Detection of Fake Currency using Machine Learning Techniques

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Abstract: Fake currency is the money produced without the approval of our government, creation of it is considered as a great offence. The elevation of color printing technology has increased the rate of fake currency note printing on a very large scale. Years before, the printing could be done in a print house, but now anyone can print a currency note with maximum accuracy using a simple laser printer. This results in the issue of fake notes instead of the genuine ones has been increased very largely. It is the biggest problem faced by many countries including India. Though Banks and other large organizations have installed Automatic machines to detect fake currency notes, it is really difficult for us to distinguish between the two types of notes. This has led to the increase of corruption in our country hindering the country's growth. Some of the methods to detect fake currency are watermarking, optically variable ink, security thread, latent image, techniques like counterfeit detection pens. Malpractice has always been a serious challenge that resulted in a serious problem in society. The automation technology creates a more copied currency that is entirely spread, resulting in reducing the economic growth of any country. The fake note detection is compulsory, and important to be very consistent and reliable. Machine Learning techniques help in building tools that is required and necessary for the research work, and this can make computer learning design, implementation, and methods to have a difference between fake and genuine currency. The proposed fake currency identification method uses several steps, including edge detection, feature extraction, image segmentation, gray scale conversion, and comparison of images to efficiently identify fake currency.

Keywords: Image Processing, training model, CNN, Machine Learning, Supervised Learning

1. INTRODUCTION

Fake currency is the money produced without the consent of the gov, creation of it is considered as a crime. The elevation of color printing technology has increased the rate of fake currency note printing on a very large scale. Years before, the printing could be done in a print cafe, but now anyone can print a note with much accuracy using a simple laser printer. This results in the printing of fake notes instead of the real ones has been increased very much. It is the biggest problem faced by most of the countries including India. Though Banks and other large organizations has installed many machines to detect fake currency notes, it is really difficult for an average person to distinguish between the two. This has led to the increase of corruption and production of fake notes in our country hindering our country's growth. Some of the methods to detect fake currency are watermarking, security thread, latent image, techniques like counterfeit detection pens. Project aims at observing images taken as input that is based on properties taken out after transformation and also on the problem based on machine learning. Machine Learning is going to use pattern recognition as well as image processing for analyzing the real properties. Therefore, the processes continued with analysis of images, to check their correctness by testing the data set with respect of set theory, which will be visible but not mentioned in the model, for achieving accuracy.

2. GENERAL OVERVIEW

Machine Learning techniques help in building applications that support in detection of currency, through automated system and algorithm. The aim of this work is to create a paradigm which can be supervised with the help of related set theory so that it can be further beneficial in detecting feigned datasets with a very few categorizing bugs. Therefore, another name referred as categorizing model grouped as data, consisting of attributes and labels for the bills referring as fake or genuine. It identifies decision boundaries which separate samples of two classes.

Since demonetization time it is seen that so much of fake currency is floating in market. In general by a human being, it is not possible to identify fake note from the real ones not instead of various parameters designed for identification as many features of forged note are similar to original one. In this paper six supervised machine learning algorithms are applied on dataset available on UCI machine learning repository for detection of Bank currency authentication. To implement this we have applied Support

Vector machine, Random Forest, Logistic Regression, Naïve Bayes, Decision Tree, K- Nearest Neighbor by considering three train test ratio 80:20, 70:30 and 60:40 and measured their performance on the basis various quantitative analysis parameter like Precision, Accuracy, Recall, MCC, F1-Score and others. And some of SML algorithm are giving 100 % accuracy for particular train test ratio [1].

Bank note identification is most important approach based on machine learning and image processing method. Many techniques involved in the classification of bank notes carried out experiments on separated image data sets of each country's. Deep learning is machine learning technique that process the features of original note. In the era of big data where for any real-world application, large amount of data has to be processed, deep learning is the superior techniques. In this research, we studied bank note of various countries by extracting its features in depth and analysis it using deep learning. Our system recommended a deep learning-based algorithm to detect Forged bank note through general scanners that can be used by persons to prevent personal monetary damages caused by fake bank note [2].

Fake currency is one of the demerits which creates problems to nation's economy and hence impacts the growth all over the world. Producing fake currency or producing fake features in the currency is considered to be a crime. Moreover, the study includes the analysis of widely acceptable statistical classification technique for currency authentication. The comparative analysis of Logistic Regression and Linear Discriminant Analysis (LDA) was performed to realize the better model for currency authentication. It has been found that classification Model using Logistic regression shows better accuracy of 99% then LDA [3].

This paper proposes a method for fake currency recognition using K-Nearest Neighbors followed by image processing. KNN has a high accuracy for small data sets making it desirable to be used for the computer vision task. In this, the banknote authentication dataset has been created with the high computational and mathematical strategies, which give the correct data and information regarding the entities and features related to the currency. Data processing and data Extraction is performed by implementing machine learning algorithms and image processing to acquire the final result and accuracy [4].

In recent years a lot of fake currency note is being printed which have caused great loss and damage towards society. So, it has become a necessity to develop a tool to detect fake currency. This project proposes an approach that will detect fake currency note being circulated in our country by using their image. Our project will provide required mobility and compatibility to most peoples as well as credible accuracy for the fake currency detection. We are using image processing and cloud storage to make this app portable and efficient [5].

Fake currency Identification and Forged Banknote Detection using image processing Banknotes are used to carry out many financial activities in banks. There has been a drastic increase in the rate of fake notes in the global market. Fake money is a challenge in all of the fields. Given methodology i.e. Fake Currency recognition that is based on image processing techniques typically follows some essential steps such as image gathering, preprocessing and recognition of the currency. The proposed system work on 2 images first is front side of the real image of currency and second is the back side of real image on which verification is to be performed.

3. TECHNOLOGIES AND METHODOLOGY

3.1 TECHNOLOGIES USED

3.1.1 Machine Learning

Machine Learning is the processing of computers so they can learn from data. For ex, spam filter is a Machine Learning technique that can learn to spam given examples of spam emails and examples of normal mails. The ex that the system uses to learn are called the training set. Each training example is called a training set . In this case, the task T is to flag spam for new mails, the experience E is the training data, and the performance measure P needs to be defined; for example, you can use the percentage of correctly classified emails. This measure is called accuracy and it is often used in classification tasks.

3.1.2 Image Processing

Image processing is the process of converting an image into a digital form and performing certain operations to get some important information from it. The image processing system usually treats all images as 2D signals when applying certain predetermined signal processing methods. Image processing requires fixed sequences of operations that are performed at each pixel of an image. The image processor performs the first sequence of operations on the image, pixel by pixel. Once this is fully done, it will begin to perform the second operation, and so on. The output value of these operations can be computed at any pixel of the image.

3.2 METHODOLOGY

The Figure 3.1 represents the system architecture of the proposed model. The objective of the design phase is to produce overall design of the software. It aims to figure out the modules that should be in the system to fulfill all the system requirements in an efficient manner.
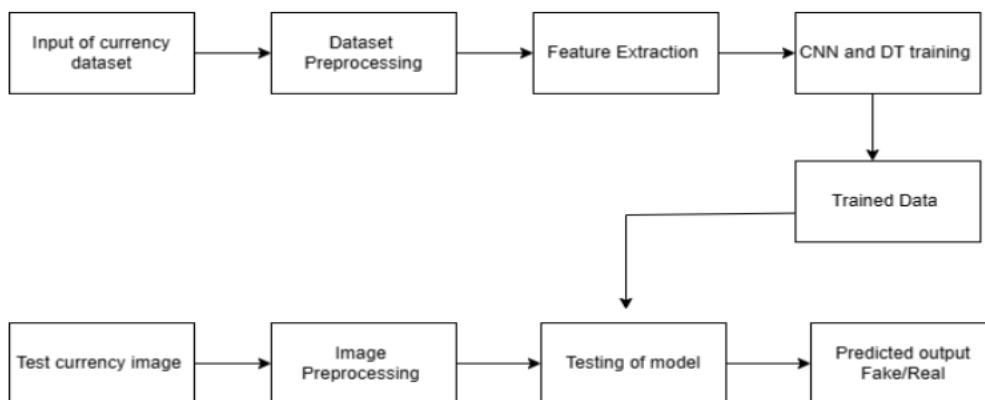

Figure 3.1- Methodology

Dataset: This dataset contains 500 images of Indian currency notes of different denominations, 250 genuine notes and 250 fake notes. The dataset is labeled with information about the denomination and authenticity of each banknote. These datasets can be used for training and testing machine learning algorithms for fake currency detection. However, it is important to note that the performance of the algorithm depends on the size and diversity of the dataset, as well as the quality of the images and the labeling process. It may be necessary to augment the dataset or collect additional images to improve the accuracy of the algorithm. The Figure 3.2 represents samples of fake and real currency images that have been collected.

Figure 3.2- Fake and real currency images

Pre-processing: Pre-Processing is an important step in any machine learning task as it can significantly affect the accuracy of the model. Here are some steps for pre-processing data for fake currency detection using the decision tree algorithm:

• Data Collection: Collection of real and fake currencies. This can include images of currency notes, videos of people exchanging currency, and other related information.

• Data Cleaning: Check the data for missing values, outliers, or other errors. You may need to remove or correct some data points to ensure accurate results.

• Data Encoding: Convert the data into a suitable format that the decision tree algorithm can understand. For example, you can convert images into numerical arrays or encode categorical data using one-hot encoding.

• Feature Selection: Identify the most important features that can help the decision tree algorithm differentiate between real and fake currency. This can include features like watermark, security thread, texture, and serial number.

• Data Splitting: Divide the data into training and testing sets. The training set will be used to train the decision tree model, while the testing set will be used to evaluate its performance.

• Data Normalization: Scale the data to ensure that all features are on the same scale. This can help the decision tree algorithm make accurate predictions.

• Data Augmentation: Increase the size of the dataset by adding variations of the existing data. This can include flipping images, rotating them, or changing the lighting conditions.

• Data Balancing: Ensure that the dataset has an equal number of real and fake currency examples. If the dataset is imbalanced, the decision tree model may be biased towards the majority class.

Canny Edge Detection: Canny edge detection is a popular algorithm for detecting edges in images, which can be used as a basis for image segmentation. It converts the image to grey scale. Gray scaling is a technique used in image processing and computer vision to convert a color image into a grayscale image. In the context of fake currency detection, grayscale images can help identify patterns and features in banknotes that are not easily visible in color images.

Feature Extraction: Feature extraction is an important step in preparing data for machine learning algorithms. Here are some features that can be extracted for fake currency detection using the decision tree algorithm:

• Watermark: A watermark is a design that is embedded into the paper of a currency note. Real currency notes have a distinct watermark that is difficult to replicate. The decision tree algorithm can be trained to identify the presence or absence of a watermark and its characteristics, such as its shape, size, and position.

• Security Thread: A security thread is a thin strip that is embedded into the paper of a currency note. The thread can be made of plastic or metal and has a unique pattern that is difficult to replicate.

• Texture: The texture of a currency note can be analyzed to detect if it is real or fake. Real currency notes have a distinct texture that is difficult to replicate. The decision tree algorithm can be trained to identify the texture of a currency note by analyzing features such as the spacing of the lines and the depth of the engravings.

• Serial Number: Each currency note has a unique serial number that is printed on it. The decision tree algorithm can be trained to identify the format of the serial number and its position on the note.

VGG 19 Model: VGG-19 is a CNN that consists of 19 layers . We can upload a version of the network trained on about a million images from various database . The required network can classify images into different object categories, such as keyboard, mouse, monitor, and many animals. As a result, the network has learned rich feature representations for large number of images. The network has an image input size of 224 X 224.

4. RESULTS AND DISCUSSION

The proposed system was implemented using CNN and decision tree in python language . The following results were observed:
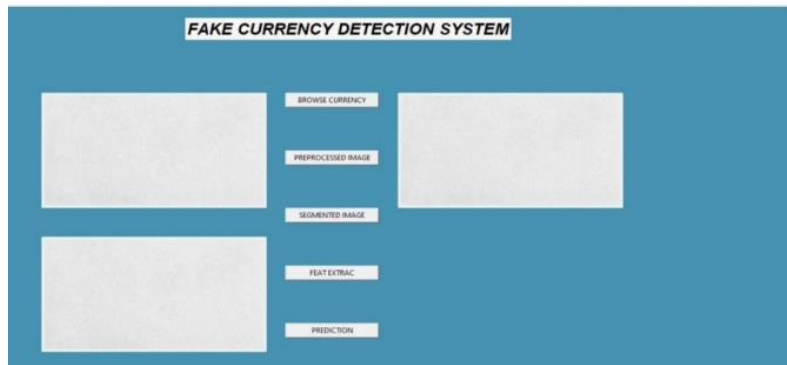

Figure 4.1 Display of GUI when no input is provided

Figure 4.1 shows GUI when no input is provided. It has buttons for browsing currency, preprocessing, segmentation, feature extraction and predictions.
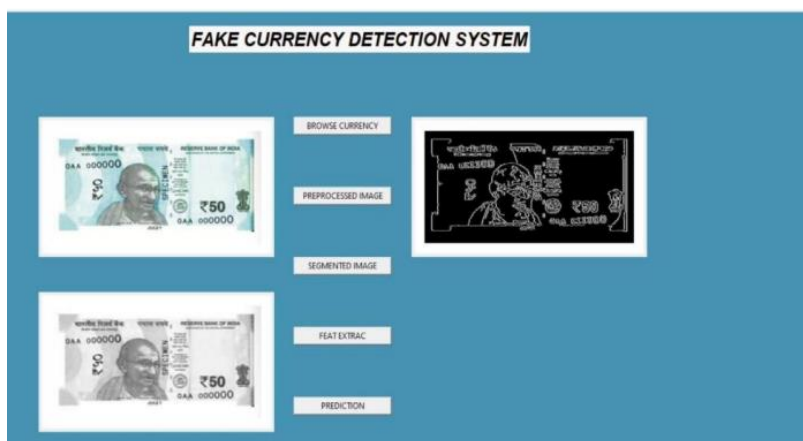

.   Figure 4.2 Display of GUI after grey scaling

Figure 4.2 shows GUI after performing preprocessing that is used for resizing of image, segmentation and feature extraction using canny edge detection.

Figure 4.3 Detection of a real note

Figure 4.3 shows GUI when all the steps are completed and real 50 rupee currency is detected through an audio output whether it is fake or real currency as a result.

Figure 4.4 Detection of a fake note

Figure 4.4 shows GUI when a 10 rupee fake currency is detected by the software after performing all the processes.

5. CONCLUSION

An effective method for extracting and recognizing the properties of Indian rupee notes is presented. The study also includes detection and identification of counterfeit cash. Our future work will focus on faster and more accurate fake currency identification with the use of modern image processing algorithms. Our future scope will include currency denomination conversion. The proposed methodology demonstrates the productive technique for fake currency detection of Indian currency notes dependent on physical appearance. By using digital image processing, analysis of currency image is more accurate as well as this method is in terms of cost efficient and time consuming compared to existing technique. MATLAB software is used for this analysis. The conferred approach offers AN economical technique of pretend currency detection supported physical look. 3 necessary security measures explored for faux currency detection are the protection thread, run brand, and identification mark. Image process algorithms are applied to extract the options.

• To mix the multiple options, call a score of all the options were consolidated. The effectiveness of the projected approach is tried by 100% recognition faux detection accuracy and therefore the low price (near about1) of mean sq. error.

• The future perspective of the approach is to sight alternative national currencies and to infuse the conferred technique into a mobile application, in order that its proving to be a larger use. the appliance areas which will be helpful through the projected approach embody faux currency detection whereas electronic currency exchange and cash deposit victimization ATM.

6. ACKNOWLEDGEMENT

Conflict of interest: The authors declare that we have no conflict of interest.

7. FUTURE WORK

In Future, many applications can be developed which would be useful for regular as well as physically challenged people, the same system can be developed for other Indian currencies and other country's

notes. Also, the app's front end can be further changed according to the user needs. This will enhance its usage by increasing the user network as India is going to establish the largest digital network in the world in next coming years. So, the application will be available in all android devices and IOS devices in future if we work on it. The future view of this approach is to analyse alternative country currencies. Techniques available today are not only fake note detector machine but they also provide some extra facilities . These features can be added with the device that would make it as most trustful fake currency detector along with counting feature that would be helpful for banking sector. This project discussed algorithms for verifying Indian currency.

8. REFERENCES

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