# FAKE CURRENCY DETECTION

# PROJECT REPORT

## ABSTRACT

The advancement of color printing technology has increased the rate of fake currency note printing and duplicating the notes on a very large scale. A few years back, printing could be done in a print house, but now anyone can print a currency note with maximum accuracy using a simple laser printer. As a result, the issue of fake notes instead of genuine ones has decreased very largely. This leads to the design of a system that detects fake currency notes in less time and in a more efficient manner. The proposed system gives an approach to verify the Indian currency notes. Verification of currency notes is done by the concepts of image processing using Deep Learning and Machine Learning algorithms. This project includes a study of image segmentation, edge detection, feature extraction, and feature matching techniques.

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## *i*) ABSTRACT

The advancement of colour printing technology has increased the rate of fake currency note printing and duplicating the notes on a very large scale. A few years back, printing could be done in a print house, but now anyone can print a currency note with maximum accuracy using a simple laser printer. As a result, the issue of fake notes instead of genuine ones has decreased very largely. This leads to the design of a system that detects fake currency notes in less time and in a more efficient manner. The proposed system gives an approach to verify the Indian currency notes. Verification of currency notes is done by the concepts of image processing using Deep Learning and Machine Learning algorithms. This project includes a study of image segmentation, edge detection, feature extraction, and feature matching techniques.

## *ii)* LIST OF FIGURES



## *iii*) ABBREVIATIONS

| | |
|---|---|
| OpenCV | Open Source Computer Vision Library |
| FLANN | Fast Library for Approximate Nearest Neighbors |
| SIFT | Scale-Invariant Feature Transform |
| RBI | The Reserve Bank of India |

# INTRODUCTION

Fake currency detection is a serious issue worldwide, affecting the economy of almost every country including India. Currency duplication also known as counterfeit currency is a vulnerable threat to the economy. The Reserve bank of India (RBI) is the main body that has the sole obligation to print currency notes in India. But RBI faces the issue of fake currency notes once shifted and coursed in the market consistently. The Reserve Bank of India (RBI) in its report said that in 2017-2018, 17,929 pieces of Rs 2,000 notes were detected in 2017-2018 while only 638 counterfeit notes of the same denomination had been detected the year before. It is now a common phenomenon due to advanced printing and scanning technology. Prior fake currency detection was finished by utilizing the chemical properties of the currency paper. The possible solutions are to use either the chemical properties of the currency or to use its physical appearance. The proposed system gives an approach to verify the Indian currency notes. Verification of currency notes is done by the concepts of image processing. The approach presented is based on the physical appearance of the Indian currency. The technology of currency recognition aims for identifying and extracting visible and invisible features of currency notes. Detecting fake notes includes image Acquisition, Image pre-processing, Image adjusting, Gray-scale conversion, Edge detection, Image Segmentation, and Feature extraction classification every step required an algorithm for which using OpenCV library features of currency notes like security thread, Identification mark, and the signature of the RBI Governor, were extracted which is then matched and compared using FLANN to verify whether the image is legitimate or not.

# BACKGROUND STUDY

Fake currency detection is done using Image Processing using Machine Learning in Python.

**Image processing** is a method to perform some operations on an image, to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which the input is an image and the output may be the image or characteristics/features associated with that image.

Image Processing Techniques:

1)Image Enhancement: Enhancement is done by adjusting the image's contrast and brightness.

2)Image Restoration: It includes restoring the quality of an image.

3)Image Segmentation: It is the process of partitioning an image into multiple segments or regions. Each segment represents a different object in the image.

4) Object Detection: It is the task of identifying objects in an image and is often used in applications such as security and surveillance.

5)Image Manipulation: It is the process of altering an image to change its appearance.

# LITERATURE REVIEW

Over the years a lot of researchers have made several contributions to this field of currency note detection. The researchers have done detection based on security features, texture, colour, etc. In this section, we review previous work in currency detection techniques.

Deshpande and Shrivastava [1], proposed a recognition and authentication system using image processing which can be good for recognizing fake currency notes. In this methodology, extract the security features with Multispectral imaging. They are so many features extracted in this process is the Mahatma Gandhi portrait, watermark, RBI watermark, 2000 watermark, and electrotype watermark of 2000 denomination note.

K. B. Zende et.al. [2], describe a fake note detection system automatic recognition of Indian currency security features based on the MATLAB system. They are so many steps included in this process are feature extraction, image segmentation, edge detection, bit plane slicing, and comparison of image. This paper extracts many features watermark Detection, Security Thread Detection, checking currency series numbers, identification marks, and sees-through registers. Here, they propose a GUI platform to check whether the currency is fake or real.

Yanyan Qin et.al. [3], proposed systems provided by SIFT (Scale-Invariant Feature Transform). Initially, the scale spaces were built for the detection of stable extreme points, and then the detected stable extreme points were considered to be feature points that have scale in variance. Secondly, the ORB descriptor is used to describe the currency feature points. This finally generated the binary descriptors with scale and rotation in variance. The ORB is 65.28 times faster than SIFT. The experimental setup is done with 20 images and achieves an accuracy of 92.53%.

Bhagat and Patil [4], proposed a fast binary descriptor based on BRIEF, called ORB, which is resistant to noise. This paper proposed the system on both sides of the currency feature. The recognized samples for conditions such as illumination changes, rotation, and scale change. The experimental setup is done with 210 Indian currency notes samples 15 each on rupees Rs. 5, 10, 20, 50, 100, 500, and 1000. The average success rate achieved is 97.14%.

# METHODOLOGY

## 3.1) REQUIREMENT ANALYSIS

### 3.1.1) Image processing library: OpenCV

Open source Computer Vision (OpenCV) is an image processing and computer vision library mainly developed for artificial vision. It has a BSD license (free for commercial or research use). OpenCV was originally written in C, but currently, it's a whole C++ interface, and there's additionally an entire Python interface to the library. Open-source computer Vision Library, also called OpenCV, is associated with a freeware software package aimed toward computer vision. It is used in this project because of its versatility and the fact that it has a C++ interface. OpenCV runs on most major Operating Systems (OS), making it worthwhile to use another computer to program or test.

#### 3.1.2) Language: Python 3.7

Python is a high-level programming language extensively used for programming. Python, an interpreted language, supports several programming scripts and a syntax that allows you to use programs in most languages such as C ++ or Java. The language provides constructions designed to permit clear programs at each scale. Python is easy and simple to know, the python code is way easier than alternative languages.

### 3.1.3) Code Editor: Visual Studio Code

Visual Studio Code, also commonly referred to as VS Code, is a source-code editor made by Microsoft with the Electron Framework, for Windows, Linux, and macOS.

### 3.1.4) Data Set: Kaggle

Kaggle, a subsidiary of Google LLC, is an online community of data scientists and machine learning practitioners. Kaggle allows users to find and publish data sets, explore and build models in a web-based data-science environment, work with other data scientists and machine learning engineers, and enter competitions to solve data science challenges.

## DETAILED DESIGN

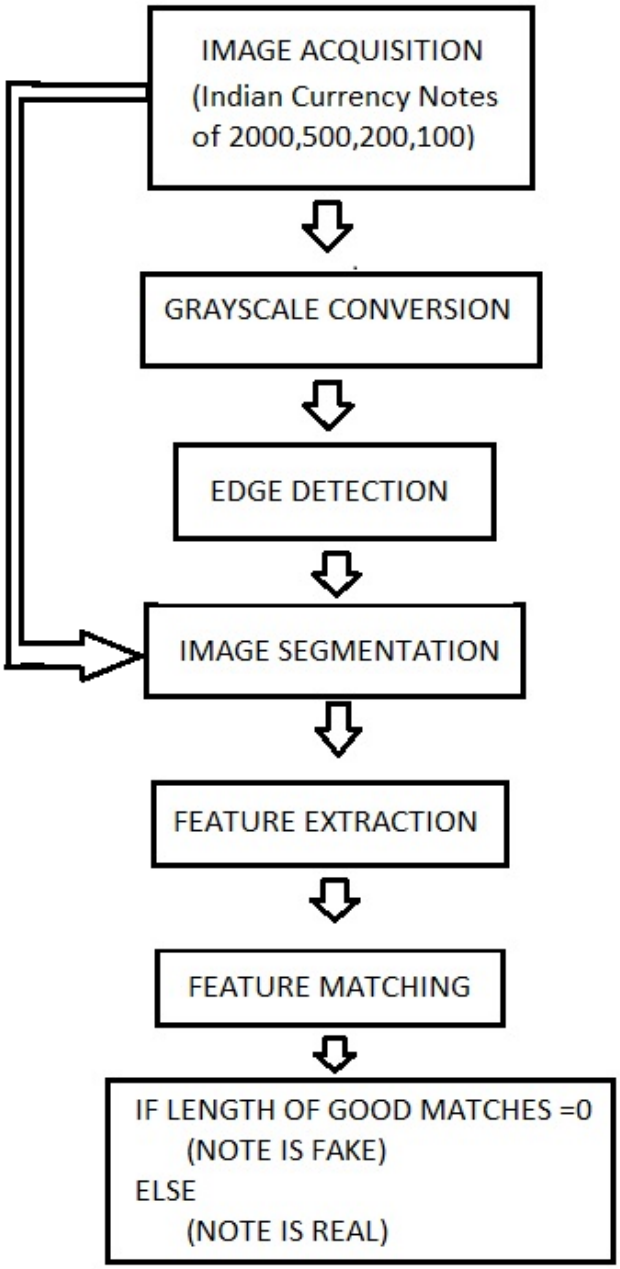



FIGURE -1

# IMPLEMENTATION

## 3.2.1) IMAGE ACQUISITION

The dataset of the Indian currency notes is extracted from Kaggle Website(https://www.kaggle.com/)

## 3.2.2) GRAYSCALE CONVERSION

The acquired image is obtained as an RGB image which is now converted into a grayscale image since it carries intensity information. Grayscaling is the process of converting an image from other color spaces e.g. RGB. A grayscale (or gray level) image is simply one in which the only colors are shades of gray. RGB image contains lots of data that may not be required for your processing. When you convert an RGB image into Grayscale you discard lots of information which are not required for processing.

## 3.2.3) EDGE DETECTION

Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing.

Algorithms used for edge detection include:

- CANNY EDGE DETECTION:

  Finds edges by looking for local maxima of the gradient of I. This method uses two thresholds to detect strong and weak edges, including weak edges in the output if they are connected to strong edges. By using two thresholds, the Canny method is less likely than the other methods to be fooled by noise, and more likely to detect true weak edges.

- SOBEL EDGE DETECTION:

  Finds edges at those points where the gradient of image is maximum, using the Sobel approximation to the derivative.

- KRISCH EDGE DETECTION:

  The Kirsch operator or Kirsch compass kernel is a non-linear edge detector that finds the maximum edge strength in a few predetermined directions.

  We have also applied some filters so that in the next clear features can be extracted

  Gaussian Filter

  Top Hat and Black Hat

  Gabor Filter

The final image acquired after applying the filters:


FIGURE-2

### 3.2.4) IMAGE SEGMENTATION

Image segmentation involves converting an image into a collection of regions of pixels that are represented by a mask or a labeled image. By dividing an image into segments, you can process only the important segments of the image instead of processing the entire image.

### 3.2.5) FEATURE EXTRACTION

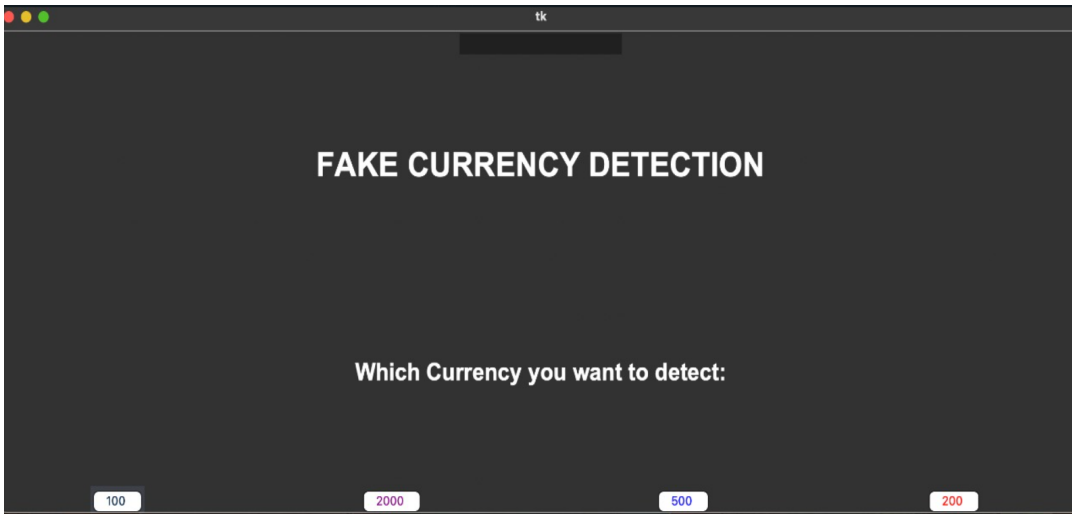
Features of currency notes like security thread, Identification mark, Bleed lines, and the signature of the RBI Governor, were extracted.

### 3.2.6) FEATURE MATCHING

Feature matching refers to the act of recognizing features of the same object across images with slightly different viewpoints.

FLANN is a library for performing fast approximate nearest neighbor searches in high-dimensional spaces. It contains a collection of algorithms we found to work best for the nearest neighbor search and a system for automatically choosing the best algorithm and optimum parameters depending on the dataset. For this project, KNN Match is used.

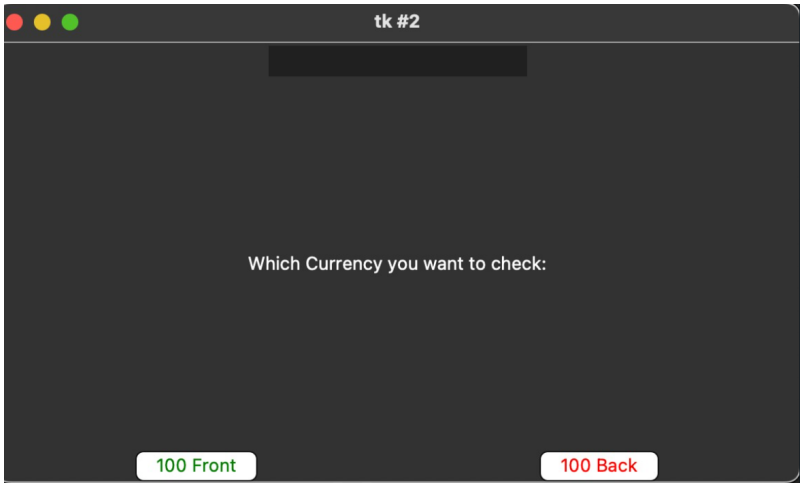
# EXPERIMENTAL RESULTS AND ANALYSIS



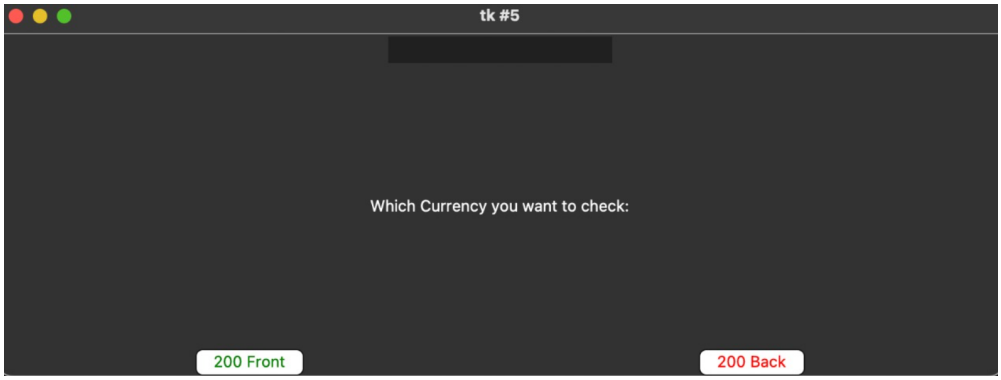

We can start by selecting which currency we want to detect (2000,500,200,100).

After selecting either of the options, we'll be directed to the following:

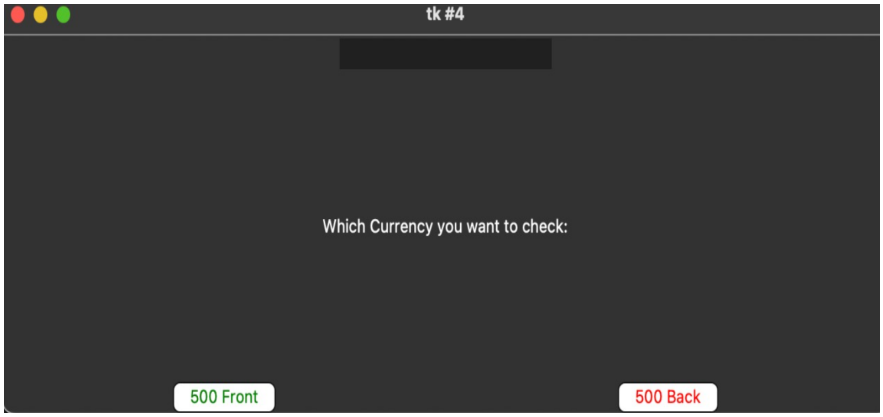
For 100:



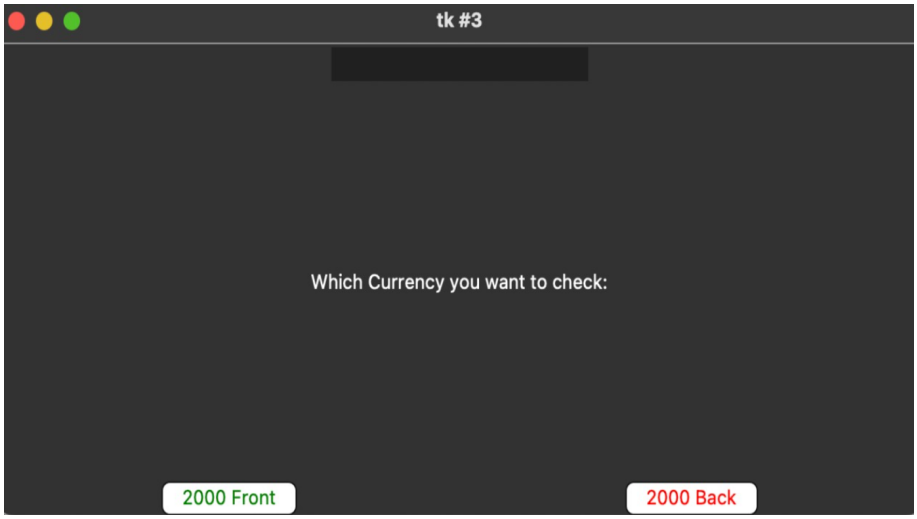

For 200:




For 500:

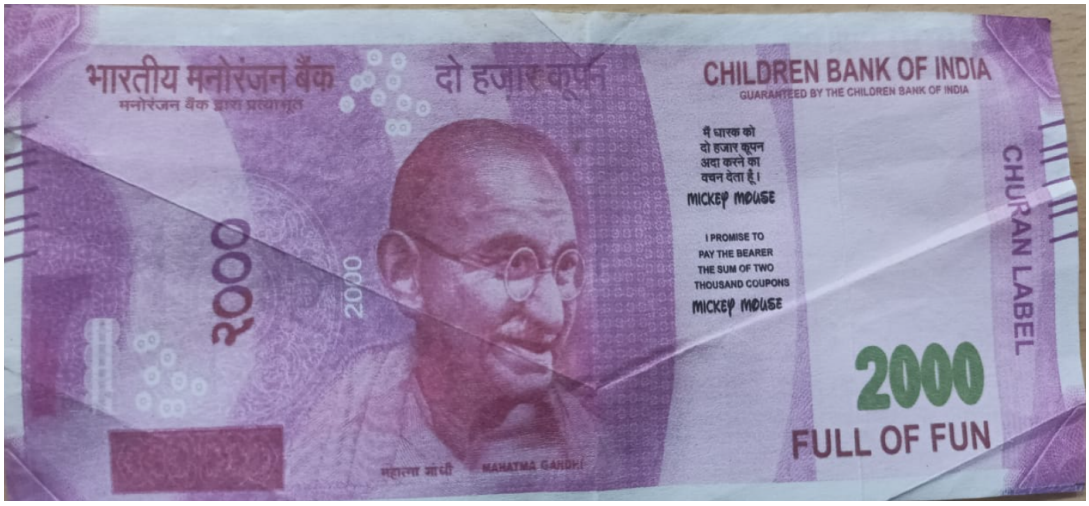



For 2000

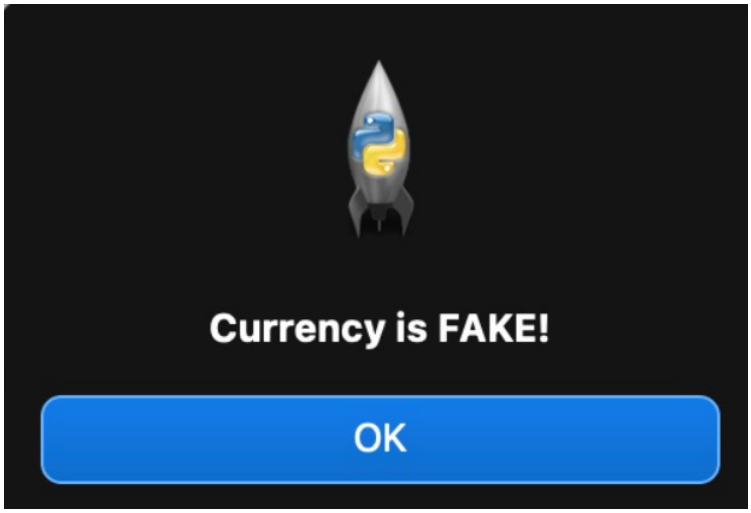


Eg:

If we select 2000 Front and input the following note:




The output will be:



# CONCLUSION AND FUTURE SCOPE

The authentication of Indian banknote currency is described by applying some image processing methods. In primer research, Features are considered and extracted including identification marks, security thread, and the signature of the RBI Governor, from the image of the currency. The process begins with image acquisition and ends with matching methods. Some features are also used to enhance the quality of the edge-detected image for feature extraction and at the same time, it will work only with a limited number of images. The complete methodology works for the Indian denomination 2000, 500, 200, and 100.

In the future, we will consider features and also design a new automatic system for fake currency detection based on deep convolution neural networks based on other parameters.

We will extract features using edge-detected images and apply matching algorithms to determine whether the note is legitimate or not.

At the same time will focus to combine 10,20,50,100,200,500 notes also and will compare them with other CNN architectures based on different kinds of epochs and splits to prove the image authenticity and integrity.

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