

# Deep Learning Based Indian Currency Detection for Visually Challenged using VGG16

Nijil Raj N, Anandu S Ram, Aneeta Bino Joseph, Shabna S



**Abstract**—Banknote recognition is a major problem faced by visually Challenged people. So we propose a system to help the visually Challenged people to identify the different types of Indian currencies through deep learning technique. In our proposed project, bank notes with different positions are directly fed into VGG 16, a pretrained model of convolution neural network which extracts deep features. From our work the visually impaired people will be able to recognize different types of Indian Currencies.

**Index Terms**—Deep Learning, VGG16

## I. INTRODUCTION

Deep learning systems can provide low cost solutions for the visually impaired. Of these, convolutional neural networks (CNN) and fully convolutional neural networks (FCN) show incredible guarantee regarding the advancement of multi use- ful innovation for the outwardly hindered. CNN have also po- tential for overcoming challenges caused by moving objects. CNN have additionally potential for conquering difficulties brought about by moving and impeded items. Deep learning CNNs are composed of several layers of processing, each comprising linear as well as non-linear operators, which are learnt jointly, in an end-to-end way, to solve specific tasks.

The term "visual impairment" is employed to explain a large number of conditions that have an effect on clarity of vision and field of vision. Technology is valuable for those with visual impairments, each as a tool for learning and communication and for providing visual stimulation. By employing a laptop with acceptable computer code and hardware the visually impaired user is given access to plain resources. For instance, speech synthesis will scan a word processed file to a visually handicapped person while not the requirement to possess it translated into Braille.

The existing sytem uses banknotes images with different orientation which is directly fed into alexnet, a pretrained model of CNN, the most popular image processing structure of deep learning neural network[3].

In our system the banknotes are detected and classified using the VGG16 model which is a type of convolutional neural ntework model. The existing system used alexnet which is also one of the pretrained models of CNN. VGGnet is used instead of alexnet because it has the capability of extracting more deep features than alexnet and hence output would be more precise.

## II. EXISTING SYSTEMS

Gouri Sanjay Tele,et al., proposed detection of Fake Indian Currency. Security highlights of currency are basic for deciding genuine and fake money. Basic security highlights incorporate watermarks, dormant pictures, security thread, and optically variable ink. In this a methodology for counterfeit currency location extricates the general traits of latent pictures and distinguishing ID mark from the image of money. Extri- cating properties from images of currency notes can get very intricate as it includes the extraction of some noticeable and undetectable highlights of Indian currency. After demonetiza- tion 500 and 2000 are the high esteemed cash notes existing till date so there is a most extreme likelihood that this notes can be duplicated so as to maintain a strategic distance from this they use programming to identify the fake notes utilizing picture handling procedure [1]. Navya Krishna G,et al., proposed Recognition of fake currency note using CNN. The Automatic Fake Currency Recognition System (AFCRS) is intended to identify the fake paper money to check whether it is fake or original. The current fake issue because of demonetization impacts the financial framework and furthermore in different fields. Another methodology of Convolution Neural Network towards recognizable proof of fake notes through their images is inspected in this paper which is relatively better than past image processing strategies. It depends on Deep Learning, which has seen huge accomplishment in image classification lately. This procedure can support both people and machine in recognizing fake notes progressively through an image of the equivalent. The proposed framework, AFCRS can likewise be conveyed as an application in the smart phone which can assist the general public with distinguishing between the original and fake notes. The Accuracy in the undertaking can be expanded through the original fake notes [2].

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N.A.J Sufri, et.al., propose a vision Based System for Banknote Recognition Using Different Machine Learning and Deep Learning Approach. They used the rgb values as features and used algorithms DT, NB, KNN, SVM and deep learning alexnet. Both kNN and DTC achieved 99.7% accuracy but both SVM and BC perform better by succeeded to achieve 100% accuracy[3].

The literature survey concludes that there are many disadvantages with the existing systems. Our proposed method of banknote recognition extracts deep features from bank notes

**Table I Analysis Of Existing Systems**

Method	Existing System Accuracy
CNN	-
CNN VGG Net	80%

using deep learning VGG 16 Model network. The different Analysis of our literature survey is shown in Table I.

### III. MATERIALS AND METHODS

#### A. Dataset

The dataset used is Indian currency. The dataset contains various Indian currencies of Rs20, Rs50, Rs100, Rs200, Rs500. It has various security features of Indian currency.

#### B. Feature Set

The deep features are extracted by VGG16 on its own. The deep features from each banknote are extracted and classified. The VGG16 design consists of twelve convolutional layers, maximum pooling layers, four fully-connected layers and a 1000-way softmax classifier. Using these layers the VGG16 extracts deep features from the banknotes. The existing system uses alexnet but it extracts less features from the banknotes than alexnet. Therefore VGG16 is preferred for greater accurate results.

#### C. Algorithms Used

1) *Convolutional Neural Network(ConvNets)*: It is a DL algorithm which accepts an input image, assign importance to numerous aspects/objects in the image and be in a position to differentiate them from one another. The pre-processing required is far lower as compared to other algorithms used for classification. They have the ability to learn these filters/characteristics.

(5 classes of notes). Then random snaps are taken out of these classes of notes. 15 images of 11 positions are considered. These positions are at random angles so that when the user inputs the image, the denominations are correctly predicted. The 11 positions are discussed below:  
 P1: Image at straight focus (horizontal or vertical) P2: Image at backside focus (horizontal or vertical) P3: Image at left flip (front side)  
 P4: Image at right flip (front side) P5: Image at left flip (back side) P6: Image at right flip (back side)  
 P7: Image folded to half from upper side at straight focus  
 P8: Image folded to half from lower side at straight focus  
 P9: Image folded to half from upper side at backside focus  
 P10: Image folded to half from lower side at backside focus  
 P11: image folded to 1/4th from lower at straight

focus. So from the above a total of 165 images for each of the currencies is taken.



Fig. 2. Shows 11 positions

### IV. METHODOLOGY

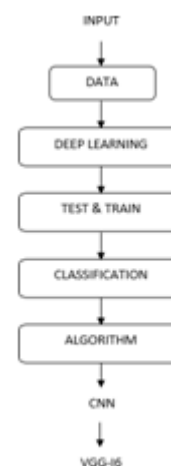


Fig. 1. Methodology

Our system extracts deep features from the inner layers. Our dataset has Rs20, Rs50, Rs100, Rs200 and Rs500 notes

#### A. Classification

Classification represents the matter of distinctive to that of a group of classes a new observation belongs, on the idea of a training set of data having observations whose category membership is known.

#### B. Test & Train Set

A training dataset could be a dataset of eg's used for learning, that is to fit the parameters for eg, a classifier. A test dataset could be a dataset that is independent of the training dataset, but follows a similar likelihood distribution as the training dataset. If a model fit to the training dataset conjointly fits the test dataset well, a lowest overfitting takes place. A much better fitting of the training dataset as hostile to the test dataset mostly points to overfitting.

#### C. Algorithm

VGG16 is a CNN model. It extracts deep features by its own from the banknotes.



Convolutional networks are merely neural networks that use convolution instead of general matrix multiplication in an exceedingly minimum of one of their layers.

1) *Building blocks of CNN:* Convolutions: Mathematical operation that slides one function over the opposite and measures integral of pointwise multiplication.

Strides: It shows how quickly window slides. Stride two suggest that window moves by two pixels at a time.

Pooling: Downsampling feature maps.

DNN: Fully connected DNN for classification



Fig. 3. Architecture

The input to the primary convolutional layer is of mounted size of vary 224 x 224 RGB image. The image is distributed through a stack of convolutional layers, wherever the filters were used with a small receptive field: 3x3 (which is that the smallest size to capture the notion of left/right, up/down, center). In one in every of the configurations, it to boot utilizes 1x1 convolution filters, which could be seen as a linear transformation of the input channels (followed by non-linearity). The convolution stride is mounted to one pixel; the spacial artifact of conv. layer input is specified when convolution, the spacial resolution is preserved, i.e. the artifact is 1-pixel for 3x3 conv. layers. spacial pooling is administrated by five max-pooling layers, that follow a number of the conv. layers. Max-pooling is performed over a 2x2 element window, with stride 2. In this there is three Fully-Connected (FC) layers followed by a output soft-max layer.

V. RESULTS AND DISCUSSION

TABLE II ACCURACY OF PROPOSED SYSTEM

No. of Epochs	Accuracy
1	98.93
2	98.80
3	99.07
4	99.07
5	99.07
6	98.73
7	98.40
8	98.93
9	99.33
10	99.07

VI. CONCLUSION

Our system proposes a vision based deep learning technique that can recognize and classify Indian Currencies were well developed. VGG 16 was found to extract deep features from the input image. Our system gives a better accuracy of 99.07% The existing system uses alexnet with extracts less features. Therefore VGG16 is used which is capable of extracting which more deep features. From this, the visually impaired people able to improve their quality of life by reduce the dependency to other especially during outside activities.

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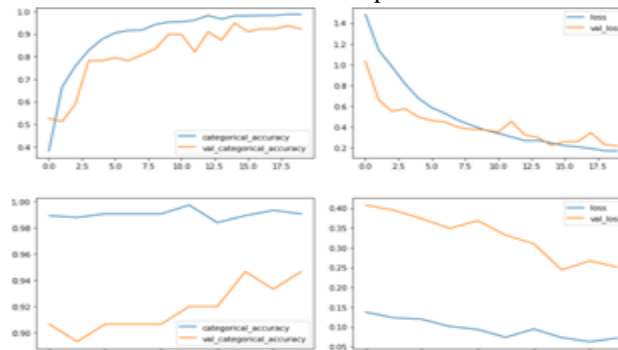


Fig. 4. Plot between categorical values and validation caegorical value

An accuracy of 99% was obtained using deep learning. The existing system is based on the orientation of Malaysian ringgits which uses a CNN model called Alexnet. The disadvantage with the existing system is that only less features are considered for recognizing the various currencies. This can extract deep features from the input images. The accuracy of proposed system is shown in Table II and the plot is given in fig 4.

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