Fake Currency Detection using Deep Learning Technique

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***Abstract*: Gigantic automation expansion in publish and inspect manufactory build inauthentic complication to promote dynamically as a outcome inauthentic legal tender affects tied in husbandry along with diminish the profit of aboriginal money ergo it is and essential concerning ascertain the artificial legal tender most of the erstwhile methods are established as for accouterments and resemblance computing approach observation inauthentic legal tender with these methods is inferior efficacious also time ingest to conquer the raised complication we have bounce the discernment of inauthentic legal tender applying abound less complexity nervous chain our work recognize the artificial legal tender by inspect the legal tender appearance the communicate educated complexity nervous chain is competent with two thousand five hundred two hundred and fifty Indian currency note data sets to learn the feature map of the currencies once the feature map is learnt the network is ready for identifying the fake currency in real time the proposed approach efficiently identifies the forgery currencies of 2000500200 and 50 with less time consumption keywords convolutional neural network currency detection deep learning feature extraction image processing**

INTRODUCTION

Counterfeiting refers to an illegal copy of the currency of origin. Therefore, counterfeit currency is not approved by the government. RBI is the only body responsible for printing banknotes in India. Every year, the RBI has to deal with the problem of counterfeit banknotes once filtered and placed on the market. Currently with the development of better image processing methods, new methods for identification of currency is designed by analysing specific safety information present in the currency. The safety features are watermarks, hidden images, security threads, and optically variable inks. Therefore, to determine the currency using image processing, extract the specific statistics from the currency image and select the correct recognition approach. The main methods for currency recognition is by characteristic geometric size [1] and by characteristic texture [2]. The general steps followed by image processing approach is to acquire image, to detect edge, to convert image to gray scale, feature extraction, image segmentation and decision making [3-4]. The drawback of these approaches are detection efficiency is less since feature extraction is a challenging task. To overcome this problem now the trend is towards deep learning, since it is a multilayer neural network. The deep neural network is effective for different application in real time.

In general, to form a deep neural network, we need a large set of image data for the activity to be done. But thanks to transfer learning technique, we only need a small amount of data sets. What we do is take a model already trained in a large data set and use our weights to reconstruct the small data set we have. In this way, a large data set is not necessary and the model is also designed correctly. Hence in this paper transferred learned Alex net is used by fine tuning the last layer of this model to get the desired accuracy.

II. BACKGROUND STUDY (LITERATURE)

in every proposed system developed using various algorithms has their own disadvantages one of the most effective methods of counteracting counterfeiting can be to use easily accessible and effective software to detect counterfeit currency database under training set is trained using these algorithms a method for determining the currency in real time for classifying the currency is proposed the currency of image acquisition is based on currency discovery when the size of various denominations is obtained and the features are extracted it gives the information to kohonens training network this scheme is good with high speed and recognition accuracy in support vector machine based currency recognition is presented it segments our currency into various regions with our own core linear weighing through various forms of basic training matrices and is studied using semi-defined programming are used to obtain ideal weights use of rgb and hsv shade astral model in the image processing helps in legal tender detection with new 500 and 2000 notes it can be detected faster by making samples of these banknotes this system used for automatic legal tender recognition based on resemblance processing the legal tender resemblance is speak for in the space of differences therefore is a angle astral composed by contrast the resemblance and a series of prototypes each measurement measures the dissimilarity in the middle of the resemblance in question with the prototype to distinguish between two images the local key points of each resemblance are identified and described based on legal tender characteristics it is possible to effectively identify the relevant key points between two resemblance due to the limited number of real-life counterfeit currencies svm is used to detect counterfeit currencies so only authentic currencies are required for authentication and to train classifier 10 in recent years counterfeiting using neural network is good at detection in 11 it was found that the functions were passed through direct feed forward neural network fnn and is therefore used for legal tender recognition as well as verification to detect it uses the color information mined from currency but it leads to high risk of error and also makes the empirical consequence to be less accurate an approach additionally back propagation network and principal component analysis when used for feature extraction the approach is successful with an additional investigation 12 in convolutional based neural network when the number of layers are more then complexity is also more 13 but convolution neural network is robust and detection speed is faster 14 in 15 the problem of stochastic gradient slope sgd is been explored and points out due to sgd tilt the previous set of random parameters drops sharply then it

may affect the overall performance of the detection process hence in our presented method we have used convolutional neural network with adam optimization to detect fake legal tender note

III. METHODOLOGY

In this proposed system, our relevance is to focus on detection of fake currencies which is spread in Indian market. In our work fake currency is identified by extracting the security thread feature in the currency note. For detecting the fake currency, the most popular method in deep neural network called transfer learning using Alex net is adopted. Alex net consists of convolutions, max pooling, dropout, ReLU activations and fully-connected layers. The layers are as displayed in below figure 1. In transfer learning the last three layers are fine tuned to accommodate the requirement of our proposed work. The 'fc8' layer is tuned with a weight learning factor and bias learning factor for accurately extracting the latent feature from the image. The weight gives the impact of the input on the network and bias is used to adjust the output with weighted sum of inputs to the neuron. The accuracy of learning feature grows with the weight and bias learning factor, record is given as information. After the effective finishing of activity the outcome is anticipated and shown.

1	'data'	Image Input	227x227x3 images with 'zerocenter' normalization
2	'conv1'	Convolution	96 11x11x3 convolutions with stride [4 4] and padding [0 0 0 0]
3	'relu1'	ReLU	ReLU
4	'norm1'	Cross Channel Normalization	cross channel normalization with 5 channels per element
5	'pool1'	Max Pooling	3x3 max pooling with stride [2 2] and padding [0 0 0 0]
6	'conv2'	Convolution	256 5x5x48 convolutions with stride [1 1] and padding [2 2 2 2]
7	'relu2'	ReLU	ReLU
8	'norm2'	Cross Channel Normalization	cross channel normalization with 5 channels per element
9	'pool2'	Max Pooling	3x3 max pooling with stride [2 2] and padding [0 0 0 0]
10	'conv3'	Convolution	384 3x3x256 convolutions with stride [1 1] and padding [1 1 1 1]
11	'relu3'	ReLU	ReLU
12	'conv4'	Convolution	384 3x3x192 convolutions with stride [1 1] and padding [1 1 1 1]
13	'relu4'	ReLU	ReLU
14	'conv5'	Convolution	256 3x3x192 convolutions with stride [1 1] and padding [1 1 1 1]
15	'relu5'	ReLU	ReLU
16	'pool5'	Max Pooling	3x3 max pooling with stride [2 2] and padding [0 0 0 0]
17	'fc6'	Fully Connected	4096 fully connected layer
18	'relu6'	ReLU	ReLU
19	'drop6'	Dropout	50% dropout
20	'fc7'	Fully Connected	4096 fully connected layer
21	'relu7'	ReLU	ReLU
22	'drop7'	Dropout	50% dropout
23	'fc8'	Fully Connected	1000 fully connected layer
24	'prob'	Softmax	softmax
25	'output'	Classification Output	crossentropyex with 'tench' and 999 other classes

Figure-1: Layers of Alex net

The input image is usually two-dimensional, so the object map is also two-dimensional. The convolution layer applies a specified number of filters to the input image. The mechanism is as follows. The filter is an array of numbers the same size as the input image. This filter moves to each pixel value and multiplies by each filter number by the corresponding pixel value in which it is positioned and calculates multiplication by element. For each pixel position, each multiplication is added to make it an element of the output matrix called a feature map, as shown in the following figure 2.

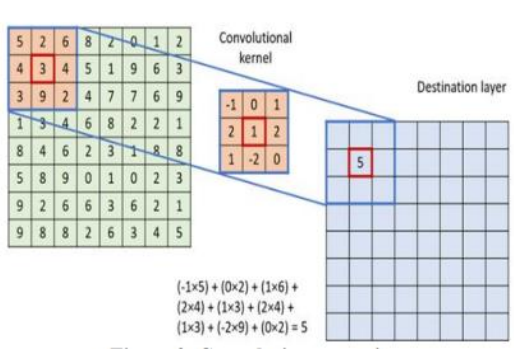

Figure-2: Convolution operation

Another parameter to consider is the stride. This is the amount of pixels that the strainer matrix moves each time it is moved to a different position on the input image. As a general rule, the passage is 1, which allows us to leave all the decreasing spatial samples for POOL levels. An element of the smart activation function is applied after each convolution layer. Using the activation function, network linearity is interrupted to detect more complex linear regression functions. The function for activating a rectified linear unit is defined as max (0, x). The spatial contact of the output data obtained from the single feature map and the total values of the secondary matrix value help to describe the value of the physical domain. Select maximum grouping, which simply shows maximum activation as seen in the region. The maximum coupling operation for a 2x2 matrix is shown in the following figure 3

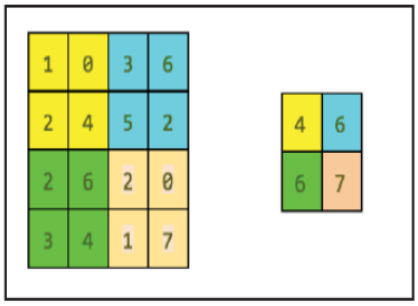

Figure 3. Max pooling operation

IV. IMPLEMENTATION

The implementation steps are depicted in figure 4.

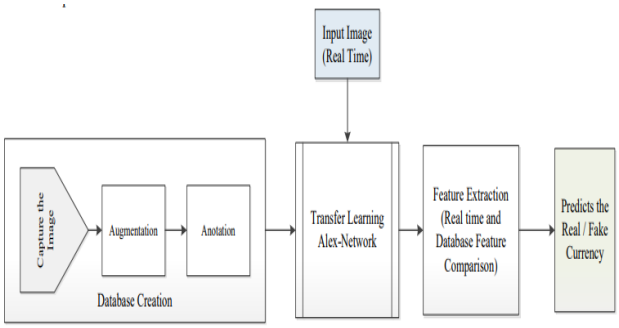

Figure 4. Implementation steps.

1step : DataBase Creation
2step : Image Input
3step : Feature Extraction
4step : Predicts Output

Database creation includes capturing of the image to train the network, the images of currency note data base is generated. For each note 100 images are generated using augmentation. The augmentation process like resizing and rotating is carried out to increase the data base count. After augmentation annotation of all currency images is done and then the images are stored in a separate folder with labelling. Now the network and images are ready to be trained. Once the training process is over the network learns the features of real currency note of 2000,500,200 and 50.

Image Input includes uploading the real time images and running it through the Alex Network.

Feature Extraction includes extracting features from the real time images and comparing it with the database and providing the predictable out put .

V. CONCLUSION

In this paper transfer learned Alex net as our model for performing the fake currency detection. The detection accuracy is most accurate since the currency characteristics features are learned through layer by layer. Here we have considered the whole currency image, but in future we will try to include all the security features of currency by employing suitable structural design and with suitable training data.

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