Currency Detection Using OpenCv

J Sreedevi[1],Bachanaboina Rajashekhar[2]
[1, 2] Dept of Computer Science Engineering
[1, 2] Mahatma Gandhi Institute of Technology, Hyderabad,India

Abstract- *The determination of currency denomination is an issue in paper currency recognition systems. This paper proposes a robust method to recognize the paper currency using the pattern matching. In the proposed algorithm a similarity measure is used to classify the currency based on the similarity of the extracted features.Feature Extraction can be done in convolution layer which is present in Convolutional Neural Network (CNN).Here we have used VGG16 model which is present in keras.To evaluate the performance of the proposed method experiments were conducted over nearly 15 Currencies of different denominations like 10 rupees old and new,20 rupees old and new,50 rupees old and new,100 rupees old and new,200 rupees note,500 rupees note,2000 rupees note. On performing the experiment, the proposed method gives 97% accuracy.*

Keywords- convolutional neural network (CNN),VGG16 model,paper currency,convolution layer.

I. INTRODUCTION

Technology is growing very fast these days. Consequently, the banking sector is also getting modern day by day. This brings a deep need for automatic fake currency detection in automatic teller machines and automatic goods seller machines. Many researchers have been encouraged to develop robust and efficient automatic currency detection machines. Automatic machines which can detect banknotes are now widely used in dispensers of modern products like candies, soft drinks bottles to bus or railway tickets. The technology of currency recognition basically aims for identifying and extracting visible and invisible features of currency notes. Until now, many techniques have been proposed to identify the currency note. But the best way is to use the visible features of the note. For example, colour and size. But this way is not helpful if the note is dirty or torn. If a note is dirty, its colour characteristic is changed widely. So, it is important that we extract the features of the image of the currency note and apply proper algorithms to improve accuracy to recognize the note [7].

PROBLEM DEFINITION

VGG16 model in keras with Transfer learning and Fine Tuning is used as a model and Convolutional Neural Network algorithm is used for image processing. Discrete Wavelet Transform is applied on each currency note for Time-Frequency resolution.

EXISTING SYSTEM

The existing system here works on the image of currency notes under ultraviolet light acquired by a digital camera. The algorithm which is applied here is as follows 1. Acquisition of image of currency note under ultraviolet light by simple digital camera or scanner. 2. Image acquired is RGB image and now is converted to grayscale image. 3. Edge detection of the whole gray scale image. 4. Now characteristics features of the paper currency will be cropped and segmented. 5. After segmentation, characteristics of currency notes are extracted. 6. Intensity of each feature is calculated. 7. If the condition is satisfied, then the currency note is detected.

PROPOSED SYSTEM

In the proposed system, Deep learning is used with the help of Keras, containing several models. Among those models,VGG16 Model is used with Transfer learning and Fine Tuning. First take the input of the given image and preprocess the given image and convert the RGB image into the grey scale image. The extracted features can be used for recognition, classification and retrieval of currency notes.

II. LITERATURE SURVEY

In this study, the Automatic Fake Currency Recognition System (AFCRS) is designed to detect the counterfeit paper currency note to check whether it is fake or original. The existing counterfeit problem due to demonetization, which affected the banking system and also the other fields. A new approach of Convolution Neural Network towards identification of fake currency notes with their images is examined in this paper which is comparatively better than previous image processing techniques. This method is based on Deep Learning, which has seen tremendous success in image classification tasks in recent times. Deep Learning techniques can help both the people and machines in identifying a fake currency note in real time through an image of the same. The proposed system, AFCRS

can also be deployed as an application in the smartphone which can help the society to distinguish between the fake and original currency note. The Accuracy in the proposed system can be increased through the original fake notes, whereas the proposed system contains the images from children's bank churan label [1].

Fake currency notes are increasing day by day, in order to overcome this we propose a very helpful and efficient system to detect the fake currency. Detecting the fake currency note is done by counting the number of interruptions in the thread line. In order to detect whether the note is real or fake on the basis of the number of interruptions. If the number of interruptions is zero(0), if it is a real note, otherwise it is fake. And for the efficient detection of fake currency notes, we also calculate the entropy of the currency notes. To detect the fake currency note MATLAB software is used [2].

The growth in the number of fake currency notes in the system has been tremendous over the past few years. The counterfeiters have kept on developing new ways to get as close to the real paper currency as possible. This puts the common masses in grave danger of being robbed of their hard-earned money. To overcome this issue, various researchers have tried to come up with different procedures to detect fake notes. In this study, we will try to understand some of the techniques that are based on image processing and perform a comparative study of the same [3].

In the present scenario, the Indian government has announced the demonetization of all Rs 500 and Rs 1000. Indian government has introduced a new Rs 500 and Rs 2000, to reduce illegal activity in India. Even fake or bogus currency of new currency notes are circulating in the society. The main objective of this work is to identify fake currencies among the real. In the currency, the strip lines or continuous lines are detected from real and fake notes by using edge detection techniques. HSV techniques are used to saturate the value of an input image to enhance reliability and dynamic way in detecting counterfeit currency [4].

Advancement of technology over the recent past has led to an increase in circulation of counterfeit notes in today's economy. To encounter this issue, it is essential that there exists an efficient mechanism to detect fake currency notes. The main problem with current systems is the trade-off between speed and complexity. This project proposes a system that can classify and subsequently verify Indian paper currency using fundamental image processing techniques. It uses the comparison between the input currency note and the calculated reference values for different parameters of original currency notes in a similar environment. This system maintains its simplicity while having high accuracy of 100% for classification and 90% for validity verification [5].

In this study, the automatic system is designed for identification of Indian currency notes and checking whether it is original or fake. In banking systems and other fields this automatic system is very useful. The counterfeit currency notes of 100, 500 and 1000 rupees is high in India. As the technology increases in scanning, colour printing and duplicating, The counterfeit problem is also increasing. In this study, by using image processing techniques fake Indian currency notes can be detected [6].

III. DESIGN AND METHODOLOGY OF CURRENCY DETETION USING OPENCV

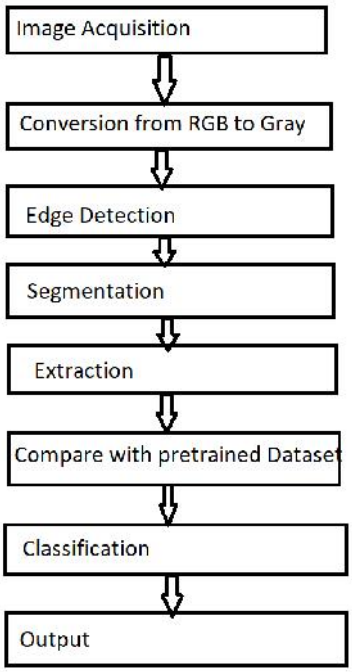

Fig 1 Block Diagram of Currency Detection using openCV

from the above fig 1 we can know the steps how it will execute. At first it will take an image from the camera as input. This image can be converted into Gray scale image for the sake of fast processing. Next edge can be detected for the sake of the object(currency Note)presentation. After this the object can be divided into multiple segments or blocks. For example 500,RESERVE BANK OF INDIA, Red Fort etc. These are the features mainly used to detect currency. and find the distances between these features of the input image to the total images of the dataset, for whatever the currency we are getting minimum distance based on that it will classify and give that as an output.

CONVOLUTIONAL NEURAL NETWORK WITH VGG16 MODEL

VGG16 (also called OxfordNet) is a convolutional neural network architecture named after the Visual Geometry Group from Oxford, who developed it. It was used to win the ILSVRC2014 (Large Scale Visual Recognition Challenge 2014)) competition in 2014. VGG-16 is a convolutional neural network that is 16 layers deep. The model loads a set of weights pre-trained on ImageNet. The model achieves 92.7% top-5 test accuracy in ImageNet, which is a dataset of over 14 million images belonging to 1000 classes. The default input size for the VGG16 model is 224 x 224 pixels with 3 channels for RGB image. It has convolution layers of 3x3 filter with a stride 1 and maxpool layer of 2x2 filter of stride 2.

ARCHITECTURE OF VGG16

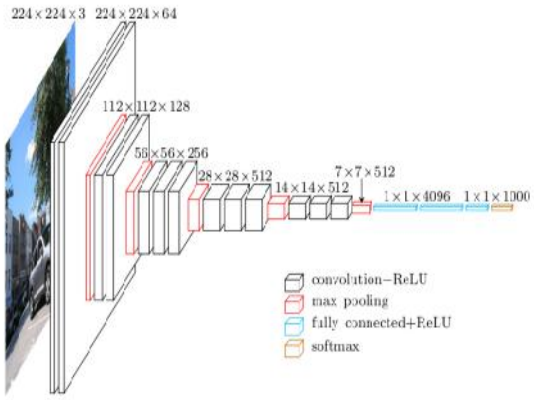

Fig 2 Architecture of VGG16 Model

The above fig 2 shows the vgg16 model architecture which consists of 16 layers. This consists of 4 parts as shown in Fig 2. Those are Convolution +ReLu layer, Max pooling, Fully connected+ReLu and Softmax layers.

Image Classification Algorithms Used In This Study

Brute Force Classification

The descriptor of one feature in the first set is matched with all other features in the second set using a distance calculation and the closest one is returned as the most matched one. Here the input image is compared with each and every image in the dataset for whatever the image is getting lesser distance that will classify and give as a result. Here we have used Manhattan distance for calculating the distance.

Convolutional Neural Network

In neural networks, Convolutional Neural Network (ConvNets or CNNs) is one of the main categories to do image recognition, image classifications, objects detection, face recognition etc. CNN image classifications take an input image, process it and classify it under certain categories. Computer sees an input image as an array of pixels and it depends on the image resolution. Based on the image resolution, it will see h x w x d (h = Height, w = Width, d = Dimension). Technically, deep learning CNN models to train and test each input image will pass it through a series of convolution layers with filters, pooling fully connected layers and applying activation function to classify an object with probabilistic values between 0 and 1.

Convolution layer

Convolution is the first layer to extract features from an input image. Convolution preserves the relationship between pixels by learning image features using small squares of input data. It is a mathematical operation that takes two inputs such as image matrix and a filter or kernel. Convolution of an image with different filters can perform operations such as edge detection, blur and sharpen by applying filters.

Padding

To fit the input image, two options are available as follows:

Pad the picture with zeros (zero-padding) .Drop the part of the image where the filter did not fit. This is called valid padding which keeps only valid parts of the image.

ReLU

ReLU stands for Rectified Linear Unit for a non-linear operation. The output is $f(x) = \max(0,x)$. ReLU's purpose is to introduce non-linearity in our ConvNet. Since, the real world data we would want our ConvNet to learn would be non-negative linear values .There are other nonlinear functions such as tanh or sigmoid can also be used instead of ReLU. Most of the data scientists use ReLU since performance wise ReLU is better than the other two.

Pooling layer

Pooling layers are used to reduce the dimensions of the feature maps. Thus, it reduces the number of parameters to learn and the amount of computation performed in the network. The pooling layer summarises the features present in a region of the feature map generated by a convolution layer. So, further operations are performed on summarised features instead of precisely positioned features generated by the

convolution layer. This makes the model more robust to variations in the position of the features in the input image. This can also be used as a feature extractor.

Types of Pooling Layers

Max Pooling

Max pooling is a pooling operation that selects the maximum element from the region of the feature map covered by the filter. Thus, the output after max-pooling layer would be a feature map containing the most prominent features of the previous feature map.

Average Pooling

Average pooling computes the average of the elements present in the region of the feature map covered by the filter. Thus, while max pooling gives the most prominent feature in a particular patch of the feature map, average pooling gives the average of features present in a patch.

IMPLEMENTATION

The system is divided into two parts. The first part is to identify the currency denomination through image processing. The second part is the oral output to notify the visually impaired person about the denomination of the note that he/she is currently having.

The development of this is based on a webcam. The real time bank notes are captured and processed through different image processing techniques like edge detection, segmentation, and feature extraction and classification.Here a processor which processes the image of the currency note captured by the web camera. The controlling code for the web camera is written and stored in the processor.

IV. RESULTS FOR CURRENCY DETECTION USING OPENCV

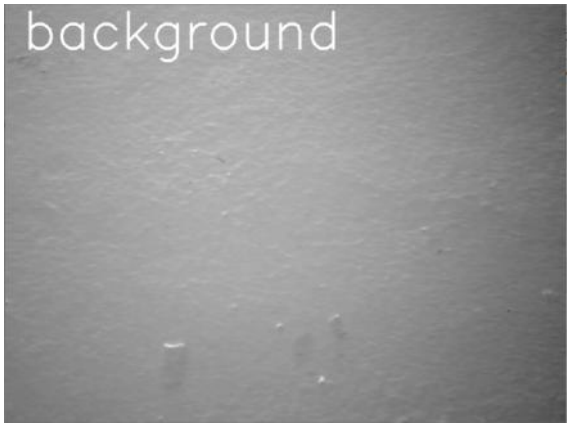

Fig 3 Background as result

In the above fig 3 there is no currency ,so it detected as background.

Fig 4 Fivehundred as result

In the above fig 4 we showed five hundred to the camera so it detected it as five hundred.

Fig 5 Fifty as result

In the above fig 5 we showed fifty rupee note to the camera and it detected as fifty.

Fig 6 Ten as result

In the above fig 4.4 we showed ten rupee note to the camera and it was detected as ten.

V. CONCLUSION AND FUTURE SCOPE

CONCLUSION

By developing this model we are now easily detecting the currency denomination by using the wavelet transform analysis as well as Keras VGG16 model. At first it will take the image from the camera and that image can be processed by using image processing techniques with the help of Convolutional Neural Network and classifying that giving that as output. For detection we are extracting some features. These features are extracted with the help of Pooling. Compare after these extracted features compare input image features with the dataset and classify based on the minimal distance. That minimal distance note is given as output here.

FUTURE SCOPE

Future scope could be to work with any note clicked with any orientation and to extend it to detecting currency denominations of other countries. The present work is used only for identification of banknotes. However, the successful experimental results demonstrate the ease of extension of the method to coins as well. Future work aims at porting the method to smartphones to develop a robust application for banknote recognition.

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