Research on Fake Indian Currency Note Detection using Image Processing

Miss.I. Santhiya Irulappasamy

Student
Department of Computer Applications,
The Standard Fireworks Rajaratnam College for women, Sivakasi, India

Abstract: **In India day to day transactions are increasing over the past few years, which give the way of increasing currency transactions in day to day life. In advantage of that the fake currency of Rs 50,100,500,1000 is been produced, but after the demonetization the counterfeit notes of new Rs 50,200,500,2000 is increased a lot which in time effects the economic growth of the country. Here in this paper how to detect the fake Indian paper currency and which type of rupees, is worked and explained with the use of image processing technique. Using algorithms Structure Similarity Index Metric (SSIM), Adaptive histogram equalization, Fast Discrete Wavelet Transform (FDWT) and Gray Level Co-occurrence Matrix (GLCM). SSIM is a method used to find the currency is real/fake. Other FDWT, GLCM and Artificial Neural Network (ANN) to detect currency value of that note.**

Keywords: **Currency, Value, Edges, Fake, Real**

I. Introduction

Reserve bank of India (RBI) has a sole has right to issue currency notes in India. Every year RBI faces the problem of counterfeit currency. The problem of increasing fake currency in India is a serious issue which has to be take care of. In recent years there has been a considerable increase in quantity of fake Indian rupees notes. Counterfeit is a fake currency it has not authorized by the government. In this paper detecting fake currency and value was categorize into 5 modules including image acquisition, currency verification, feature selection, extraction and machine learning. Using algorithms Structure Similarity Index Metric (SSIM), Adaptive histogram equalization, Fast Discrete Wavelet Transform and Gray Level Co-occurrence matrix (GLCM). These algorithms used to find the currency is real/fake and detect currency value.

II. Literature Review

Vipin Kumar Jain [2019] have proposed a paper **Recognition of Fake currency detection** done by image processing technique. This paper based on Fake Currency Identification by Android Mobile Phone Using Digital Image Processing. This is convenient use of Hand-Written Character Feature Extraction, the cell phone gadget is utilized to capture image, it is accessible wherever the image captured by android cell phone live in type of video and it is spared there, again it is changed over in gray scale design, binaries image and some morphological task performed on it, finally we found block of each character from complete images.

Amol A. Shirsat, S.D. Bharkat [2013] have proposed a **Paper Currency Recognition System**. This system mainly consists of three parts. The image of interest is first processed and extracting the feature by applying toolbox MATLAB. The second part is currency recognition where classifier such as neural network is used. And finally, the result is displayed on pc.

S. S. Veling, Miss. Janhavi P. Sawal, Miss. Siddhi [2019] have proposed a paper **Fake Indian Currency Recognition System** by using MATLAB proposed work is to propose a currency note recognition system under hyperspectral imaging mode with different lights under different wavelengths and the comparison of features by using image processing algorithms.

Prof. Madhav Thigale, Lina Ladhane [2017] have proposed a paper **Note to Coin converter using Digital Image Processing.** A user will place the note and then with the help of image processing the Indian currency note will be identified. We are using MATLAB algorithm for detection of the value of note and we have implemented a fake note detection unit using UV LED and photodiode.

Deborah. Soniya Prathap [2014] have proposed a paper **Detection of Fake currency** using Image Processing. Choose the image and apply preprocessing. In pre-processing the image to be crop, smooth and adjust. Convert the image into gray color. After conversion apply the image segmentation. The features are extracting and reduce. Finally compare the image into original or forgery

III. Proposed work

This paper proposes a system that can classify and subsequently verify Indian paper currency using fundamental image processing techniques. It uses the comparison between the input banknote and the calculated reference values for different parameters of original banknotes in a similar environment. In this project, SSIM is a method finding the relationship between the input image and reference image are compare and make the value, value depends on the how much input image will be matching to the reference image is present in recognition technology. Three modules like feature selection, extraction, and classification using machine learning algorithm Artificial Neural Network those are used to detect currency value.

A) Methodology

1) Image Acquisition

Performing image procurement in image processing is based the initial phase in the work process succession in light of the fact that, without an image, no processing is possible. There are different approaches to obtain image, this system uses loaded an image in a specific folder.

2) Currency Verification

This module tells the input currency is real/fake using Structure Similarity Index Method (SSIM). This method finding the relationship between the input image and reference image are compare and make the value, value depends on the how much input image will be matching to the reference image is present in recognition technology. Then the value compares with given threshold value, test experience value less than the threshold it produces the result the "given input currency is fake" otherwise it is "original currency".

SSIM working Process:

The Structural Similarity Index (SSIM) metric extracts 3 key *features* from an image:

- Luminance
- Contrast
- Structure

The comparison between the two images is performed on the basis of these 3 features.

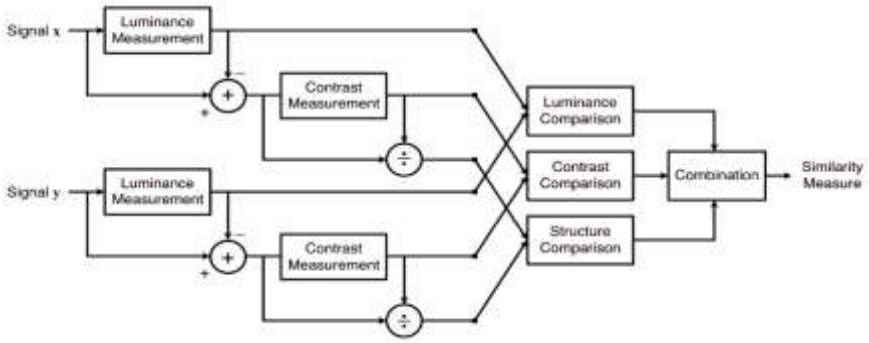

Fig.1 In the figure.1 shows the arrangement and flow of the Structural Similarity Measurement system. *Signal X* and *Signal Y* refer to the Reference and Sample Images.

3) Feature selection

Using Adaptive Histogram Equalization Technique to enhance the given image. This module selects the specific features from an enhance image. For e.g., edges, boundaries, contour from image using Fast Discrete Wavelet Transform (FDWT) under Curvelet co-efficient algorithm. This is mainly dividing the image into 9 parts with the help of a pixel. Some of them are edges, colour, and boundaries. The 9 parts are understable only for machine. Pass 9parts of the feature selection to next step of a feature extraction.

FDWT Working Process:

Fast Discrete wavelet transform (FDWT) is a spectral evaluation approach used for studying non-desk bound information, and affords time-frequency representation of these information. Since facts contains non-desk bound traits, FDWT have been extensively used for studying facts. FDWT uses long term home windows at low frequencies and quick time windows at high frequencies, main to good time–frequency localization. FDWT decomposes a sign into a set of sub-bands through consecutive excessive-bypass and coffee-pass filtering of the time domain. The high-skip filter out, g is the discrete mom wavelet at the same time as the low-pass filter, h is its replicate model. The down sampled alerts through first filters are referred to as first stage approximation, A1 and detail coefficients, D1. Then, approximation and detail coefficients of next stage are received through the usage of the approximation coefficient of the previous degree. The wide variety of decomposition ranges is decided depending at the dominant frequency components of the statistics. Scaling feature, /j, k(x) based on low skip filter and wavelet feature, wj, ok(x) based totally on high skip filter.

A numerical analysis and functional analysis, a **Fast-discrete wavelet transform (FDWT)** is any wavelet transform for which the wavelets are discretely sampled. As with other wavelet transforms, a key advantage it has over Fourier transforms is temporal resolution it captures both frequency and location information (location in time). The Haar wavelet transform may be considered to pair up input values, storing the difference and passing the sum. This process is repeated recursively, pairing up the sums to prove the next scale, which leads to differences and a final sum.

4) Feature Extraction

This module extracts the features from a feature selection method using Grey Level Co-occurrence Matrix (GLCM). This algorithm calculated the selected features by calling some of the methods are Energy, Correlation, Contrast, and Homogeneity. This method works some of the mathematical operations with the selected features represented a matrix, finally produces a one value, that is GLCM value. Passing the GLCM value to the neural network.

GLCM Working Process:

Also referred as **co-occurrence distribution.** It is the most classical second-order statistical method for texture analysis. An image is composed of **pixels** each with an intensity (a specific gray level), the GLCM is a tabulation of how often different combinations of gray levels co-occur in an image or image section.

Texture feature calculations use the contents of the GLCM to give a measure of the variation in intensity at the pixel of interest. GLCM texture feature operator produces a **virtual variable** which represents a specified texture calculation on a single beam echogram. Define each element i, j of the GLCM of sample present in set W, as the number of times two samples of intensities i and j occur in specified **Spatial relationship**.

The sum of all the elements i, j of the GLCM will be the total number of times the specified spatial relationship occurs in W.

- Make the GLCM symmetric:
- Make a transposed copy of the GLCM.
- Add this copy to the GLCM itself.
- This produces a symmetric matrix in which the relationship i to j is indistinguishable for the relationship j to i.
- Due to summation of all the elements i, j of the GLCM will now be twice the total number of times the specified spatial relationship occurs in W.
- Normalize the GLCM:
- Divide each element by the sum of all elements.
- The elements of the GLCM may now be considered probabilities of finding the relationship *i, j (or j, i)* in W.
- Calculate the selected ***Feature***. This calculation uses only the values in the GLCM. For e.g.,
- Energy,
- Entropy,
- Contrast,
- Homogeneity,
- Correlation,
- The sample s in the resulting virtual variable is replaced by the value of this calculated feature.

5) Machine Learning

This module defines the classification occur in the image using Artificial Neural Network. When ANN call trained a particular image and produces a specific value, it is considered as a training experience value. After that with the help of GLCM test experience value this system predict the currency value. For e.g.,50 Rupees,100 Rupees.

ANN Working Process:

An ANN is based on a collection of connected units or nodes called artificial neurons, which loosely model the neurons in a biological brain. Each connection, like the synapses in a biological brain, can transmit a signal to other neurons. An artificial neuron that receives a signal then processes it and can signal neurons connected to it. The **signal** at a connection is a real number, and the output of each neuron is computed by some non-linear function of the sum of its inputs. The connections are called *edges*. Neurons and edges typically have a *weight* that adjusts as learning proceeds. Neural networks learn (or are trained) by processing examples, each of which contains a known **input** and **result**, forming probability-weighted associations between the two, which are stored within the data structure of the net itself. The training of a neural network from a given example is usually conducted by determining the difference between the processed output of the network (often a prediction) and a target output. This is the error. The network then adjusts its weighted associations according to a learning rule and using this error value. Successive adjustments will cause the neural network to produce output which is increasingly similar to the target output. After a sufficient number of these adjustments the training can be terminated based upon certain criteria. This is known as **supervised learning**.

IV. Process Flow

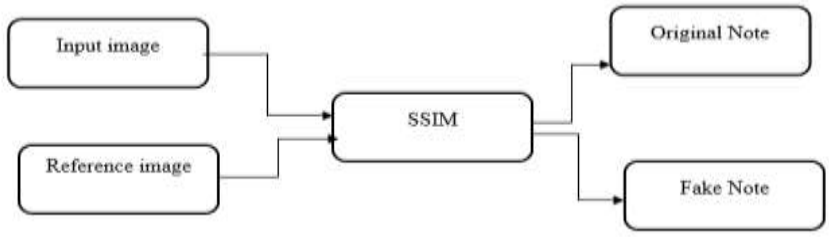

Fig.2 In the Figure.2 shows the flow to detect the currency is real/fake.

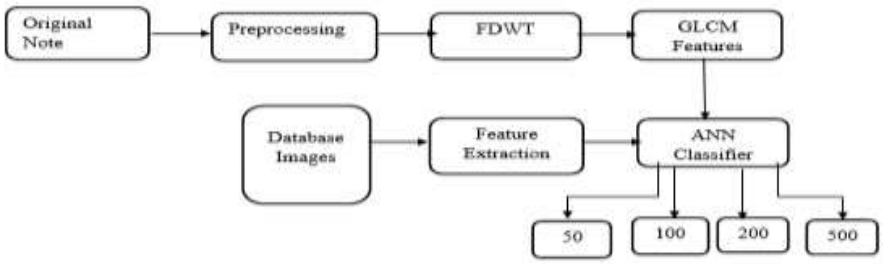

Fig.3 In the figure.3 shows the flow of algorithm.

V. Advantages

- The application will prove very beneficial to detect fake currency.
- The application is a user friendly and easily accessible.
- It will save time, reduce the effort of the user.

VI. Conclusion

In the project we are identifying the original rupees and fake rupees using structural similarity index method after that if the user given original image mean which types of rupees using feature selection algorithm FDWT and Feature Extraction algorithm GLCM and machine learning algorithm ANN are used to find which classification is occur in the image using image processing with machine learning algorithm.

References:

[1] Dr. Vipin Kumar Jain "Fake currency detection" S.S. Jain Subodh P.G. College, Volume 10, Issue-II June 2019.
[2] Amol A. Shirsat, S.D. Bharkat "Paper currency recognition system" Government College of Engineering, Volume 10, Issue-I April 2013.
[3] S. S. Veling, Miss. Janhavi P. Sawal, Miss. Siddhi "Fake Indian currency recognition using MATLAB" Shrikshan Prasarak Mandal's College of Engineering. Volume 7, Issue IV April 2019.
[4] Prof. Madhav Thigale, Lina Ladhane "Note to coin converter using digital image processing" Dr. D. Y. Patil Institute of Engineering Management and Research, Volume 4, Issue III March 2017.
[5] Zhou Wang, Alan C. Bovik "Image quality assessment: from error visibility to structural similarity" IEEE Transactions on Image Processing, Volume 13, Issue IV April 2004.
[6] Vedasamhitha Abburu, Soumya Gupta, "Currency recognition system using image processing" National Institute of Technology, August 2017.