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FAKE CURRENCY DETECTION

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ABSTRACT

We present a computer vision and machine learning-based technique for detecting the genuineness of Indian paper cash. In this technique, currency features are extracted, and custom datasets are created for currency detection. Using ML-CNN based classifier approach of front and rear surfaces Rs. 200 denomination security feature of Indian currency note, so that the denomination of the banknote both front and reverse may be detected more correctly. Our system is built on the vgg19 architecture and employs a CNN model to categorize Indian currency notes for authenticity.

Keywords: Machine Learning, Currency Detection, ML-CNN, Indian Currency Note, Vgg16 Architecture.

I. INTRODUCTION

As per the recent government figures, over 3.53 lakh incidents of fake cash discovery in India's financial systems have increased in the previous eight years. With the introduction of paper cash, faking became more polished. The government of India has gone to extraordinary lengths to demonetize 500- and 1000-rupee notes. One of the motivations for this approach, according to Prime Minister Shree Narendra Modi, was to combat the rising threat of phony Indian paper currency. However, following currency devaluation, Indian banks admitted an all-time high volume of counterfeit money and saw a 480 percent increase in fraudulent activity, according to the first ever study on questionable credits that concluded in the aftermath of the 2016 notes ban [1]. The Reserve Bank of India (RBI) is the only institution in India with the sole jurisdiction to print bank notes. The RBI, as the country's primary monetary body, manufactures currency notes in denominations ranging from Rs. 2 to Rs. 2000. The RBI has publicised many security mechanisms [2] so that fraudulent banknotes can be recognised by the overall population. However, identifying a fake note solely based on its appearance is difficult. Furthermore, the ordinary consumer is unconcerned with all the encryption techniques. This challenge can be solved by developing programmes that can identify a counterfeit currency note using a camera picture. In image categorization tasks, machine learning techniques have had a great deal of success [3]. Our approach presents a two-class binary picture classification task: false or real. The ML-CNN model developed utilizes the vgg16 architecture makes it possible to detect fake notes without manually analysing picture attributes. The model learns from the produced dataset and assists us in detecting a counterfeit note by training it on it.

II. RELATED WORK

In this paper, author suggest a highly useful and effective technique for detecting fake currency. Counting the quantity of disruptions there in thread line is used to detect fake cash notes. The number of interruptions can be used to find out if a note is authentic or counterfeit. If there are no interruptions, it is genuine; otherwise, it is a fake. They also compute the entropy of money notes to detect fraudulent currency notes more effectively. The bogus money note is detected using MATLAB software.[4]

The method given in this article is determined by the physical characteristics of Indian money. The security thread, intaglio printing (RBI logo), and identifying mark, which have been used as security elements of Indian money, have been extracted using image processing methods. The crucial value of all 3 elements has been combined to discern among real and fraudulent currency, which makes the technology more reliable and precise. The suggested system's accuracy in detecting fraudulent cash is 100 percent. The mean square error, which is about 1%, is another variable used to assess the suggested system's effectiveness. It might be embraced by common citizens as well, who frequently struggle to distinguish between real and phony currency.[5]

Various fake cash detection methods developed by different researchers are presented in this article. The evaluation focuses on the ways for detecting illegal currency based on specific characteristics, and also the likelihood of each technique's accomplishment. In addition, the study looks at a commonly used analytical

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categorization method for determining the legitimacy of currency. A comparative of Logistic Regression and Linear Discriminant Analysis revealed the best model for currency validation (LDA). It was revealed that a segmentation system relying on multinomial logit outperforms LDA by 99 percent. The reader will profit from the study by determining the most practicable strategy to adopt based on the findings.[6]

Many phases are involved in the identification process, including edge detection, feature extraction, picture categorization, image capture, grayscale transformation, and image comparison. The proliferation of various money identification systems is detailed in this study, which includes several related efforts on paper currency recognition. Choosing the proper feature would boost the system's overall execution. The purpose of the proposed project is to examine prior articles and literature to determine the pros and the cons of each strategy.[7]

The model proposed in this work combines OCR, Face Identification, and the Hough Transformation Algorithm. The microprinting, watermark, and ultraviolet lines aspects of Bangladeshi banknotes are retrieved for the purpose of determining whether the notes are genuine. The suggested model's testing findings show that it has a 93.33 percent accuracy, making it acceptable to employ it in a mobile app. The obtained findings are further analysed to the result of various OCR, Facial Identification, and Hough conversion algorithms to show that the proposed technique delivers the highest level of preciseness. [8]

The automated technique in this study is meant to identify Indian rupee notes and determine whether they are fake or genuine. The automated system is extremely beneficial in the financial system, as well as in other fields. The number of fake paper currency of 100, 500, and 1000 rupees has increased in India. Because of advancements in technology such as scanning, colour printing, and duplication, the counterfeit problem has grown. The identification of fraudulent Indian rupee notes is accomplished in this work utilising an image processing approach.[9]

It's difficult to tell the difference between phoney bank cash and genuine bank notes. As a result, there will need to be an automated process accessible in ATM and bank machines. In order to create such an automation process, an effective algorithm must be created that can anticipate if a currency not is real or counterfeit bank cash, as phony notes are meticulously made. In this research, six supervised machine learning methods are used to identify Bank money authenticity using data from the UCI machine learning repository. To do so, we used Support Vector Machines, Random Forests, Logistic Regression, Nave Bayes, Decision Trees, and K-Nearest Neighbour with 3 train test ratios of 80:20, 70:30, and 60:40, and measured their performance using quantitative analysis parameters such as Precision, Accuracy, Recall, MCC, F1-Score, and others. Furthermore, certain SML algorithms provide 100 percent accuracy for a specific train test ratio.[10]

This research uses Deep Learning to create a convolution neural network (CNN) model with the goal of detecting counterfeit notes on mobile devices such as smartphones and tablets. A self-generated dataset was used to train and test the model. The CNN network receives images captured using a smart phone camera. The results are promising, and they may be improved with more study and modifications to the Deep CNN model's design. The testing accuracy was 85.6 percent, whereas the calibration and testing preciseness were 98.57 and 96.55 percent, respectively.[11]

Because of the rising circulation of phoney notes in today's economy, the relevance of automatic systems for money recognition has grown in recent years. Basic image processing methodologies such as picture capture, image pre-processing, extract features, and segmentation utilising support vector machines are included in this recognition system. The pictures of currency were pre-processed using a different methodology, and different characteristics of the picture were withdrawn with the help of the local binary pattern technique. Once the features were withdrawn, it was necessary to recognise the currency using a productive categoriser called the Support vector machine. Eventually, a model capable of recognising Ethiopian paper currency with a 98 percent precise demonstrates a high-performance segmentation method for paper currency identification, as well as verifying the authenticity of provided banknotes with an average preciseness of 93 percent.[12]

Using K-Nearest Neighbours and image processing, this research provides a method for detecting fraudulent cash. KNN is suitable for computer vision tasks since it has a high precision for tiny data sets. The banknotes authentication dataset was developed using advanced computational and mathematical methodologies to provide accurate data and information on the entities and attributes of the currency. To obtain the result and

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accuracy, data processing and data extraction are carried out using machine learning algorithms and image processing.[13]

III. ARCHITECTURE

The layers in VGG16 model are as follows:

- Conv3x3 (64)
- Conv3x3 (64)
- MaxPool
- Conv3x3 (128)
- Conv3x3 (128)
- MaxPool
- Conv3x3 (256)
- Conv3x3 (256)
- Conv3x3 (256)
- Conv3x3 (256)
- MaxPool
- Conv3x3 (512)
- Conv3x3 (512)
- Conv3x3 (512)
- Conv3x3 (512)
- MaxPool
- Conv3x3 (512)
- Conv3x3 (512)
- Conv3x3 (512)
- Conv3x3 (512)
- MaxPool
- Fully Connected (4096)
- Fully Connected (4096)
- Fully Connected (1000)
- SoftMax

Vgg 16 Architecture:

1. This network was given a fixed size (224 * 224) RGB picture as input, indicating that the matrix was of form (224,224,3).

2. They employed kernels of (3 * 3) size with such a stride size of 1 pixel to cover the whole concept of the picture, and the only pre-processing they did was remove the typical RGB value out of each pixel, computed across the entire training set.

3. To keep the image's spatial resolution, spatial padding was applied.

4. With side 2, max pooling was done over a 2 × 2-pixel frame.

5. This was followed by the Rectified linear unit (ReLu) to bring non-linearity into the model to enhance classification and save processing time, while earlier models employed tanh or sigmoid functions.

6. Implemented three fully linked layers, the first two of which were 4096 bytes each, followed by a level with 1000 channels for 1000-way ILSVRC categorization and a SoftMax function.

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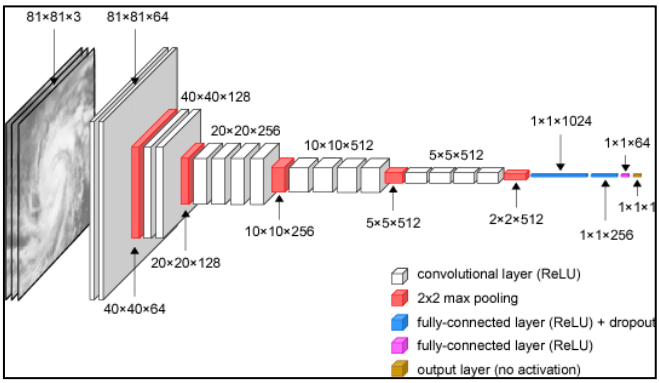

Figure 1

IV. METHODOLOGY

This paper offers a system that uses convolutional neural networks using deep training to detect and recognize banknotes of various denominations. It entails determining the difference between phony and genuine bank notes. It entails the following phases in the operation.

CNN model training:

The recommended convolution neural network is trained on many photos captured in a variety of lighting conditions, including natural and artificial lighting, as well as illumination fluctuations and rotation. The CNN model is trained using these pictures.

The CNN model is built using the VGG NET architecture, which is shown below:

VGG Net:

It is a website dedicated to providing information on the This model has sixteen convolutional layers and it may appeal to you because some of the layers have a highly uniform topology. This network, like AlexNet, has the best 3x3 convolutions, but it also has a lot of filters. The VGG Net's weighting configuration and parameter settings are open to the public for study, and it has been used as a foundation feature extractor in a wide range of applications and problems. The best trained model is saved after completing training with different epochs.

Detecting the currency:

The training set will be used in both a system editor-based predictor and a mobile application, with the picture of the note being captured via a web camera in the system-based version and a cell camera in the android app-based version. This picture will be pre-processed before being sent into the neural network that has been trained. If the supplied picture of a note is fraudulent, the model's output will be recognition of a phony note. Because the final product will be in audio format, it will also benefit blind individuals.

Data set:

Due to our big and unique data set demand, we employ multiple datasets found on the website in our project. We obtain essential information from diverse sources on the internet. The Kaggle website, which is an open - source database set website, is one of these sources.

V. RESULTS AND DISCUSSION

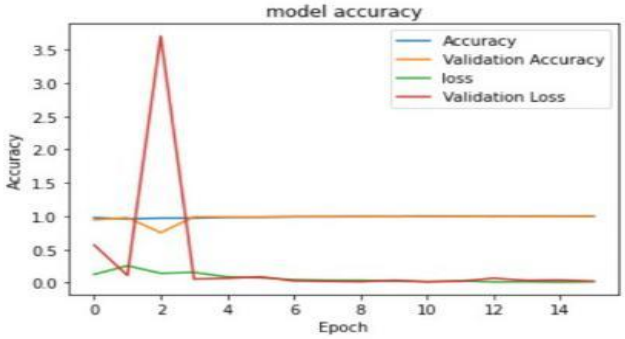

Figure 2: Model accuracy

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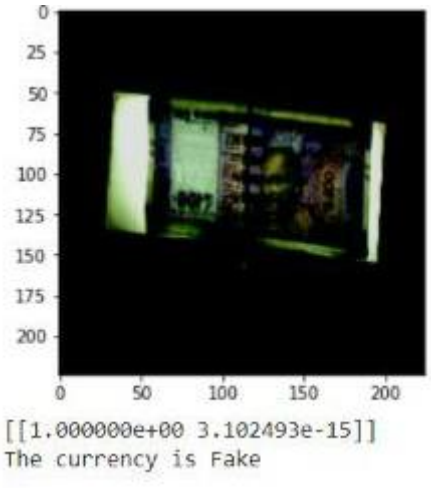

Figure 3

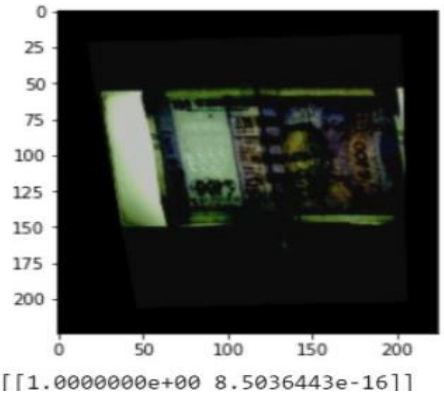

Figure 4

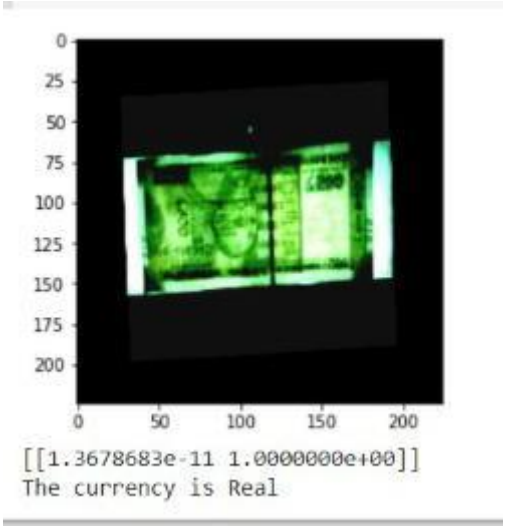

Figure 5

VI. CONCLUSION

In picture categorization jobs, machine learning has had a lot of success. Our ML-CNN-based architecture acts as a feature extractor, removing the requirement for image processing and manually validating the existence of security characteristics in the note. The created dataset has shown to be useful in conducting experiments and simulating real-world scenarios. Any ordinary individual will be able to use the programme to recognize a counterfeit note. The model's accuracy will be improved by experimenting with various ML-CNN architectures in the future. Increasing the data set for the model to be better trained and give better outcomes.

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