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Fake Currency Detection Using Deep Learning Algorithm

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Abstract: In this Paper, the Automatic Fake Currency Recognition System is designed to detect the counterfeit paper currency to check whether it is fake or original. The existing counterfeit problem due to demonetization effects the banking system and also in other fields. A new approach of Convolution Neural Network towards identification of fake currency notes through their images is examined in this approach which is comparatively better than previous image processing techniques. This method is based on Deep Learning, which has seen tremendous success in image classification tasks in recent times. This technique can help both people and machine in identifying a fake currency note in real time through an image of the same. The Accuracy in the proposed system is evaluated using accuracy.

I. INTRODUCTION

Every year Reserve bank of India face the counterfeit currency notes or destroyed notes. Handling of large volume of counterfeit notes imposes additional problems. Therefore, involving machines with the assistance to the human experts, makes notes identification process simpler and efficient. For the detection of forged notes (take a bank as example) it needs to identify the denomination every time they use the device which consist of ultraviolet light. The bank employee keeps the paper currency note on the device and try to find whether the watermark identification, serial number and other characteristics of the notes are proper to get the denomination and check its authentication. This increases the work of the employee. Instead, if the banker uses this system, the result could be more accurate. Same is the case with areas such as shopping malls, investment firms where such systems can be used. Immediate need is to make an easier way to identify the currency notes.

Automatic Fake currency recognition is very important in many applications such as automatic sellers' goods machine and automatic teller goods machine. By using this system, we can detect valid Indian currency note. The system we going to use including eight steps such as image acquisition, gray scale conversion, edge detection, feature extraction, image segmentation, comparison of input and output. automatic machine more helpful in banks as well as in any small shop because that faces problems of counterfeit currency notes. so, using this machine recognition of notes simpler and more systematic.

Currently, the use of paper money remains one of the main options for the exchange of products and services. However, one of the remaining problems is the detection of counterfeit banknotes, which increasingly resemble originals, making it difficult for someone who is not an expert in the field to detect them. On the other hand, there are machines for detecting counterfeit banknotes [1]; however, these are often expensive, so the identification and retention of counterfeits ends up falling on financial and government entities, with minimal community involvement [2].

For bank staffs, there is a "Currency Sorting Machine" that helps them to recognize different kinds of currencies. The main working processes of "Currency Sorting Machine" are image acquisition and recognitions. It is a technique named "optical, mechanical and electronic integration", integrated with calculation, pattern recognition (high-speed image processing), currency anti-fake technology, and lots of multidisciplinary techniques. It is accurate and highly efficient. But for most staffs, they have to keep a lot of different characteristics and anti-fakes label for different commonly-used currencies in their mind. However, each of them has a handbook about the characteristics and anti-fakes labels of some less commonly-used currencies. Even for that, no one can ever be 100 percent confident about manual recognition.

Counterfeiting refers to an illegal copy of the currency of origin. Therefore, counterfeit currency is not approved by the government. RBI is the only body responsible for printing banknotes in India. Every year, the RBI has to deal with the problem of counterfeit banknotes once filtered and placed on the market. Currently with the development of better image processing methods, new methods for identification of currency is designed by analyzing specific safety information present in the currency. The safety features are watermarks, hidden images, security threads, and optically variable inks. Therefore, to determine the currency using image processing, extract the specific statistics from the currency image and

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select the correct recognition approach. The main methods for currency recognition is by characteristic geometric size [1] and by characteristic texture [2]. The general steps followed by image processing approach is to acquire image, to detect edge, to convert image to gray scale, feature extraction, image segmentation and decision making [3-4]. The drawback of these approaches are detection efficiency is less since feature extraction is a challenging task. To overcome this problem now the trend is towards deep learning, since it is a multilayer neural network. The deep neural network is effective for different application in real time.

II. LITERATURE SURVEY

Gouri Sanjay Tele et al. [5] proposed the detection of Fake Indian currency. Security highlights of currency are basic for deciding genuine and fake money. Basic security highlights incorporate watermarks, dormant pictures, security thread, and optically variable ink. This methodology for counterfeit currency location extricates the general traits of latent pictures and distinguishing ID marks from the image of money.

Extracting properties from images of currency notes can get very intricate as it includes the extraction of some noticeable and undetectable highlights of Indian currency. After demonetization, 500 and 2000 are the high esteemed cash notes existing to date, so there is a most extreme likelihood that these notes can be duplicated to maintain a strategic distance from this. They use programming to identify the fake notes utilizing the picture handling procedure.

Navya Krishna G, et al. [6], proposed Recognition of fake currency notes using CNN. The Automatic Fake Currency Recognition System (AFCRS) is intended to identify the fake paper money to check whether it is fake or original. The current fake issue because of demonetization impacts the financial framework and in different fields. Another methodology of Convolution Neural Network towards recognizable proof of fake notes through their images is inspected in this paper, which is relatively better than past image processing strategies.

It depends on Deep Learning, which has seen huge accomplishments in image classification lately. This procedure can support both people and machines in recognizing fake notes progressively through an image of the equivalent. The proposed framework, AFCRS, can likewise be conveyed as an application in the smartphone that can assist the general public in distinguishing between the original and fake notes. The accuracy of the undertaking can be expanded through the original fake notes.

N.A.J Sufri, et.al.[7], propose a vision Based System for Banknote Recognition Using Different Machine Learning and Deep Learning approaches. They used the RGB values as features and used algorithms DT, NB, KNN, SVM, and deep learning alexnet. Both kNN and DTC achieved 99.7% accuracy, but both SVM and BC performed better by achieving 100% accuracy.

Veeramsetty et al. [8], in this research, the novel-lightweight-Convolutional-Neural Network (C-NN) system for recognizing Indian currency notes was established for web and cellphone applications efficiently. Moreover, to create the dataset, a total of 4657 images were taken.

All acceptable currency notes, include Old-new 10-rupees note, old- new 20-rupees note, old-new 50-rupees note, old and new 100-rupees note, new 200, 500, and 2000-rupees note, were used. Before providing the photos to the models as inputs, they are all resized to 1024x1024 pixels.

The currency note images are augmented with data to increase the dataset size. Zoom, Rotation-90, Rotation-270, Tilting, Distortion, and Fliping are the various types of augmentations used. There were 11657 images in the dataset after data augmentation. The CNN in the following is used: one. Input-images, two. Convolution, three. Nonlinearity operations were utilizing ReLU, four. Pooling, five. Flattening, six. Layer's full connection. According to findings, the proposed model outperforms six commonly recognized existing architecture in training and testing accuracies.

Chowdhury et al. [9] proposed a system utilizing image-processing and deep-learning methods to develop an automatic model for recognizing banknotes in India independent of orienting the face sides of the banknotes. Moreover, images were gathered from scans of the originals copies that were accessible on the internet and by photographing genuine banknotes.

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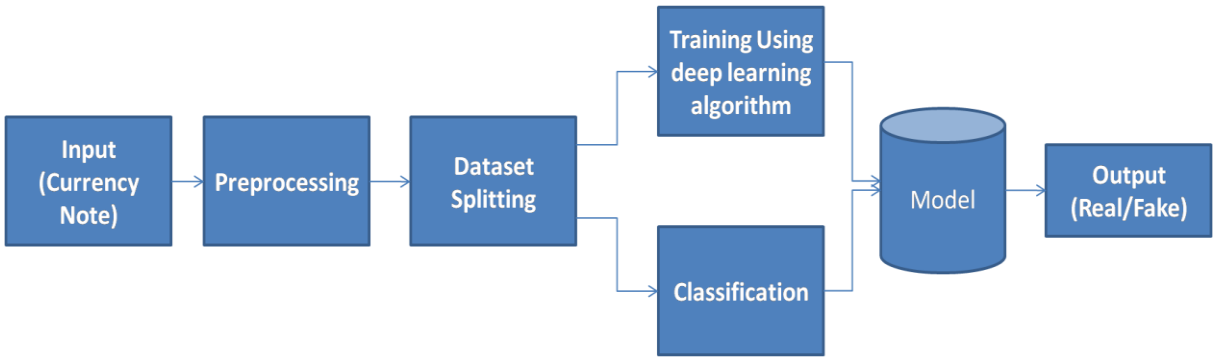
III. METHODOLOGY

Design And Drawing:



1.Data Collection:

The database of fake and real currency is created in real time. The currency notes of 10, 20, 50,100, 200, 500 and 2000 are considered for the evaluation. The images are captured using phone camera of resolution 12 MP in different light condition and in different directions. The new currency notes are take for evaluation and for fake the children bank notes are taken. the samples of real and fake notes are as shown in below Fig.2.

(a)

(b)

2.Pre-processing:

The captured image with cameras are noisy; hence pre-processing is required to remove the unwanted noise from the image. The proposed system utilizes a median filter to eradicate the salt and pepper noise. Median filtering is a valuable nonlinear process in reducing impulsive or salt-and-pepper noise. It is also helpful in preserving edges in an image while reducing random noise. Impulsive or salt-and-pepper noise can occur due to a random bit error in a communication channel. In a median filter, a window slides along the image, and the median intensity value of the pixels within the window becomes the output intensity of the pixel being processed.

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3.Training Using CNN:

CNN's are a category of Neural Networks that have proven very effective in areas such as image recognition and classification. CNN's are a type of feed-forward neural network made up of many layers. CNN's consist of filters or kernels or neurons that have learnable weights or parameters and biases. Each filter takes some inputs, performs convolution, and optionally follows it with a non-linearity[. A typical CNN architecture can be seen as shown in Fig.4. The structure of CNN contains Convolutional, pooling, Rectified Linear Unit (ReLU), and Fully Connected layers.

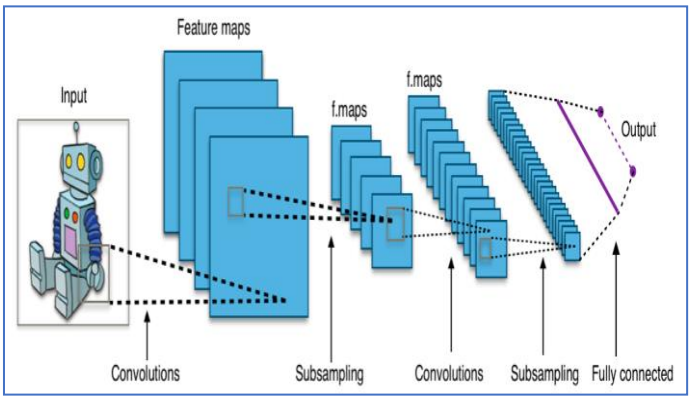

Fig. Architecture of CNN

Convolutional Layer:

The convolutional layer performs the core building block of a Convolutional Network that does most of the computational heavy lifting. The primary purpose of the Convolution layer is to extract features from the input data which is an image. Convolution preserves the spatial relationship between pixels by learning image features using small squares of the input image. The input image is convoluted by employing a set of learnable neurons. This produces a feature map or activation map in the output image and after that, the feature maps are fed as input data to the next Convolutional layer. It is mathematically represented as

$$G[m,n] = (f * h)[m,n] = \sum_j \sum_k h[j,k] f[m-j, n-k]$$

where the input image is denoted by f and our kernel by h. The indexes of rows and columns of the result matrix are marked with m and n respectively.

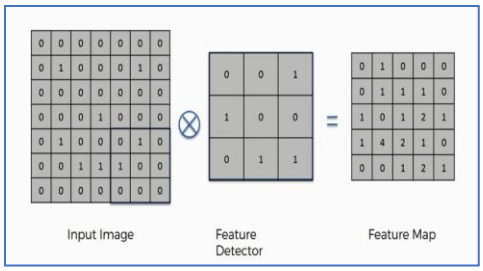

Fig. Convolutional Layer

IV. IMPLEMENTATION

Software Specification

Image processing library: OpenCV 4.1.1

Open source Computer Vision (OpenCV) is an image processing and computer vision library mainly developed for artificial vision. It has a BSD license (free for commercial or research use). OpenCV was originally written in C, but currently, it's a whole C++ interface, and there's additionally an entire Python interface to the library. Open-source computer Vision Library, also called OpenCV, is associated with a freeware software package aimed toward computer vision. It is used in this project because of its versatility and the fact that it has a C++ interface. OpenCV runs on most major Operating Systems (OS), making it worthwhile to use another computer to program or test.

Keras

Keras is an open-source NN library written in Python. It can be executed on top of Tensorflow Microsoft Cognitive Toolkit, R-language, Theano, or PlaidML. It is developed to enable superior experimentation with DNN. It focuses on

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being user-friendly, modular, and extensible. It was developed as part of the study effort of project ONEIROS, and its primary author and maintainer are Francois Chollet, a Google engineer.

In 2017, Google's TensorFlow group decided to support Keras in TensorFlow's core library. Chollet explained that Keras was conceived to be an interface somewhat a standalone ML framework. It offers a higher-level, more spontaneous set of abstractions that make it simple to develop DL models regardless of the computational backend used.

Keras was created to be user-friendly, modular, simple to enlarge and to work with Python. The API was "designed for human beings, not machines", and "follows best practices for reducing cognitive load".

Neural layers, cost functions, optimizers, initialization schemes, activation functions, and regularization schemes are all standalone modules that you can unite to create new models. New modules are simple to add as new classes and functions. Models are defined in Python code, not separate model configuration files.

Language: Python 3.7

Python is a high-level programming language extensively used for programming. Python, an interpreted language, supports several programming scripts and a syntax that allows you to use programs in most languages such as C ++ or Java. The language provides constructions designed to permit clear programs at each scale. Python is easy and simple to know, the python code is way easier than alternative languages.

V. RESULTS AND DISCUSSION

The results of the proposed system is discuss in this section. In the Phase I, the database is collected from the online as well as real time capture. The database distribution for the proposed system is as shown below in Table I.

	Training	Testing
Real	1130	347
Fake	1019	384

The results of the system are presented in qualitative and quantitative analysis.

Qualitative Analysis

The aim of qualitative analysis is a complete, detailed description. No attempt is made to assign frequencies to the linguistic features which are identified in the data, and rare phenomena receive (or should receive) the same amount of attention as more frequent phenomena. Qualitative analysis allows for fine distinctions to be drawn because it is not necessary to shoehorn the data into a finite number of classifications. Ambiguities, which are inherent in human language, can be recognized in the analysis. The input image samples of 10,20,50,100, 500 and 2000 real notes are shown in Fig. 5.1

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VI. CONCLUSIONS

In this project, detection of fake Indian currency note will be done by using image processing principle. This will be the low-cost system. The system will work for denomination of 10, 20, 50, 100, 500, and 2000 for Indian currency. The system also provides accurate and valid results. The process of detection of fake note will be quick and easy. In this system input will take by camera and output will be displayed on PC. In this system CNN and Vgg16 algorithms are used to train and test the fake currency. The qualitative and quantitative analysis of the proposed system shows that the vgg16 algorithm outperforms than the CNN algorithm. The CNN algorithm achieved a training and validation accuracy of 98.50% and 98.19%, and loss of 0.0557 and 0.0593 while Vgg16 achieved a training and validation accuracy of 98.74% and 99.43% and loss of 0.6964 and 0.1056.

VII. REFERENCES

[1]. Sonali R. Darade, Prof. G. R. Gidveer, "Automatic Recognition of Fake Indian Currency Note", 2016 International Conference on Electrical Power and Energy Systems (ICEPES) Maulana Azad National Institute of Technology, Bhopal, India. Dec 15-16, 2016

[2]. Ingulkar Ashwini Suresh1, Prof. P. P. Narwade, "Indian Currency Recognition and Verification Using Image Processing", International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 06, June-2016

[3]. G. Trupti Pathrabe, Mrs. Swapnili Karmore, A Novel Approach of Embedded System for Indian Paper Currency Recognition, International Journal of Computer Trends and Technology, May to June Issue 2011, ISSN: 2231- 2803.

[4]. Rubeena Mirza, Vinti Nanda, Characteristic Extraction Parameters for Genuine Paper Currency Verification Based on Image Processing, IFRSA International Journal of Computing, Volume 2, Issue 2, April 2012.

[5]. Gouri Sanjay Tele, Akshay Prakash Kathalkar, Sneha Mahakalkar, Bharat Sahoo, and Vaishnavi Dhamane. Detection of fake Indian currency. International Journal of Advanced Research, Ideas, and Innovations in Technology, 4(2):170–176, 2018.

[6]. Naga Sri Ram B Yamini Radha V Rajarajeshwari P Navya Krishna G, Sai Pooja G. Recognition of fake currency note using convolutional neural networks. 4(2):182–186, 2018.

[7]. N. A. J. Sufri, N. A. Rahmad, N. F. Ghazali, N. Shahar, and M. A. As'ari. Vision based system for banknote recognition using different machine learning and deep learning approach. In 2019 IEEE 10th Control and System Graduate Research Colloquium (ICSGRC), pages 5–8, 2019.

[8]. Veeramsetty, V., Singal, G. and Badal, T. (2020) 'Coinnet: platform independent application to recognize Indian currency notes using deep learning techniques,' Multimedia Tools and Applications, 79(31–32), pp. 22569–22594.

[9]. Chowdhury, U. R., Jana, S. and Parekh, R. (2020) 'Automated System for Indian Banknote Recognition using Image Processing and Deep Learning, in 2020 International Conference on Computer Science, Engineering and Applications, ICCSEA 2020, pp. 1–5.