levels and serves as a foundation for advanced studies involving images. The sections cover an introduction to digital image processing and computer imaging systems, digital image analysis and computer vision (including segmentation, line and edge analysis, discrete

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transforms, and feature analysis), digital image processing and human vision (including enhancement techniques, restoration, and compression), and program and application development using CVIPtools.

III.PREVIOUS WORK

According to the UN charter, there are approximately 195 countries globally, with 193 as UN members and two as observing states. The UN recognizes 180 different currencies worldwide, each varying in characteristics such as size, color, and texture. As international trade and tourism grow rapidly, accurate currency recognition becomes crucial. Many people travel abroad and use their native currency for transactions, often unaware of foreign currencies and exchange rates. Hence, there is a pressing need for an automated system that efficiently and accurately identifies currency notes.

DISADVANTAGES:

1. Critical recognition requirements.
2. Time-consuming process.

IV.PROPOSED MODEL

The proposed system is based on image processing, aiming to enhance the currency recognition process by making it robust and automatic. Initially focusing on the INR and USD as examples, the system leverages computer science technologies like Digital Image Processing and Python. This project is a crucial step towards industrial development, with plans to include more currencies based on practical demand and usage.

V.ALGORITHM:

Edge detection in digital image processing is crucial for segmenting images into regions of discontinuity. It identifies significant local changes in intensity, which can be categorized into horizontal, vertical, and diagonal edges. This technique finds wide application in:

- Pattern recognition
- Image morphology
- Feature extraction

By highlighting areas of abrupt intensity changes, edge detection helps in reducing data while preserving structural properties of an image. This process aids in understanding image features and boundaries, essential for various image processing tasks.

VI. SYSTEM ARCHITECTURE DIAGRAM

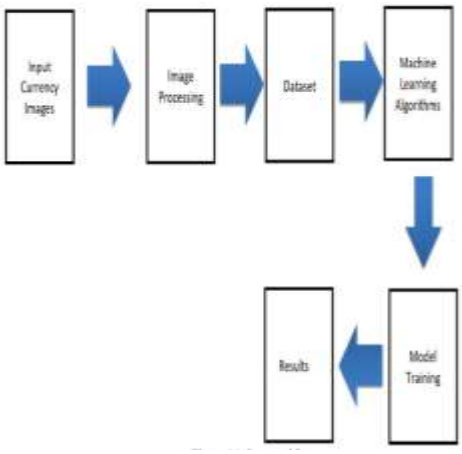

Figure 1. System Architecture

VII.IMPLEMENTATION:

1.Open Image:

When you click on this button then it will direct you to memory and ask you to select image of currency. After selecting an image you will automatically return to the window

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and your selected image will be visible in application window.

2.Recognize:

This button is used for currency recognition. After pressing this button currency recognition will start and you will get output in few seconds on the application window.

3.Conversion:

This button is used for currency Conversion. After pressing this button currency Conversion will start and you will get output in few seconds on the application window.

4.Reset:

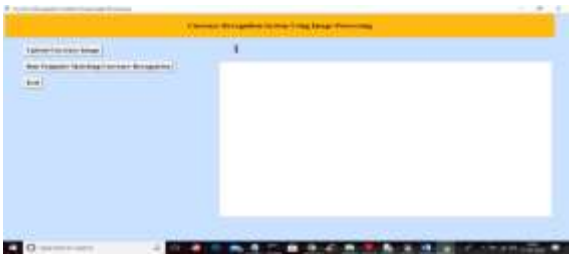
This button is used to clear the application window.

5.Exit:

This works as simple exit button, you will come out of the application and all processes of application will be terminated.

VIII.RESULTS

To run project double click on 'run.bat' file to get below screen



In above screen click on 'Upload Currency Image' button to upload currency images like below screen

In above screen selecting and uploading '1.jpg' file and then click on 'Open' button to load image and then click on 'Run Template Matching Currency Recognition' button to get below output

In above screen first image is the training image template and second image is the original image so by applying template matching algorithm we can predict correct currency not and that currency not recognized as INR 100. Similarly you can upload other image and test

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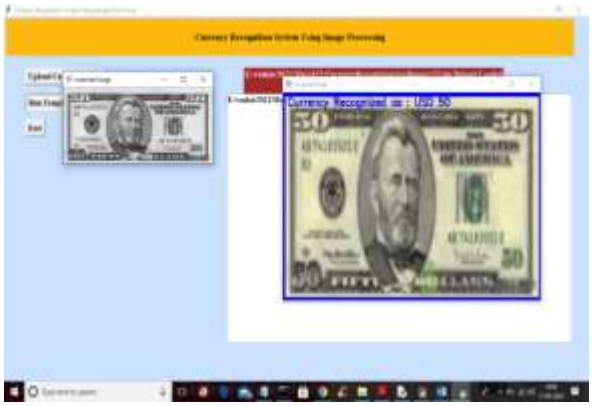

In above screen in blue colour text we can see currency identified as USD 50

Note: this is computer program not human so it may recognized 7 images out of 10 correctly as no computer algorithms are 100% perfect.

IX.CONCLUSION

In conclusion, our designed system accurately identifies both the country of origin and the denomination of a given banknote. Currently, it supports twenty of the most common currencies but can easily expand to include more countries based on our described methodology. Compared to the crude pixel-by-pixel comparison algorithm, our approach is significantly more accurate and faster. Our algorithm achieves currency and denomination identification in an average of 5.3 seconds, showcasing substantial improvement. However, it's important to note that our system currently addresses a limited number of currencies out of the 180+ worldwide. Future developments could focus on expanding this coverage. Additionally, while effective in most cases, our system currently lacks robustness in identifying mutilated notes, an area we aim to improve in future iterations.

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