

# Fake Currency Detection Using Machine Learning

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**ABSTRACT:** In recent years, many counterfeit banknotes have been issued, causing great damage and loss to the society. Therefore, we need to develop tools to detect fake currency. In this project, we propose an image-based approach to detect counterfeit banknotes in circulation in Japan. Our project provides not only the mobility and compatibility that most people need, but also reliable detection accuracy for counterfeit money. Detecting counterfeit currency is a serious global problem, affecting the economies of almost every country, including India. Currency duplication is a vulnerable threat to the economy. Significant advances in technology in the scanning and printing industries exacerbates the counterfeit problem. By virtue of this, counterfeit cash impacts the economic system and devalues the real currency. Therefore, detecting counterfeit money is very important. Most of the earlier methods used are based on the hardware techniques and the image processing technology. Identifying the counterfeit money using these methods are ineffectual and also time-consuming. To overcome these negativities, fake money detection using machine learning concepts has been proposed. Our work will identify the counterfeit money by examining the currency images. Using this machine learning technique, we build a counterfeit currency detection system that detects fake and real currencies. Counterfeit currency detection system, as the name suggests, check whether the banknotes someone gave you are real or counterfeit. This system is very useful as the circulation of fake money is increasing day by day. Therefore, we need a system to prevent this. This system is available to banks and the general public. This allows banks to distinguish between counterfeit

and genuine banknotes. This can also be used to prevent ordinary people from becoming thugs.

**KEYWORDS:** Fake currency, Machine learning, Image processing, Numpy, OpenCV, Convolutional neural network.

## I. INTRODUCTION

Counterfeit currency detection systems, as the name suggests, check whether the banknotes someone gave you are real or counterfeit. This system is very useful as the circulation of fake money is increasing day by day. Therefore, we need a system to prevent this. Detecting counterfeit money is a serious worldwide problem, affecting the economies of most of the countries including India. Currency cloning, also known as counterfeit money, is a vulnerable menace to the economy. With advanced scanning and printing technology, this has become a daily occurrence. One possible solution is to use the chemical properties or physical form of the currencies. The method presented in the system is primarily based on the physical appearance of the Indian banknotes. Image processing techniques has been applied to extract the features that have been used as Indian currency's security feature. Therefore, we provide a more portable and user-friendly approach to detect fake notes using machine learning. This system is available to banks and the general public. This allows banks to distinguish between counterfeit and genuine banknotes. This can also be used to prevent ordinary people from becoming thugs.

## II. LITERATURE SURVEY

In Ruheena et.al [1], introduced a technique that extracts the security elements of the currencies to detect counterfeit money. The transfer learning Alex net model is employed in this technique to identify counterfeit money. For each of the currency notes 100 images are used in the data set. The input is real time images of the currency notes that are taken through Alex network. In this method all the security features of the currency are not considered.

In Aman Bhatia et.al [2], introduces a system that uses the samples of fake currencies for detection. In this system K-Nearest Neighbors algorithm and the image processing methods are used. The characteristics of banknotes play an important role in the recognition or identification process. Here the data set consist of the images of both the real and the fake currencies which are taken from the high-quality industrial camera. In this system as the training data increases the speed of detection will decrease.

In Qian Zhang et.al [3], presented a model for counterfeit currency detection on the basis of deep learning techniques using the Single Shot Detection (SSD). Convolutional Neural Network or CNN is applied for extracting the features of the currency notes. For implementation purpose only Indian currency papers are included. The characteristics of banknotes play an important role in the recognition or identification process. As a feature extractor 6-layer CNN model was chosen. The data set was fully trained as it reached the accuracy of 98%. The limitation of this paper was that only three denominations were used for the detection.

In Rihab Salah Khairy et.al [4], introduced a system that uses boosting and voting ensemble model for the detection of the banknotes. This employed 10 algorithms. The result on datasets proved that the ensemble models fit for improving accuracy of detection of individual algorithms. This proposed model is suitable as well as proficient in detecting the counterfeit notes.

In P. Ashok Babu et.al [5], proposed a system using the image processing technique for recognizing the currency and identifying whether the currency image is real or duplicate. Here the MATLAB software is used for recognizing the currency. The objective is to contemplate the distinctive highlights of recent certifiable money and use them. Highlights of certified notes can be removed by using digital image handling. This approach has been tested with each Indian denomination to obtain a very accurate result.

In Karthik K et.al [6], presented a system that uses deep convolution neural networks and

convolutional neural networks to detect bogus cash. 2000 datasets were used in its training, to teach it the characteristics of currency. This system's primary goal is to deliver precise detection based on the data that is recorded. All of the currencies' security characteristics are not taken into account here.

In Kamble et.al [7], presented a system for the recognition of fake money by using the currency images. SVM and the k-means algorithms are used in the data extraction. For implementation purpose only Indian currency papers are included. The images are taken in dissimilarity space and compared with various set of prototypes. SVM (support vector machine) has been used in the detection of the counterfeit money. An image of note is taken for detection. After taking it as an input, edge detection and segmentation is performed and then SVM is applied to obtain an classified image.

In M. Laavanya et.al [8], proposed a system for real-time currency detection using DNN or deep neural networks. The main objective is to reduce the black money and to prevent the monetary damages. For the detection of paper currency, the transfer learned CNN is trained with the dataset consisting of various currency banknotes. The factors considered in the recognition of the banknotes are on the basis of size and the texture of images. The main drawback of the system is low efficiency because of the extraction feature which can be a challenging task.

In J. Refonaa et.al [9], proposed a system to prevent the widespread of black money or counterfeit money in the market. Popular techniques such as high frequency RFID tag or NFC (Near Field Communication) has been used for currency recognition. NFC's are suitable for shorter ranges and is also expensive, which is the main drawback. This system will be very useful for eradicating black money. This approach have been tested with each Indian denomination and the accuracy results were around 96%.

In Rushikesh Jadhav et.al [10], presented a system that proposes the currency paper recognition technique using the image processing algorithms. This technique is based on the three factors: colour, texture and size that are used in the recognition of currencies. For implementation purpose only Indian currency papers are included. With this approach currencies are easier to check at anytime and anywhere, and the technology used in the implementation is CNN (Convolution Neural Network). This approach have been tested with each Indian denomination and the accuracy results were around 95%. A classification model has been

generated by considering all the factors mentioned above to improve the accuracy of this technique.

The characteristics of banknotes play an important role in the recognition or identification process.

Figure: Table Analysis

SL No.	Title	Existing System	Methodology/ Algorithm	Drawback
1	Fake Currency Detection using Deep Learning Technique.	Deep neural network called transfer learning using Alex Net is used	Transfer learning using Alex net	All the security features of the currency is not considered.
2	Fake Currency Detection with Machine Learning Algorithm and Image Processing.	Fake currency recognition using K-Nearest Neighbours followed by image processing.	K-Nearest Neighbours (KNN) algorithm	As training data increases the speed will rapidly decrease.
3	Currency Detection and Recognition Based on Deep Learning..	Detection using deep learning	Single Shot Multi-Box Detector (SSD) model, Convolutional Neural Network (CNN) model	Computationally expensive.
4	The detection of counterfeit banknotes using ensemble learning techniques of AdaBoost and voting.	AdaBoost and voting ensemble are deployed in combination with machine learning	Ensemble techniques of Boosting and Voting algorithms	Expensive in terms of time and space.
5	Fake currency Recognition Using Edge Detection.	Image processing technique is used	Edge detection and MATLAB software	Time consuming and complex.
6	Fake Currency Detection Using ML.	Detection using CNN and Machine Learning	Deep Neural Network and Convolutional Neural Network models	Lot of training data is required to become effective.
7	Design and Implementation of Fake Currency Detection System.	Detection using dissimilarity spaces	SVM & k-means algorithm	Not cost effective and time consuming.
8	Real Time Fake Currency Note Detection using Deep Learning	The characteristics of security-threads currency notes was extracted to identify fake currency	Deep convolution neural network	Convolutional Neural networks are computationally expensive.
9	Effective Identification of Black Money and Fake Currency Using NFC, IoT and Android.	Detection using RFID and NFC chips	NFC, RFID, Image processing	Practical implementation requires high capital and difficult to implement.
10	Currency Recognition using Machine Learning	Tflite model and teachable machine are used	Convolutional neural network, image processing	Less accurate when image loaded from outside.
11	Automated Currency Recognition Using Neural Networks.	Programmed paper cash acknowledgment framework for paper currency.	InceptionV3, neural network, K-nearest neighbors (KNN) and support vector machine (SVM)	Time consuming and requires high computational power.
12	Currency Identification and Forged Banknote Detection using Deep Learning.	deep learning is used to detect Forged bank note through general scanners	Deep learning algorithm	Extracting security features of Currency is not considered.

### III. PROPOSED SYSTEM

Our proposed system consists of two main phases. The first one is classifying the currency notes on the basis of denomination. The second one is checking whether the note is real or fake.

#### 1. Classification based on denomination:

We are using the dataset that is comprised of Indian currencies of rupees 10, 20, 50, 100, 200, 500, 2000 denominations.

**Pre-processing:** We will be resizing the images of the Currency notes and then convert it to NumPy arrays. We will be normalizing the values of picture element so that it can lie in the range of 0-1.

**Model Creation and Training:** We will be using the CNN model of three-layer with Rectified Linear Unit activation function. The three layers extract the features from images and the Rectified Linear Unit function will preserve non-linearity in pixels in pictures.

#### 2. Verifying real or fake:

The second phase of the system is mentioned here. Here we use multi-sectoral template matching followed by OpenCV in python.

**Extracting Features:** Canny edge detection is applied to extract the security features. This detection is done for every denomination.

**Template matching:** Here an image or template is considered as a feature and its presence is detected in one more image. The template image slides on top of the input picture like in the two-dimensional convolution. Before the template matching, set of threshold values will be decided. The result obtained will be compared with threshold value. If it is more than the threshold value then the template will be marked as detected.

Counterfeit currency detection system, as the name suggests, check whether the banknotes someone gave you are real or counterfeit. This system is very useful as the circulation of fake money is increasing day by day. This system is available to banks and the general public. This allows banks to distinguish between counterfeit and genuine banknotes. This can also be used to prevent ordinary people from becoming thugs.

### IV. CONCLUSION

In this research, a system has been proposed for the identification and detection of the black money, also known as counterfeit money with an average accuracy of 95%. Most popular and common technique in the machine learning known as Image processing is used in the

extraction and classification of the paper currency images. We also plan to comprise the flip side characters of the currency image in our detection system. In this way we look forward to produce an even better and palatable results in the future.

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