Real-Time Fake Currency Detection Using CNN

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Abstract: Currency forgery is a significant crime that has a negative impact on a country's finances. In banking systems, the proposed technique will be useful in detecting counterfeit money. Due to a rise in the number of counterfeit notes on the market, India is experiencing more serious issues. Various false note detecting solutions are available globally to combat this problem, however the most of them are hardware-based and expensive.
This focuses on obtaining public access in order to detect counterfeit currencies. The suggested method can determine a banknote's legality by looking for certain security features including watermarks, latent pictures, security threads, and so on. Machine learning algorithms can be used to identify counterfeit banknotes. These security aspects are extracted and encoded as part of the approach. A support vector machine is used to extract security features from the input image, as well as to identify and classify them.

Keywords: Counterfeit currency, Convolutional Neural Network (CNN), Support Vector Machine (SVM), Android Application, Region of Interest (ROI), Edge Detection, Artificial Intelligence (AI), Image Processing, Machine Learning (ML), Deep Learning(DL).

I. INTRODUCTION

The detection of counterfeit banknotes is very important in many applications, such as banking, good sellers, and good tellers. Banknote counterfeit detection is a process of identifying in-genuine currencies. The growth of counterfeited currency is becoming a great threat to worldwide by impacting each country's economy thoroughly.

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The invention of currencies around the world has launched a global challenge to stop currency counterfeiting. Though the banknotes are incorporated with several security features, but due to huge enhancement in printing media makes ease to make fake banknotes. Therefore, detecting counterfeit banknotes is an essential need for country to protect its economy. On November 8, 2016, the Indian government announced the demonetization of all Rs. 500 and Rs. 1,000 banknotes. It also announced that it would issue Rs. 500 and Rs. 2,000 new notes in exchange for demonetized notes [2]. The Indian Government believed this act would shadow economy and reduce the use of illicit and counterfeit cash to fund illegal activity and terrorism. But the common people became the actual victims of fake banknotes fraud.

Each Indian currency note has specific security features that are followed for all the banknotes. With the help security features, the detection of genuine banknote is possible. In this paper, the proposed technique extracts the security features from the image of the banknote and detects its genuineness using Machine Learning techniques.

At this point in time, there are various techniques that have been implemented to detect the counterfeit banknotes; but unfortunately, many of these are very complex as well as require hardware support. There are few counterfeit currency detection techniques implemented by many researchers in the field of Image Processing[3] as well as Machine Learning. Fig. 1.1 and Fig.1.2 shows the statistics of the counterfeit notes detected across the country.
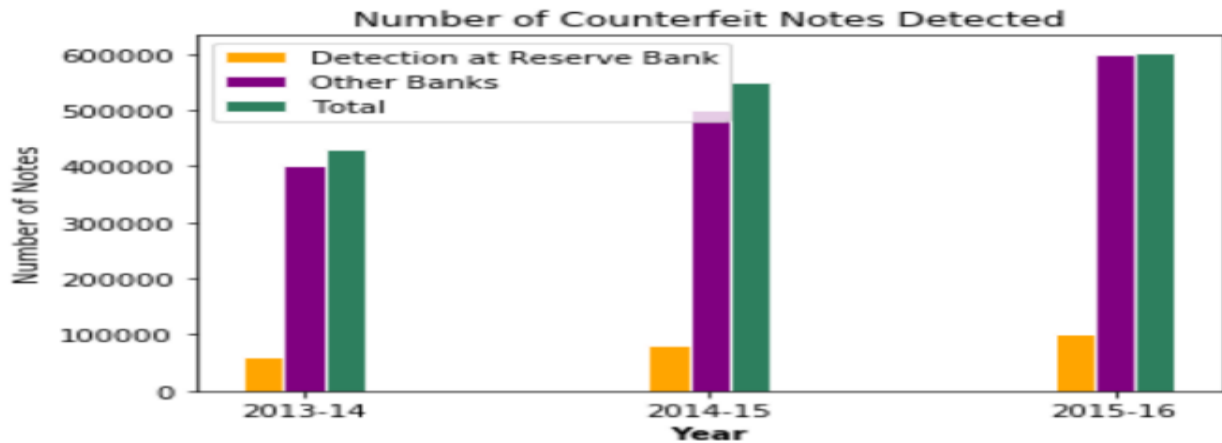
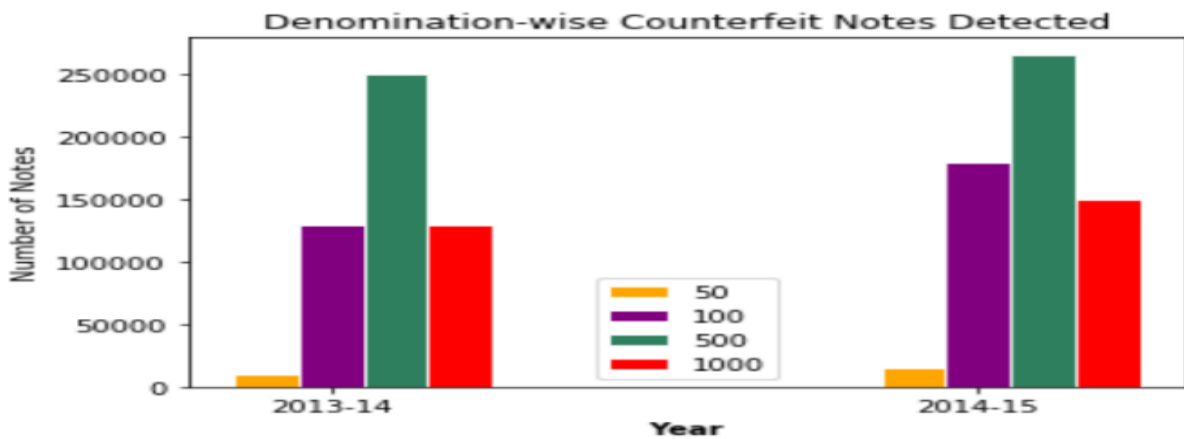Fig.1.1: Statistics of Detected Counterfeit Banknotes.

Fig.1.2: Statistics of Demonization-wise Detected Counterfeit Banknotes.

The identification of currency depends on the characteristics of currency notes of a particular country. Due to use for a long time, currency notes may be contaminated by noises. To Identify whether the currency is authentic or not there are many features. Although it may not be practically possible to accurately identify a counterfeit in a paper currency which can only be identified by an intelligent machine.

requires a system that will recognize currency. It has various potential applications that includes banknote counting machines, money exchange machines, assisting blind persons, electronic banking, currency monitoring systems etc. The recognition of currency is a very important need for visually impaired people. They are not being able to differentiate between currencies correctly, so it is very easy for them to be cheated by the others. Therefore, there is an urgent need to design a system that will recognize the currency authenticity and its value.

Currency duplication also known as counterfeit currency is a vulnerable threat on economy. It is now a common phenomenon due to advanced printing and scanning technology. The possible solutions are to use either chemical properties of the currency or to use its physical appearance.

Some of these are implemented using image mapping techniques but are not very accurate. To overcome the limitations of the already implemented techniques, in this paper, we propose an efficient and cost-effective counterfeit currency detection through a Mobile application that uses Machine Learning technique Convolutional Neural Network to authenticate the banknotes.

II.   PROPOSED METHODOLOGY

Proposed System:
The main purpose of this project is to obtain a false-positive income using Machine Learning. This process can be automated on mobile using the application software. Basic logic is developed using image acquisition, image segmentation, feature extraction and comparison. Enlarged images of the real currency are transferred to the Machine learning dataset.

The features of the note to be tested are compared to a dataset made from an actual enlarged image and determine whether it is real money or fake. The most important challenge is to repeat the systematic and systematic review process to reduce error and time.

Methodology:
The system proposed here work on the image of Indian currency note acquired by a digital camera. The method which is applied here is as follows

a. Acquisition of image of Indian currency note by simple digital camera or scanner.

b. Image acquired is RGB image and converted to Grayscale image.

c. Edge detection of whole gray scale image.

d. Now Indian currency features of the paper currency both observe and reverse will be cropped and segmented.

e. After segmentation, feature of Indian currency note are extracted.

f. BF matcher match that database features with test images note then the test note is said as original otherwise fake.
Input: A webcam or phone camera will be used to take the input image by the user. The input image then taken by the user will be used for pre-processing steps such as erosion, dilation and noise cancellation.
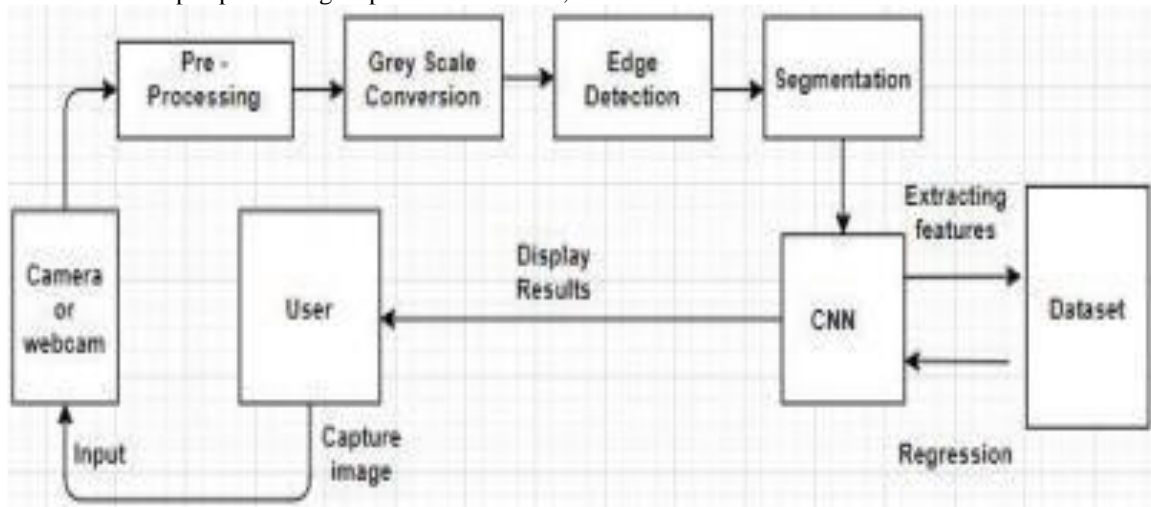
Block Diagram of Proposed architecture

Image Processing: Further the input image will be moved into the system for processing wherein the image goes through an algorithm (CNN) and series of operations such as grayscale conversion, edge detection, image segmentation, feature extraction and then finally towards templates matching.
Template matching: The template matching will then be used to find the small parts of an image that is needed to be compared with a template/dataset image. It is basically used to assure quality control of image.

III. SYSTEM DESIGN IMPLIMENTATION

Introduction
In this proposed system, a fake note detection using various method. In image pre-processing the image was cropped, adjusted and smoothed. Then the image converted into gray scale. After conversion the edges are detected. Next the image segmentation is applied. After segmentation the features are extracted. Finally compared and find the currency original or fake. The complete methodology works for Indian denomination 10, 20, 50, 100, 200, 500 and 2000. The method is very simple and easy to implement.
Implementation of Proposed Methodology
• The user has to open the app to capture an image.
• This image is uploaded to the real - time database AWS server in order to obtain real-time results.
• The image is then fed to the CNN model and the produced results will be displayed on the screen within fraction of seconds.

• Flask will be working as backend in order to compute the image.
• The image is uploaded to the real time database so that the real time result can be computed.
• Image which is in the database is fed to the CNN model and the predicted results are pushed back into the database.
• Conversion of the image to 224 x 224 pixels and image pre-processing is performed.
• After the results have been predicted by the model and uploaded to the database, the android application fetches the results instantly and the results will be displayed on the app through JSON object.

Developed Modules

1. Image Acquisition: The acquisition image. In this process, first image by using various ways to acquire image such as with the help of camera or scanner. This part is very impartment for extraction and detection of a currency

2. Pre-Processing: Image pre-processing is required prior to the main dataset and extraction of information and performs different operation for any currency verification. It includes Image Adjusting: When we get the image from a camera, shows reduce the calculation and decrease size of an image. These will also be removing the background form the image also helping in reducing the size of the image.

3. RGB to Gray-Scale Conversion: The capture image acquired is in RGB colour. This image is heavy and has more noise. Fig 5 shows by converting into gray scale, it reduces the size of the image and also the intensity information which is easy to process instead of processing three components R (Red), G (Green), B (Blue).

4. Edge Detection: Edge detection is a tool in computer vision, particularly in the process of feature extraction and detection, which aim at identifying key points in a digital image. To segment an object from capture image, one needs closed region boundaries. Edge detection is one of the processes in image processing, image analysis, image pattern recognition, and computer vision techniques.

5. Image Segmentation: The image segmentation is the process which is divided a digital image into multiple segments, set of pixels. It is also called the image thresholding which threshold is decided and if value of given pixel is above threshold, then is converted into white pixel otherwise converted into black pixel.

6. Feature Extraction: Feature extraction process very important role in image processing and computer vision. In computer vision, feature extraction is the special form of dimensionality reduction. It is method of capturing image for retrieval and indexing. The aim is to extract and identify the unique feature of each Indian denomination under various challenging condition such as rough note, fold condition also under different background.

IV.   TEST CASES

Steps	Description	Input	Expected Output	Actual result	Status
1	Turning AWS Server on and run the flask backend.	Run the windows batch file	The system must connect to the server	The system connects to the server	Pass
2	Opening the App	Tapping the app icon in Android phone.	Opens the the app without any crashes.	App opened succcessfully	Pass
3	Open the camera app	Click on capture button	Camera should turn on	Camera turned on and ready to capture the image	Pass

| 4 | Capture the image | Click the shutter button to capture | Captured image must show up on app | Image captured and displayed in app | Pass |
| 5 | Result Generation | Wait for 3 to 4 seconds for image computation | The image will must generate with any of one class: Real or Fake | Responded with Real or Fake | Pass |

V. CONCLUSION WITH FUTURE ENHANCEMENTS.

The main motive behind the development of this application is to provide a better way for people to find out about money using an easily accessible device. The paper also includes the study of detailed information about various Indian currency notes. At present we are having new MG series Indian currency note and we have also experiment of notes Rs. 2000, Rs. 500, Rs. 100, Rs.50, Rs.20 and Rs.10. Our experiment shows that this is the low-cost system to detection the Indian banknote. We had checked different notes on this system and the result is 80% which means that the system is working efficiently.

This project focused on understanding the new Indian paper currency to determine whether that is a real or falsified note. Several software methods have been utilized for the identification of banknotes. But, to recognize a note is counterfeit or real in real-time with better accuracy, a few architectures have been introduced by researchers. The present implemented methods can be extended further by generating an application based on a smartphone with their respective operating systems and web applications that would be helpful for visually challenged people.

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