

A Review On Indian currency recognitionMr. Viranchi N Patel¹, Dr. Udesang K Jaliya², Mr. Keyur N Brahmbhatt³¹Computer engineering, Birla Vishvakarma Mahavidyalaya, Vallabh vidyanagar-388120² Computer engineering, Birla Vishvakarma Mahavidyalaya, Vallabh vidyanagar-388120³Information technology, Birla Vishvakarma Mahavidyalaya, Vallabh vidyanagar-388120

Abstract — Advancement of Technology had been replaced humans in almost every field with machines. By introducing machines banking automation have reduced human workload. More care is required to handle currency is reduced by automation of banking. The identification of the currency value is hard when currency notes are blurry or damaged. Complex designs are included to enhance security of currency. This makes the task of currency recognition very difficult. To correctly recognize a currency it is very significant to choose the good features and suitable algorithm. In this paper literature review of currency identification is explain and also different classification methods and feature extraction techniques is explain.

Keywords- Automatic banking, Feature Extraction, ROI (region of interest), segmentation, classification

I. INTRODUCTION

Currency is the paper notes and coins which is releases for passing around within an economy by the government. It is the medium of switch for services and goods. For transaction Paper currency is an important medium. Characteristics of Paper currency is easiness, strength, cheap and complete control due to this it become popular. Among all other alternative forms of currency the most preferable form of the currency is the paper. There is a one drawback of paper currencies which is that it cannot be reused but compared with the other methods this problem is not that much serious problem. Because of the technological progression entered to the banking sectors financial institution and banking had started financial self-services. By using ATM counter and Coin – dispensers automated banking system is achieved where machines are used to handled currencies. In such situations for the classification of the bank notes the machine will use the currency recognizer. [1]

Currency has two types of features internal and external features. External features include physical aspects of the currency like width and size. But such physical features are not good because notes may damage due to circulation of currencies. Due to this damaged currencies system may fails to recognize currencies. . Internal features include Color feature which is also not reliable because currencies are passed through the various hand due to this it becomes dirty so recognition based on color feature sometimes gives incorrect result. For currencies of each denomination there is a specific color and size followed by Reserve bank of India. [1, 2]

It is a very simple for human to identify the denomination of currency note because our brain is extremely skillful in determining new matters and discovering them later without much trouble. But this currency recognition task turns to very challenging in computer vision, in case of when currencies becomes damaged, old, and faded due to wear and tear. [5]

Security features are included in every Indian Currency which provides help in recognition and identification of the currency value. Various Security features are identification mark (shape), Center value, Ashoka, Latent image, See through register, Security thread, Micro letter, Watermark, RBI seal [8] Security features of 100 rs note is shown in fig.

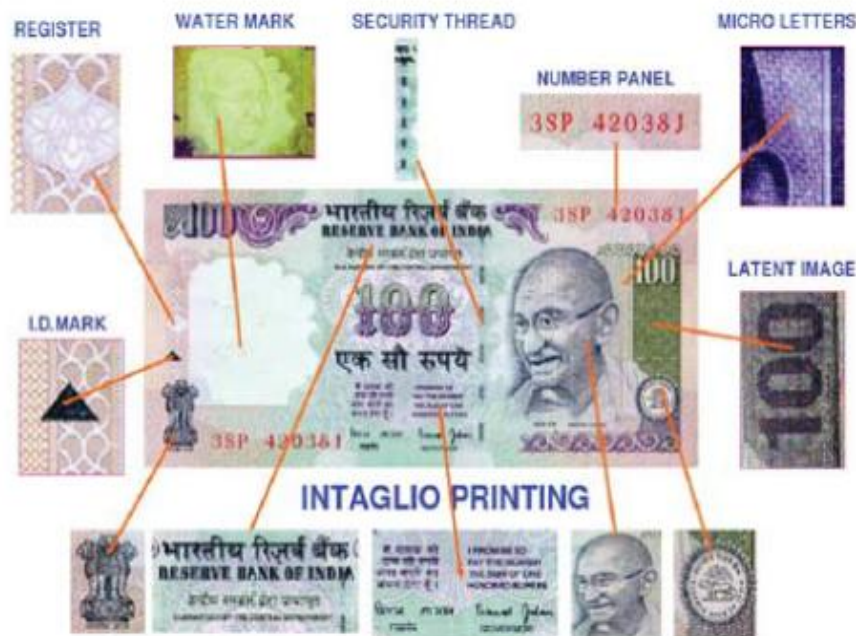


Figure 1. Features of 100rs note [5]

II. LITERATURE REVIEW

MrigankaGogoi, Syed Ejaz Ali, Subra Mukherjee [5] propose a method for currency value classification. They used not only one feature but includes three features which is Aspect Ratio, Color feature and most important the shape feature also known as Identification mark feature. They first extract the color feature from the note. Then they take currency dimension and find the aspect ratio. Next step is portion in which identification mark is present is segmented. Then by using “Fourier Descriptor” they obtain feature, which is the shape of I.D. mark. Once the features are extracted then to classify the shapes apply Artificial Neural Network and on the bases of this classification, values of various Indian Currencies are recognize.

Vishnu R, Bini Omman [1] proposed a method where the system compare the features which are extracted from the given input note by computing the similarity measure between the features of the input note and the template image of the particular feature. Jaccard Similarity Indices is used for calculating similarity measured.

Vishnu R, Bini Omman [2] proposed a method where first by using histogram equalization images are template image normalized. Then they extract features (Shape, Micro Letter, Center, Latent image, RBI seal) by placing a rectangular box of specific dimensions from images of currency which discovers the Region of Interest (ROI). After features extraction PCA (principal component analysis) is apply to each of these features. Finally, the distance between the weight vectors of test image and weight vector of each training images is calculated by applying Mahalanobis distance method. Then the class of test image is the class of training image for which the similarity is found to be high.

Jayant kumar Nayak, Chaitan Majhi, Apurva Kumar Srivastav, Ajaya Kumar Dash [4] proposed method for indian currency recognition they use the region of interest is the region containing the face value of the paper currency note. They find the region of interest and its masking using active contours without edges segmentation by Chan Vese algorithm.

Vishnu R, Bini Omman [3] use PCA (Principal Component Analysis) method [2] and for data Validation WEKA Classifier is used. In this method to generate training model features extracted in training set is loaded. Based on this model classifier decide test feature class. Model classification and generation is done using WEKA. Classification algorithm like Support Vector, Random Forest, and Naive Bayes used for model prediction and generation.

Dr. Ajit Danti, Karthik Nayak [6] extract the shape feature, year and governor declaration from the note. For that they use grid based method and divides the note into number of blocks. Out of all blocks they select only those block which contains shape feature, governor declaration and year respectively. From this block they extract the features and then apply neural network for classification.

Kedar Sawant, Chaitali More [7] proposed method where they extract four features from currency which are color information, aspect ratio, identification mark and latent image. For color feature extraction they used HSV color model, for Identification mark Fourier Descriptor is used, aspect ratio is calculated by dividing height of note with length of the note. Finally for classification Euclidean distance method is used. And then allocate the test sample to that class with the shortest Euclidean distance.

III. METHODOLOGY

A. GENERAL BLOCK DIAGRAM

General block diagram of currency recognition is shown in figure 2,

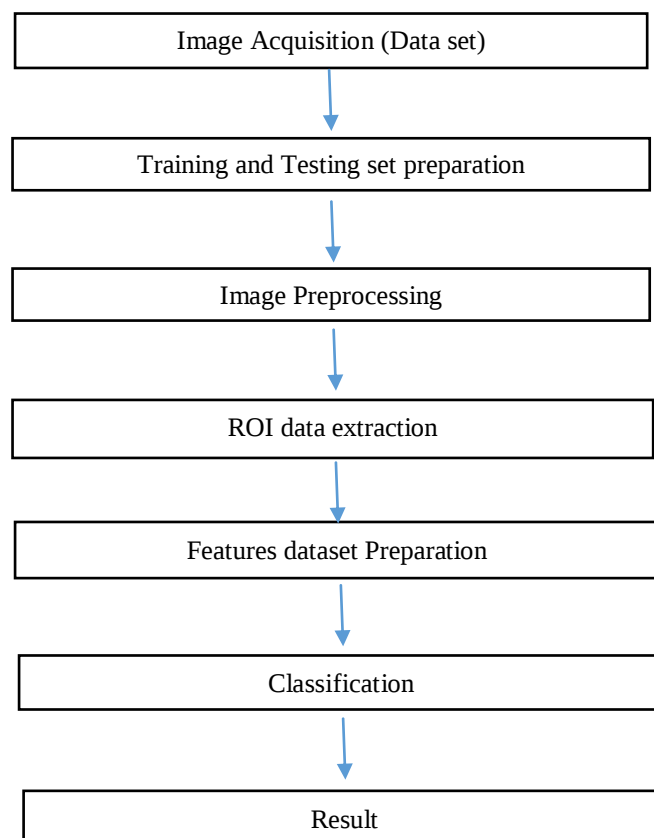


Figure 2.block diagram

B. IMAGE ACQUISITION (DATA SET PREPARATION)

To prepare database of the currency. Notes are scan using a color scanner by setting appropriate resolution. To get currency images in exact size enable auto cropping at the time of scanning the currency. By scanning the currency database are prepared, so there will be a less noise in images so few steps are required for preprocessing [1, 2].

C. REGION OF INTEREST

In all types of currency note at specific location Region of Interest (ROI) are fixed. ROI dimensions of all features are taken and the portion of the note is cropped from images that comes inside the ROI and saved as separate image [1, 2, 3, 4].

D. SEGMENTATION

Grid based segmentation [6], apply 3×3 grid on each side of note and divides the note into number of blocks. Here 3×3 grid is apply on both the side of note so for each side we get 9 block so total 18 blocks we get numbered form 1 to 18.

Chan vese algorithm [4] is used for segmentation of face value. it is a good algorithm to segment image whose foregrounds and backgrounds are statically different. This method fits two phase piecewise model to the given image.

E. FEATURE EXTRACTION

ASPECT RATIO

Each Indian currency is different in dimension so aspect ratio is consider as a feature but due to wear and tear sometimes original size of the note is reduce so threshold value is considered for aspect ratio.[5,7]

$$\text{Aspect ratio} = \frac{\text{height of note}}{\text{length of note}} \quad (1)$$

I.D. MARK EXTRACTION

For extraction of I.D. mark Fourier Descriptor is used. Good representation and good normalization both allows by Fourier Descriptors. For a shape signature $S(t)$, $t = 0, 1, 2, \dots, L$. In the sampling stage assuming that its normalized to N points [5, 7], the Discrete Fourier Transform of $S(t)$ is express by,

$$U_n = \frac{1}{N} \sum_{t=0}^{N-1} S(t) \exp\left(\frac{-j2\pi nt}{N}\right), n = 0, 1, 2, \dots, N-1 \quad (2)$$

The coefficients n and U_n are normally called Fourier Descriptors (FD) of the shape.

COLOR EXTRACTION

RGB COLOR MODEL

RGB color model [5, 7] is used to find out the dominant color from Indian currency. In this model each color looks with its principal spectral elements of RED, GREEN and BLUE. This model is represented using Cartesian co-ordinate system. RGB color space is shown in figure as a cube. The origin of RGB space represents black while the opposite corner represents white. For simplicity make assumption that all the colors vectors are standardized so the cube in figure is a unit cube. Each pixel is a linear combination of three dimensional base vectors, which are RED, GREEN and BLUE.

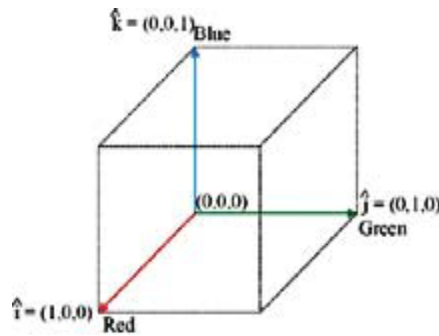


Figure 3.RGB color model

F. CLASSIFICATION

Different classification methods are,

JACCARD SIMILARITY INDICES

To find out the similarity between two vectors following equation is used [1],

$$J(C,D) = \frac{|C \cap D|}{|C \cup D|} \quad (3)$$

Where C is a feature vector of input currency and D is a feature vector of template.

MAHALANOBIS DISTANCE

Mahalanobis distance [2] is used to determine input currency class. In this method distance between weight vector of input images Ω_{in} and sample weight vector Ω is calculated. Equation is given by,

$$dm(\Omega_{in}, \Omega_i) = \sqrt{\sum_{j=1}^K \frac{(\Omega_{in_j} - \Omega_{i_j})^2}{\lambda_j}} \quad (4)$$

Where, $\forall i = 1, 2, \dots, M$

NEURAL NETWORK

The neural network [4] consists of three layers which are input layer, output layer and hidden layer. Backpropagation (BP) algorithm for artificial neural network is used for recognition of 6 classes of currency.

RANDOM FOREST (RF)

In Random forest classifier several individual tree are use which merge together to form a forest. At each node by using random selection of attributes the individual trees are generated to find the split. Each tree depends on value of random vector sampled independently and with the same distribution of all tree in the forest. By growing the tree ensembles random forest accuracy is obtained. Each tree votes at the time of classification and the most popular class is returned. For random vector generation two methods are used Bagging and random split selection. Due to large numbers of instances it does not over fit [3].

SUPPORT VECTOR MACHINE (SVM)

Support Vector Machine [3] is a supervised learning algorithm. It is used for both regression and classification. To find the hyper plane which differentiate the training data that relies on two dissimilar classes is main concept of SVM. By using nonlinear mapping SVM transform training data into a higher dimension. To separate the data into two class SVM finds an optimal hyper plane. Maximum margin between vectors of two class is called optimal hyper-plane.

IV. CONCLUSION

This paper shows generalize block diagram of any currency recognition system and also describe different methods that can be used for segmentation, feature extraction. It also describe different classification techniques used for classification of currency notes.

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