

# Fake Currency Detection with Machine Learning

Amala Mariyat  
Department of Computer Applications  
Amal Jyothi College of Engineering  
Kanjirappally, India  
amalamariyat2022a@mca.ajce.in

Ms. Anit James  
Department of Computer Applications  
Amal Jyothi College of Engineering  
Kanjirappally, India  
anitjames@amaljyothi.ac.in

**Abstract** — One of the major crisis faced by the common people is to identify banknotes. It identifies the note which is given to the system. All Indian notes have unique features. Indian currencies have a set of old notes and a set of new notes. So, it is difficult to identify each Indian note. Gives the system a note to identify which note it is. The input is taken using OpenCV for testing. The training dataset is a folder of a collection of images. ORB is used to find key points from the image. Then Flann(Fast Library for Approximate Nearest Neighbors) is performed approximate nearest neighbor searches. To show which image is being tested, good matches are shown through the lines in an image.

**Keywords**—fake currency detection, banknote identification, fake currency detection using machine learning, orb, knnmatch, Flann, OpenCV, Image processing

## I. INTRODUCTION

It is difficult to identify Indian notes if it is real or fake, as it have unique features. There are lack of technologies introduced for solving such problems. There are a lot of studies have been done about this problem. Still, the technologies related to this are getting updated. Each note in Indian currencies are similar in some features but different many other features. As the features of currencies change the system should be updated. Now, Indian currencies have two types, old currencies, and new currencies. On 8th November 2016, when the Government of India announced the issuance of new Indian bank notes, the people of India faced a huge problem to change their Indian currencies. According to common people, that was impossible to change each note day by day. They got losses during that time because the time they got to check their money was less. We have to face such situations more easily if it happens again. This checks the matching of the input image with all notes and shows the best matches. So, the user can identify notes. Various Machine Learning techniques are used in it to detect notes.

The methods for detecting genuine bank notes are:

- Finding the keypoints and descriptors using ORB
- Training dataset for Machine Learning: Training data are used to teach predictive models using Machine Learning Algorithms how to extract relevant features.
- Matching the query image with each of the training images: Image matching is an important concept in computer vision and object recognition.

## II. LITERATURE REVIEW

Sarthak Bhardwaj Et al [1]

In this, the characteristics of The features of the appropriate

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currency will be processed and analyzed in mat files, so these stored features will be matched with the sample currency. There are significant issues with currency recognition, such as steganographic recognition, currency note resolution, and dirty notes.

Binod Prasad Yadav Et al[2]

Describes paper currency recognition with the help of digital image processing techniques. Sobal operator with gradient magnitude is used to extract the characteristics. The currency will be checked using image processing techniques. This approach includes several components, including image processing, edge detection, image segmentation, character extraction, and image comparison.

Kuldeep Verma Et al[3]

The currency identification process through certain external features is subject to errors due to the pollution and depreciation that the currency experiences during transactions. Therefore, they proposed an Indian currency identification system based on the internal characteristics of the currency. In this work, they have extracted the texture as an intrinsic feature of currency identification and evaluated the class discriminating capacity of these features for the Indian currency.

Felipe Grijalva Et al[4]

This work takes its theoretical basis from digital image processing techniques and primarily the image recognition method known as Eigenfaces, which is based on the mathematical theory of principal component analysis. It has high accuracy rate and speed.

Devashree R. Patwardhan Et al[5]

The system aims to help people who need to identify different currencies also work with convenience and efficiency. This project suggests an image processing technique for paper currency recognition and conversion. ROI can be used with pattern recognition and neural networks matching technology.

Tushar Agasti Et al[6]

This article describes extraction of various features of Indian currency notes. Features of the currency are extracted using MATLAB software. The proposed system has advantages such as simplicity and superiority.

## III. MOTIVATION

The difficulty of identifying bank notes especially, Indian banknotes for common people is a huge problem. They also have to deal with money without any problem. It is necessary to

propose such a system. Also, the people who work with money like cashiers, are facing problems to discriminate the money as each note has its features. And is also time-consuming to classify banknotes for such people. By studying this, found a lot of explorations are found, but there are a few studies that are showing more accurate results. There are a lot of features in banknotes, that a very difficult to compare. That is the reason why this system is too much complicated. This system will help common people to easily understand which is the denomination of banknotes.

Indian Bank notes operate on 5, 10, 20, 50, 100, 200, 500 and 2000 notes. There are certain features to consider when processing images of money.

- The note should be very defined.
- The photo must be same size as the money.
- Improved image with featured upgrade.

#### IV. METHODOLOGY

The purpose of this paper is to find a Machine Learning model to identify the Indian currency note. The model should be able to match the correct note. A folder of images is collected and given as a dataset. The model should be trained with more data to get accuracy in learning. The result from this model will be the best matching of banknote. ORB and Flann are used for image processing and matching.

The steps that require to be followed to recognize banknote are:

1. Data Collection
2. Data Pre-processing
3. Model Building
4. Analyzing
5. Result

- A. **Data Collection:** Data collection is the process of collecting and measuring information from countless different sources. In order to use the data we collect to develop machine learning solutions, we need to collect and store it in a way that makes sense for the business problem. Here, the data is a collection of images of Indian currencies that are taken.



Fig.1- 100 rupee, dataset image



Fig.2- 50 rupee, dataset image

- B. **Data Pre-processing:** This is the stage where all the Machine Learning methods are done. This process involves data cleaning, data conversion, and data reduction. All this is done to make the data more efficient. Data can be processed to make our model more accurate. Thus the classification would be correct.

1. **Data cleaning** is the process of preparing data for analysis by removing or modifying data that is incorrect, incomplete, irrelevant, duplicated, or improperly formatted.
2. **Data conversion** is the process of converting raw data into a format or structure that is more suitable for model building and data discovery in general.
3. **Data reduction** is technique for reducing the number of input variables in training data.

- C. **Machine Learning:** Artificial intelligence (AI) that allows software applications to be more accurate in predicting results without special programming. Various Machine Learning techniques are used here.

**OpenCV** is an open source library for computer vision and image processing tasks in machine learning. It mainly aims at real-time computer vision.

**Matplotlib** is one of the plotting libraries in Python, however it is widely used in the machine learning application in its arithmetic extension. It is used to plot images.

**ORB** is a combination of FAST keypoint detector and BRIEF descriptor. Fast is a feature from the Accelerated Segment Test used to detect features in a given image. Use FAST to find keypoints first, then apply Harris corner to find the best n points in them. It also uses a pyramid to build multi-scale features.

**FLANN** (Functional Link Artificial Neural Network) is a single-layer ANN with minimal computational complexity used in a variety of applications,

including system identification, pattern recognition, prediction, and classification. FlannBasedMatcher() and knnMatch() are used to match images.

#### V. BUILD MODEL

The model building is the main step in the Recognition of Indian currency. While building the model user uses the algorithms.

Images are readed using OpenCV, Keypoints are found using ORB and matches are found using Flann. The steps involved are:

1. Import the packages that are necessary.

```
import os
import numpy as np
import cv2
from matplotlib import pyplot as plt
```

2. Read the test image.

```
img1 = cv2.imread('10.jpg',0)
```

3.Find the keypoints and descriptors with ORB.

```
orb = cv2.ORB_create()
kp1, des1 = orb.detectAndCompute(img1,None)
```

4.Training dataset are assigned.

```
training_set = os.listdir('training-data/')
for ind in range(0, len(training_set)):
    training_set[ind] = 'training-data/' + training_set[ind]
```

5.Flann parameters are declared.

```
FLANN_INDEX_KDTREE = 0
index_params = dict(algorithm = FLANN_INDEX_KDTREE, trees = 5)
search_params = dict(checks=50) # or pass empty dictionary
```

6.Finding the matches.

```
flann = cv2.FlannBasedMatcher(index_params,search_params)
des1 = np.float32(des1)
des2 = np.float32(des2)
matches = flann.knnMatch(des1,des2,k=2)
```

7.Drawing matches.

```
matchesMask = [[0,0] for i in range(len(matches))]
img3 = cv2.drawMatchesKnn(img1,kp1,img2,kp2,matches,None,**draw_params)
```

## VI. RESULT

This result shows the most appropriate matching in the resultant image. Flann helps to find the best matches in the images. The resulting image is the matching combination of query image and the training image.

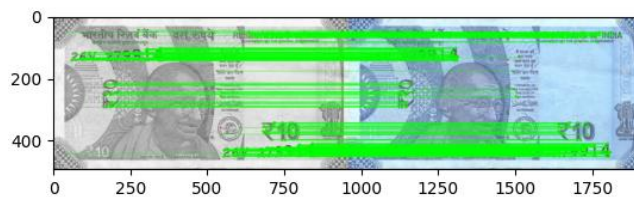


Fig.3 Output

## VII. CONCLUSION

Currency detection is carried out by ORB and Flann in machine learning. The dataset contains different images of Indian note. Each notes are compared with the query image. And the output will be the best matching image. The system is capable of extracting features even if the note has scribbles on it. This system can process Rs 10, 20, 50, 100, 200, 500 and 2000 notes.

## REFERENCES

- [1] Sarthak Bhardwaj, Shivam Vishwakarma, Suneel Kumar, Sagar Jaiswal, and Gauri Katiyar. "Identification of Currency via Image Recognition", International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), 2021
- [2] Sarthak Bhardwaj, Shivam Vishwakarma, Suneel Kumar, Sagar Jaiswal, and Gauri Katiyar. "Identification of Currency via Image Recognition", International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), 2021
- [3] Binod Prasad Yadav and C. Patil. "An automatic recognition of fake Indian paper currency note using MATLAB", 2014
- [4] Kuldeep Verma, B. Singh and Anupam Agarwal. "Indian currency recognition based on texture analysis", Nirma University International Conference on Engineering, in 2011
- [5] Felipe Grijalva, Juan Carlos Rodriguez, Julio Larco and Luis Orozco. "Smartphone recognition of the U.S. banknotes' denomination, for visually impaired people". IEEE ANDESCON At: Bogotá, Colombia, 2010
- [6] Prof. Suraj Bhoite, Rutuja Narawade, Simran Tiwari and Shruti Patil. "Review paper on Indian Currency Detection for Visually Impaired People". International Journal of Creative Research Thoughts (IJCRT), 2022
- [7] Tushar Agasti, Gajanan Burand, Pratik Wade and P Chitra. "Fake currency detection using image processing". In IOP Conference Series: Materials Science and Engineering, 2017