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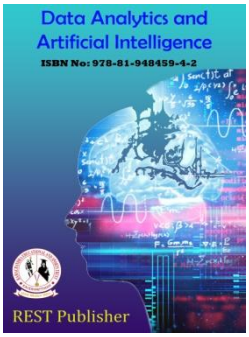

A Study On Detection Of Counterfeit Money By Image Processing

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Abstract: *This system, known as the Currency Recognition System, is utilized all over the globe for the purpose of detecting currency fraud. One can find applications for this framework in financial frameworks, cash-monitoring devices, cash-trade frameworks, and so on. In today's technologically sophisticated world, this framework is crucial, and it ought to be simple to obtain. In this essay, we suggest a method for automatically identifying paper money using a programed we've created. Simple, reliable, and effective describe the method that was used. The methodology is divided into several sections, such as those for preparing the images, extracting the characteristics, and comparing the prepared and test pictures. The output includes the currency's denomination, whether it is a genuine note or a fake, and a conversion of the currency into the currency of another country. User-friendly and well-designed mobile software was produced. A challenging dataset with various constraints was used to determine the performance of the proposed system.*

Keywords: *Image analysis, Cross-platform, Flutter plugin, Characteristic extraction, and Image Comparison.*

1. INTRODUCTION

A form of money known as a currency is one that is issued by the government of a certain country and is designed to look like the real thing but is usually used for dishonest or illegal purposes. It serves as an exchange medium as well as a unit of account and a store of wealth. It is a unit of currency—like the dollar, the euro, or the pound—that is recognized as payment in a particular region or among a particular population. In today's technologically advanced society, widespread use of this paper money can cause issues. A prime illustration of this is fake currency. People frequently create counterfeit paper currency that resembles the original notes in an effort to spread them around more widely. It can be difficult to tell the original letter from a look-alike. When such fake currency enters the system of circulation, the nation's economy quickly declines. Also, these notes are used in terrorist activities. The terrorists use it to cripple the economy of a nation and create an economic terror. Although this fake currency is being printed with precision, there is a chance to detect them with some effort. The local racketeers use photographic methods, hand engraved blocks, lithographic process and color scanning process to manufacture the fake notes. In fake notes, the watermark is made by painting with the picture of Mahatma Gandhi. later oil or grease is applied to give translucent feel for the fake note. In original notes, the watermark is made using water coated metal stamp or dandy roll. In false notes, the security thread is simulated by printing a line with grey ink or by using aluminum thread while pasting two paper sheets together, but in genuine notes, the security thread is woven into the paper at the time of production and consists of tiny lettering or discrete numbers. Since the individual number shapes and figure alignments are challenging to copy, counterfeiters have difficulty producing accurate copies. To find the similar notes, follow this lead. This gives inspiration to create a mechanism that can identify such fake currency. A method called the Currency Recognition System seeks to quickly and accurately identify fake currency. The general public can identify counterfeit currency with just one touch when it is introduced in the form of a mobile programme that is easily downloaded. The system was created using a mix of Open CV and image analysis methods, as well as the Python programming language. Using the flutter platform, a mobile programme is created that works with both iOS and Android devices. By reducing the movement of counterfeit notes and boosting the nation's economy, this app, when distributed to all citizens of a nation, will swiftly eradicate fake notes and contribute to the development of that nation.

2. RELATED WORK

Because of technological advancements in the fields of computers, printers, and scanners, it is now very simple to duplicate cash notes; as a result, a huge amount of fake money has been reported in daily news. Kamesh Santhanam, Sairam Sekaran, Sriram Vaikundam and Anbu Mani Kumarasamy [1] two different kinds of systems to distinguish fake currency were included in the framework that was suggested. The first variety makes use of UV (Ultra Violet) recognition through laboratory viewing, and the second type makes use of light polarisation after passing through money. The output is only deemed positive if both findings are favourable. In terms of dependability, automation, and accuracy, this strategy is a vast improvement over earlier approaches. Verification of documents is accomplished using this method. When compared to UV and magnetic ink detectors, which rely on the chemical properties of the currency note, the polarisation technique is more accurate because it uses the physical properties of the note. Thus, it can be considered an inventive method of money detection. Kedar Sawant, Chaitali More [2] suggested a system that relied on the software interface for recognition. The method that is most frequently used to detect fake Indian money is digital image processing. The dimensions, latent image dominant hue, and identification mark are just a few of the distinctive characteristics used to categorise Indian currency. By extracting and conducting segmentation, this is used to recognise the currency. This process shifts from being machine-oriented to being more software-oriented by using image processing methods.The ability to distinguish between various currency denominations and spot fake money will be made easier for visually impaired people with the aid of this system. The method places a greater emphasis on the security features found on currency notes and uses them to authenticate and verify Indian currency. The accuracy of the suggested method is close to 90%, according to experimental findings. Ankush Roy, Utpal Garain, Biswajit Halder, and David S Doermann [3] A framework for identifying fake money has been suggested that makes use of image preparation and design acknowledgment techniques. In the analysis, real-world cases are used to illustrate how it is possible to create a machine that can be highly accurate and verify paper money. A thorough evaluation of the methodology using real-world instances strengthens its effectiveness.As ease framework is sought after, the vast scope organisation of such a framework becomes feasible, and the complexity of the general framework is kept to a minimum to obtain minimal effort equipment acknowledgment of the suggested strategy is achievable. The need to implement logically advanced features in banknotes results from how difficult it has become to distinguish skillfully conveyed counterfeit currency. Sangwook Baeka, Euison Choib, Yoonkil Baekb, Chulhee Lee [4] a method that combines strong fake banknote declaration figures was put forth. The proposed algorithm was tried using 20 different types of Indian rupee (INR), European Euro (EUR), and US Dollars (USD). When neural systems were applied, the trial outcomes showed 99.9% order accuracy for certifiable banknotes and 100% characterization exactness for counterfeit currency. 99.8% grouping accuracy for certified banknotes and 100% order precision for counterfeit banknotes were obtained when the probability test method was used. Ch. Rupa, T. Sumanth [5] The technique for judging the nature of monetary standards with a reduction in the need for confirmation through the use of design acknowledgment strategies is suggested, and this improves the accuracy of counterfeit note detection. The following processes are used as acknowledgment stages: preprocessing, shading detection, division, edge location, and layout coordination. The software informs the customer whether the money is genuine or fake. The suggested framework is tested using statistics from Indian cash transactions. The model's main characteristics are execution analysis, which is done using techniques like quantitative strategy histograms and quality measurements correlation along with experiment study reports. In order to perceive the money using image handling, various calculations are used. For recognition, the programme makes use of the primary colour and a unit of currency. Images are preprocessed using edge discovery, division, shading shift, and example coordination, among other techniques. Y. Neeraja, B. Divija and M. Nithish kumar [6] suggested a method where the identification of cash is based on a number of innovations, such as edge location, highlight extraction, picture division, picture obtaining, dim scale change, and picture correlation.

3. EXISTING SYSTEM

We can always increase the accuracy of the money recognisable proof structure by applying some effective pre-preparing and highlight extraction techniques. Based on the physical characteristics of the notes, the methodology provides an effective way for identifying counterfeit currency. The effort will be helpful in reducing counterfeit money. It is possible to identify the boundaries that are missing from the fake notes. Image processing technique is used to identify unique currency.

Proposed System:

Forgers are particularly interested in the paper monetary norms. Using the physical or chemical characteristics of money-printing paper forms, fake finding can be carried out. End users are hampered by the system's difficulty in use, high cost, and lack of reach. As a result, dynamic exploration is presently focused on the highlight-based fake discovery

framework. The work flow begins with an input picture, which can either be a train image or a test image, as shown in the below figure. The input pictures are first pulled from the dataset, after which they are pre-processed to remove any disastrous data. After the pre-processing is finished, the preprocessed picture can either be a train (inculcate) image or a test (examine) image.
Work flow of Currency Detector:

1) USER
a. Currency Image
b. Output(Currency Recognition with Authentication)
2) READ IMAGE
a. Feature Extraction
b. Display
3) SYSTEM
a. Template Matching
b. Recognize
4) DATASET
a. Match Currency Feature
b. Get Particular Currency Feature
5) FEATURES ON CURRENCE

When modelling a dataset, the inculcate (train) picture is used, and the examiner (test) image is input provided by the user to verify the model's accuracy. The training image is used to train the dataset or when modelling it, and the test image is the input image provided by the user to identify the sort of note. Several processes are applied to the input picture. The precise steps in this procedure are illustrated in Figure 1. The output indicates whether the paper is genuine or not. If the note is legitimate, an output is shown that states that it is authentic and also provides the currency's worth. In addition, the equal value of the Indian Rupee

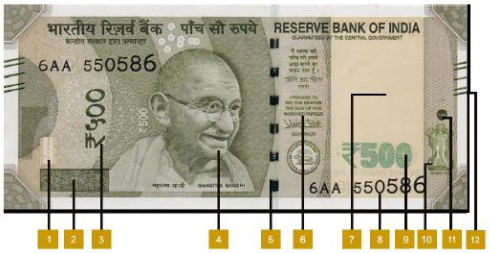

FIGURE 1. Rs 500 note along with security features

4. SYSTEM DEVELOPED

A picture's content is broken down into many important points using PC vision (features). Real information captured by the camera or the placement of specific models can be used to speak to and acquire the picture. This is how demonstrations are found and recognized in multi-media records using the recognition of picture intrigue foci. Features must be detected by effective algorithms. They should have the option to obtain results that are nearly continuous, repeatable, and that allow for the recognition of a particular element in different images. Hamming separation computations are quickly executed in the binary bit string descriptor algorithms BRISK and ORB. SIFT and SURF, on the other hand, use Euclidean separation between descriptors, are typically robust, and demand increasing amounts of processing time. ORB (Oriented RAPID and Rotated BRIEF) (Oriented FAST and Rotated BRIEF) A well-thought-out replacement for SIFT and Surf is Oriented FAST and Rotated BRIEF, created at the Open CV labs. In the job of feature detection, it performs as well as SIFT and is almost twice as quick as the earlier one. ORB combines the BRIEF description with the FAST key point detector. These two methods are extremely effective and affordable.

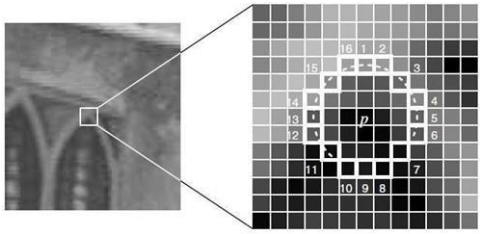

FIGURE 2. Fast key point

The features from the Accelerated Segment Test method do not contain an orientation component or multi scale features. This encourages the use of multi scale picture pyramids. This pyramid is made up of numerous profiles of the same picture that were taken in various orientations and resolutions.

5. OUTPUT

Python, Open CV, Android Studio, Windows 10 Home Single Language/Mac OS/Linux, and Flutter Flask are the required pieces of software. Processors must be at least 1 GHz and preferably 2 GHz or higher in terms of hardware requirements. Disk drive minimums of 32 GB and 64 GB or more are recommended, and memory requirements are 1 GB of RAM minimum and 4 GB or more recommended. 13-pixel cameras or higher. Base64 String, Scaffold, Image Picker, and Image Cropper are some of the plugins needed for the front end of the programme.

FIGURE 3. Screens of application (Initial, Image cropper, Image display)

Adding the dataset: The training dataset is prepared using the orb Detect and ompute () method. The dataset loading and picture training are demonstrated by the equation below. The key-points and descriptors are referred to by the terms kp and des. The method detect And Compute accepts an image as input, identifies the key points, and computes the descriptors. (keypoints, descriptors)=orb. Detect And Compute (image) Key points: The locations where the intensities change within an image's area of interest.

6. CONCLUSION

The validation of Indian paper money is described in this currency recognition system by using opencv techniques. Python programming is used. An effective method for currency detection was produced by using the ORB model, brute force matcher, and KNN matching methods. In a flash, the decision is made. A cheap method was developed for the App. Everyone can benefit from it, as it is very effective.

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