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Counterfeit Detection using Deep Learning

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Abstract: *Detecting counterfeit currency is a critical issue that has gained increasing attention in recent years. Deep learning techniques have shown significant promise in a variety of image processing tasks, including counterfeit currency detection. In this project, we propose a deep learning-based counterfeit currency detection system that uses convolutional neural networks (CNNs) for feature extraction and classification. The proposed system consists of two main phases: training and testing. In the training phase, a dataset of genuine and counterfeit banknotes is used to train the CNN model to distinguish between genuine and counterfeit banknotes. A CNN model extracts features from an input image using convolutional layers and then applies fully connected layers for classification. Experimental results show that the proposed deep learning-based counterfeit currency detection system achieves high accuracy. The system outperforms existing state-of-the-art techniques in terms of detection accuracy, robustness, and real-time performance. In conclusion, it can be said that the proposed system could be a useful tool for preventing the circulation of counterfeit currency and minimizing economic losses. The system can be integrated into various automated teller machines (ATMs) and vending machines to detect counterfeit money in real time.*

Keywords: Counterfeit currency, image processing tasks, convolutional neural networks, currency features, accuracy detection

I. INTRODUCTION

Financial activities are carried out by many people every second, and one of the most important assets of our country are banknotes [3]. Counterfeit notes are marketed to create irregularities in the financial market, even though they resemble the original notes. Basically, they are illegally created to perform various tasks [12]. In 1990, counterfeiting was not a major concern, but as in the late 19th century, counterfeiting had drastically increased [13]. In the 20th century, technology is developing a lot, which will help fraudsters to create fake banknotes whose similarities are not like the real ones, and it is very difficult to distinguish them [1]. This will lead to the financial market falling to its lowest level. To stop this and ensure the smooth flow of transactions, counterfeit bank currency must be maintained [16]. It is very difficult for humans to distinguish between genuine and counterfeit bank currency. The government has designed banknotes with some features by which we can identify genuine ones [9]. But fraudsters create counterfeit notes with almost the same characteristics with a nice precision that makes it very difficult to identify the genuine note [5]. So nowadays, banks or ATMs are required to have some system that can identify a counterfeit banknote from a real one [12]. To determine the legitimacy of banknotes, artificial intelligence and machine learning (ML) can play a vital role in designing such a system that can identify a counterfeit banknote from genuine bank currency [6,7,12]. Currently, supervised machine learning (SML) approaches are widely used for classification problem. It even shows promising results in medical diseases [2]. Few authors have applied only SML algorithms to bank currency authentication [6-9, 12]. We need to develop an automatic system to determine whether a note is genuine or fake. Initially, the input is an image of a musical note, and we can extract the features of the musical note from various image processing techniques. Next, these images are fed as input to SML algorithms to predict whether a banknote is genuine or fake. We can see in the review that not much work has been done on this side.

II. LITERATURE SURVEY

In a paper by Tushar Agasti et al [14] says that currency has always been a problem that has caused many problems in the market. Increasing technological advancements have made it possible to create more counterfeit money that is

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circulating in the market, reducing the overall economy of the country. Coin authenticators are available in banks and other commercial areas. However, the average person does not have access to such systems, hence the need for counterfeit currency detection software that can be used by ordinary people. This proposed system uses Image Processing to detect whether the currency is genuine or counterfeit. The system is designed completely using the Python programming language. It consists of steps such as grayscale conversion, edge detection, segmentation, etc., which are done by appropriate methods.

A publication by Eshita Pilania et al [17] speaks about, in the pastfew years, technologies such as colour printing, copying, and scanning have made significant advances, exacerbating the problem of counterfeiting. In the past, only licensed printing companies had the ability to make banknotes, but now it is possible for anyone to print fake banknotes with the help of today's technologies such as computers and laser printers. Counterfeit notes are a problem in almost all countries, but India has been hit particularly hard and has become a very serious problem. Fake 100 rupees, 500 rupees and 1000 rupees seem to be flooding the entire system and there is no proper way for the ordinary person to deal with them. A system should be designed that helps to identify banknotes in a short and fast time. Our system describes an approach to verifying the currency notes of India and other countries. Currencies are verified using image processing technology.

Nayana Susan Jose, Shermin Siby, Juby Mathew, Mrudula Das [10], Android Based Currency Recognition System for Blind, International Journal of Engineering Research in Computer Science and Engineering (IJERCSE) Vol 2, Issue 4, April 2015.In recent years, many unauthorized fake rings have started producing and selling fake coins, and at the same time, fake banknotes have been printed, which has caused a lot of damage to society. Therefore, identifying fake currency is essential. We propose a new approach to detecting counterfeit Indian currency notes using images. Images of currencies are represented in a dissimilarity space, a vector space constructed by comparing the image to a set of prototypes. Each dimension measures the difference between the examined image and the prototype. To obtain the difference between the two images, local key points in each image are identified and described. It can effectively identify the key matching points between two images based on currency characteristics. A further post-processing method is proposed to remove inconsistent keypoints. Since the number of fake currencies in real life is limited, SVM is implemented to detect fake currency, so only real currencies are needed to train the classifier.

Komal Vora, Ami Shah, Jay Mehta [11], A Review Paper on CurrencyRecognition System, International Journal of Computer Applications (0975 –8887) Volume 115 – No. 20, April 2015. This paper discusses the algorithm based on a frequency domain feature extraction method for currency detection. This method effectively uses local spatial features in the currency image to identify it. The entire system is pre-engineered for optimal and efficient implementation of the two-dimensional discrete wavelet transform (2D DWT), which is used to develop currency identification systems. A set of statistical moments of coefficients is then extracted from the estimated effective matrix. The extracted features can be used for banknote identification, classification, and retrieval. The result of the classification will facilitate with the identification of counterfeit currency mainly by obtaining the serial number by applying OCR. The proposed method was found to provide excellent results.

III. EXISTING SYSTEM

In the current project, a review of these applied machine learning approaches to classification, whether or not it is original or not. Yeh et al. al. implemented a SVM based on multiple kernels to reduce the false rate and compare to SVM (single kernel). Classify real and fake networks. Author's Hassanpour et. al., the texture-based feature extraction method used for texture recognition and modelling is the Markov chain concept. This method is able to recognize the currencies of different countries. To classify whether a banknote is counterfeit or not, global optimization algorithms are used in the training phase of artificial neural networks (ANN), which has achieved good success in banknote classification.

3.1 Disadvantages

Accuracy is Low.

The technology is increasing very vastly that will help the frauds to generate fake note whose resemblance is like genuine not and it is very difficult to discriminate them.

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IV. PROPOSED SYSTEM

Fake currency is a serious problem worldwide that affects the economy of almost all countries, including India. Counterfeit currency is one of the major problems facing the entire world today. Counterfeiters are becoming increasingly difficult to track as they use highly advanced technology. One of the most effective methods to stop counterfeiting is to use counterfeit detection software that is readily available and effective. The starting point of our topic is image processing technology and its application for the purposes of validating banknotes. The software detects counterfeit currency by extracting banknote features. Software success can be measured in terms of accuracy and speed. So our goal is to work on those parameters that will not be possible to implement on counterfeit banknotes, so we started working on parameters that will be enough to distinguish fake and original banknotes.

Advantages:

- Very high accuracy.
- It is very easy to sort fake and original bills.

V. SYSTEM REQUIREMENTS

5.1 Hardware requirements

- System: Pentium IV 2.4 GHz.
- Hard disk: 40 GB.
- Diskette: 1.44 MB.
- Monitor: 15 color VGA.
- Mouse: Logitech.
- RAM: 512 MB.

5.2 Software requirements

- Operating system: Windows
- Coding language: Python 3.7

VI. RESULT

We have seen many of the previous project based on machine learning, Based on our study we found that CNN is the best Algorithm to get better accuracy.

Figure 1: Frontend of the project using Tkinter module in python.

We used BANK NOTE AUTHENTICATION data set that is openly available for the usage from the internet.
We have uploaded the dataset for the training of the data for the system.

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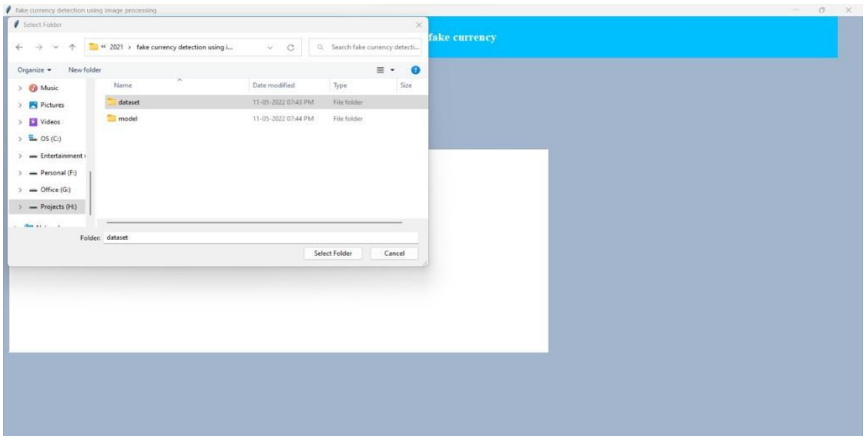

Figure 2: The process of uploading the data set for training.

The next process is image pre-processing the image is converted to Gray scale image internally.

Figure 3: Image processing and uploading test images.

After uploading the final test image the output will be predicted whether the image is Fake or Real Image.

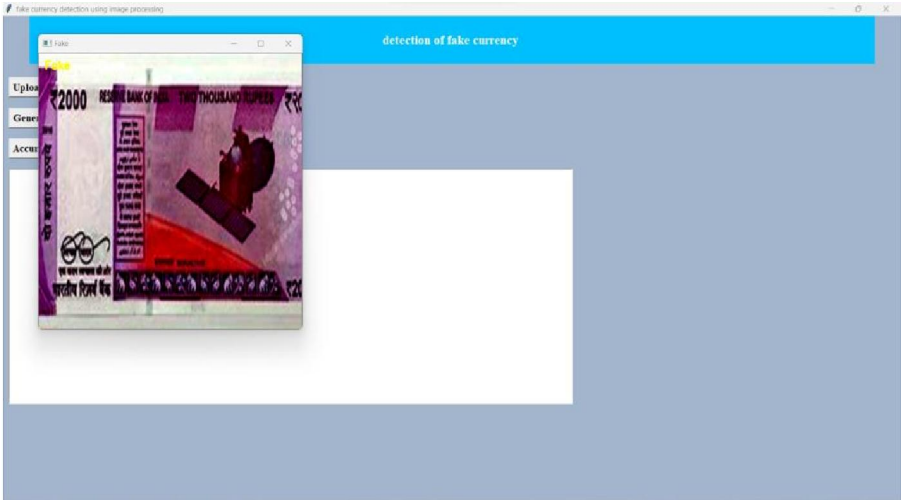

Figure 4: Final output of the image uploaded whether the is image is fake or real.

Our project also produces the accuracy graph based on the results that are generated using CNN model.

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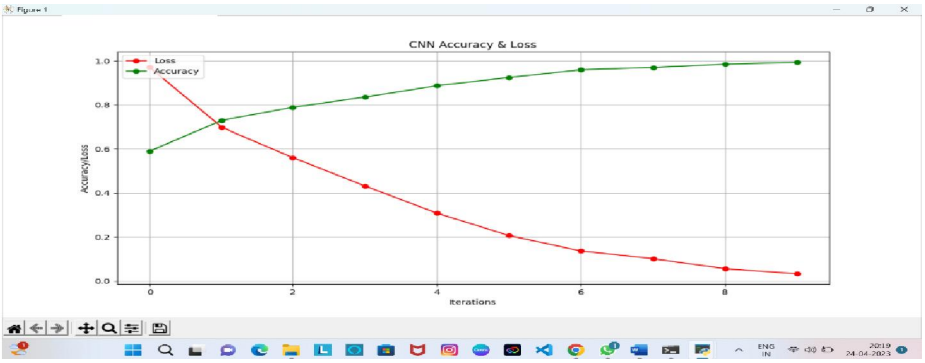

Figure 5: Accuracy graph based on results generated.

VII. CONCLUSION

In this study, there are several things that can be inferred from the results of machine learning using error rate analysis [6] and convolutional neural network.

1. The convolutional neural network uses two convolutional layers, one Max Pooling layer, one fully connected layer and one output layer with SoftMax, which can achieve higher accuracy.
2. The use of error rate analysis can increase the efficiency and reduce the computational cost of the training process. This is evident from the reduction in the number of layers from the previous method [7] and the number of epochs needed. In the proposed model, the number of epochs required to achieve convergence is only 9

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