USING IMAGE PROCESSING AND KNN TECHNIQUE TO DETECTION FAKE INDIAN BANKNOTES

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ABSTRACT

This research designed an image processing technique and K Nearest Neighbour (KNN) to recognize the fake Indian banknotes. Our designed technique detects notes while the images are poorly oriented, and their sides are inaccurate. Moreover, first, banknotes images are pre-processed to detect whether the given testing banknotes belong to India. Once we learned that these banknotes belong to India, we started classifying the denomination in two ways: (i) OpenCV is being used to Extract textures and colour to create a vector of features and apply KNN classification to classify samples tests on the extracted features, (ii) For classification, we choose KNN for feeding of Indian banknotes images.

For these implementations, we choose python as a programming language. The reason behind choosing python for these implementations is python is becoming a very vast and fast-growing programming language.

I. INTRODUCTION

Money related exchanges are an integral part of our daily life. It is a matter of concern while transacting huge amounts in cash. Subsequently, a smart automated framework for money detection has become necessary nowadays. Image processing and characterization procedures have been used to check in a automatic manner by building a dataset of bank notes and afterwards using classifiers to separate them into predefined classes of the section. The difficulties for this work are - lighting conditions, various elements for the front and back sides, various elements for the newer adaptation of notes, orientation changes.

II. LITERATURE REVIEW

Several different strategies for currency recognition have been suggested in recent works. Kalpna G et al. [1] has used LBP and PCA for currency recognition. The LBP is used for matching purposes, texture analysis, and PCA for training. For metrics combination, the Euclidian distance algorithm is being used to compute simple measures. Uttoran Roy et al. [2] has used image processing and deep learning technique. Feature extraction extracts feature vectors, and samples are classified using KNN. Abburu et al. [5] extracted the Ashoka pillar emblem from Indian currency noted by matching the template and used K-means clustering for extracting colour features. Jyothi et al. [6] used feedforward neural network for classification and extracted intensity of colour mean, texture, colour variance and colour skewness. Gogoi et al. [10] have applied a feedforward neural network to extract dominant colour, unique mark, and aspect ratio as feature extraction. Kamal et al. [11] used central numeral, Ashoka pillar emblem, colour information and ID mark as feature extraction. The technique has been

applied for colour matching Euclidean distance, and for detection of emblems, central number and ID mark template matching have been applied. Principal Component Analysis has been applied by Vishnu et al. [12]. Additionally, he has used central numeral, ID mark, latent image, micro letter, RBI seal for feature extraction. Author Verma et al. [13] in their research have RBI seal, central number, the face of Mahatma Gandhi and extracted feature of texture from them. Support vector machine classification has been applied for classification. Nayak et al. [9] has pruned the face value from the currency notes images and then sent it for classification to the neural network. Dayakshini et al. [4] have drawn out applied segmentation for serial numbers from Indian currency and applied template matching for identification. Author Darade et al. [8] and Rathee et al. [7] have done a similar task for identification. Both have segmented the features like security threads, Id marks, micro lettering, and latent image. After feature extraction, they have compared the test images with the training images for the expected outcome.

We have used the newly Indian currency notes in this research for the dataset.

We have taken 10, 20, 50, 100, 500, 2000 notes as a dataset.

Fig 1: Indian bank notes

III. METHODOLOGY

We have created a dataset by capturing the images of counterfeit and genuine currency with the help of a DSLR camera. After capturing the images, we have resized them in dimension 400X400[3]. As we have used the DSLR camera, the captured images have a DPi of 660. We have implemented wavelet transform in the captured images for feature extraction after resizing. The collected attribute after the implementation of wavelet transform is as follows:

Class of currency

Skewness

Variance

kurtosis

Entropy

The first attribute of the five extracted features implies that the selected notes are fake or genuine, marked as 0 for fake and 1 for genuine. The other four shows the continuous features. We have taken a very small dataset in which 7 are training datasets, and 1 is a testing dataset.

On data analysis, we found the following observations -

We can see that the maximum and mean values of all the extracted features are greatly vary, which states that the captured data is highly assorted. Hence, normalization is needed to avoid overlooking the result just by a single attribute. Additionally, below can be observed after each plotting attribute-

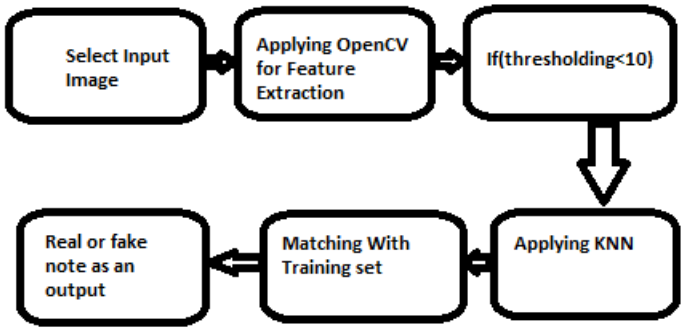
Entropy skewed negatively, which states that the entropy value of data is very high [14]. Another observation is that Kurtosis skewed positively.

Variance and skewness of the attributes are smoothly circulated across the spectrum.

We have used python for the implementation. The command-line interface is being used.
Fundamental methodology points:
Below are the steps for the detection of Indian banknotes detection.

1. Selecting the image from the testing image database.
2. Conversion of the image from RGB to Grayscale at the time of pre-processing.
3. Applying Opencv ORB_create function for the feature extraction of given images.
4. The feature extracted are thresholding, factor, patch size, scale vector.
5. The setting threshold value of 10, if the matches are less than 10, we further proceed to KNN.
6. Using KNN for the classification of matching images.

Splitting Dataset collection into two parts: Training and testing.
The image dataset contains the new Indian banknote images used for training. On the other hand, we have used new Indian banknotes images for recognition. In the proposed approach, we have used OpenCV and KNN for extraction and classification.



IV. RESULTS AND DISCUSSION

The result and discussion process are the most important part of any research. The image of the Command-line based image selector is given below:

1. We have created a python-based list, in which we have hardcoded a few of the images as a training set.
2. Next, we will convert the training image in RGB image to greyscale for feature extraction.
3. Selecting testing image for detection.
4. Extracting threshold of training and testing images.
5. Applying KNN for classification.

Currency recognition: It includes OpenCV and KNN for recognition. After completing this process, it will display the matched currency with a message box with its category, to which category currency belongs. E.g. 10, 20, 50, 100, 500, 2000 (see in figure 2, 3, 4, 5)

V. CONCLUSION

However, a lot of research has been done on currency recognition. There are still many issues we have faced during implementation. We have considered almost all the currency of new Indian banknotes like 10,20,50,100,200,500,2000 and extracted the features. While implementing, below given issues we have faced:

1) The resolution of notes must be high.

2) The currency images size must be the same.

3) With the changes in the features, we should enhance the images.

In this paper, we have used OpenCV and KNN classification algorithms to detect fake new Indian banknotes. It gives an accuracy of around 95%.

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