Indian Currency Recognition

using Deep Learning

UNDER THE GUIDANCE OF

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Abstract

Money is an important factor in a person's day to day business transactions. While it is easy for a normal being to recognize any denomination, it is a cumbersome task for people who are visually impaired or aged or even for a foreigner who has no idea what the currency is valued to.

Here for the same purpose a YOLO-v3 CNN based currency recognition system is proposed which aims to reduce the gap between visually challenged person and normal visioned person.

Chapter 1 Introduction

"Make your vision so clear that your fears become irrelevant"

Money, for a human, is as important as food, water and for some even air. But what if you are unable to recognize its value even if you had a load of it. What seems to be an easy task for 20-20 visioned person, is actually a mind bender for any visually challenged person.

Every tedious task for us humans can be done easily using correct technology and the introduction of Artificial Intelligence has reduced that gap by a very large factor. This thesis aims to do the same in reference to *Currency Note Recognition.*

Nearly everybody has a mobile device nowadays, in fact based on a study by World Bank, it was established that there are in reality more mobile devices than humans on earth. Thus, the thesis aims to utilize the already available end devices to be the deploying device.

What if a smart device like your cell phone is capable of recognizing the currency or may even count them for you. This would remove the need of those big heavy machine bank clerks use to count your deposits.

By collecting data from various sources like Kaggle, free dataset providers and major portion from authors collection, a YOLO-v3 CNN based model is being trained which can be used by visually impaired people to recognized any Indian currency available in worst conditions possible.

The thesis aims to **take input through a webcam/mobile cam and predict the currency value presented in audio or visual text form.**

Chapter 2 Work Architecture & Strategy

Following the Qian Zhang and Wei Qi Yan strategy of Currency recognition, the following abstract flowchart is being designed, which will act as the Work Architecture for the thesis.

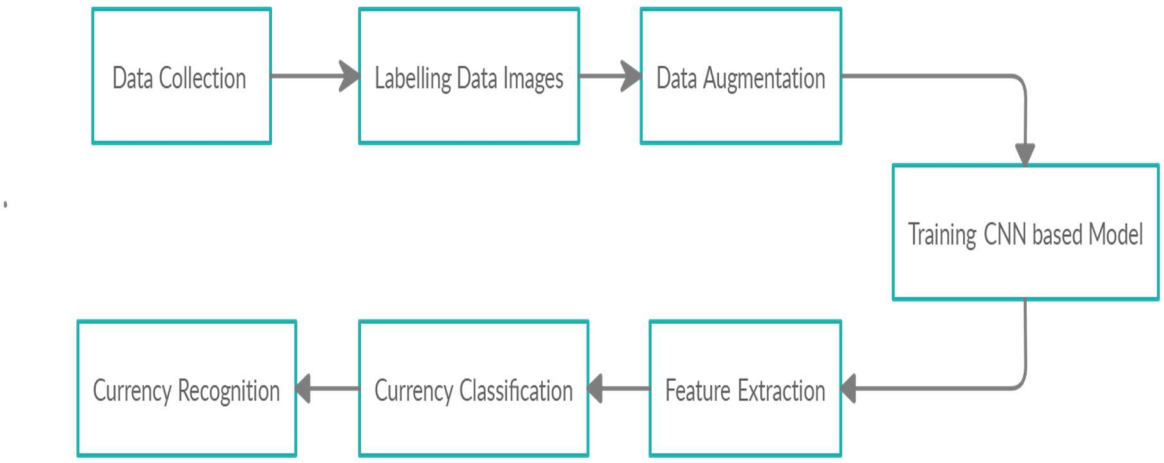

Fig 2.1 Depicting the first draft of the working architecture

In earlier stages, after data collection and augmentation final product, that is, a well-trained CNN model is expected as result, from which featured will be extracted to be later used for recognition in real time situations.

In later stages, using object recognition algorithms like YOLO, prediction of real time image can be done effectively.

Chapter 3 Deep Learning – Convolution Networks

A Convolutional Neural Network is most popular Deep learning algorithm in which it takes an input image, assign weights and biases to various aspect according to the object in the image.

In other algorithms we need to do lots of image processing and hand engineering to achieve the accuracy. But in CNN have the ability to learn these all the characteristics of images. So, we don't need to do a lots of hand engineering in images, CNN will do for us. And also, we can achieve a good accuracy in our work.

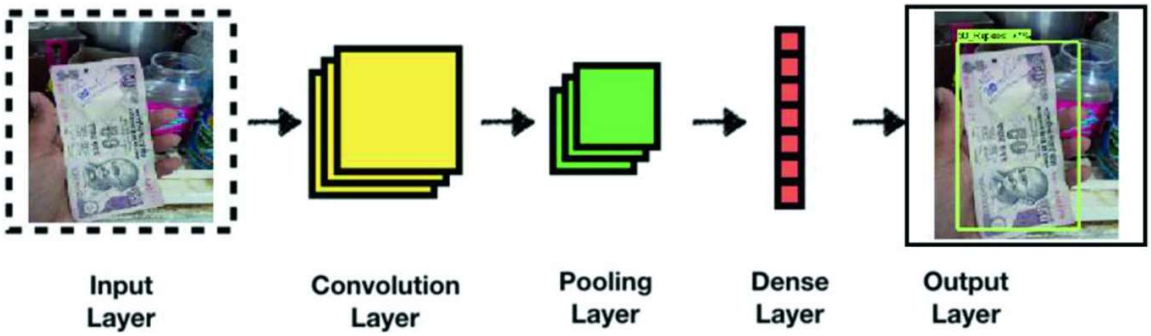

Fig. 3.1 Shows a rough working of CNN for the thesis

The use of CNN in the project is purely because of the efficiency and reduced computational cost that CNN provides when dealing with Image based dataset.

In later phases of the project a more defined and descriptive network of the convolutions will be presented.

Chapter 4 Object Detection – YOLO-v3

When it comes to deep learning-based object detection, there are three primary object detectors to encounter:

1. R-CNN and their variants, including the original R-CNN, Fast R-CNN, and Faster R-CNN
2. Single Shot Detector (SSDs)
3. YOLO

R-CNNs are one of the first deep learning-based object detectors and are an example of a two-stage detector. The problem with the standard R-CNN method was that it was painfully slow and not a complete end-to-end object detector.

While R-CNNs tend to very accurate, the biggest problem with the R-CNN family of networks is their speed — they were incredibly slow, obtaining only 5 FPS on a GPU.

To help increase the speed of deep learning-based object detectors, both Single Shot Detectors (SSDs) and YOLO use a one-stage detector strategy.

These algorithms treat object detection as a regression problem, taking a given input image and simultaneously learning bounding box coordinates and corresponding class label probabilities.

In general, single-stage detectors tend to be less accurate than two-stage detectors but are significantly faster.

We'll be using YOLOv3 in the experiment.

Chapter 5 Dataset Description

A dataset containing very high-quality images is very crucial for this experiment. Following are some points that needs to be, and are covered while collecting data for the experiment:

- Practically, the currency maybe crumpled, untidy and may contain stains from Holi celebration. To rectify this problem images are modified using Data Augmentation.

- A huge amount of data is not likely possible, since capturing images of different notes is very time taking and tiresome task, thus data from various free sources like Kaggle was also included in the already build collection of images.

Further, image labelling is a task which takes a lot of time; thus, we shall be using Scikit-learn library for the task. The library labels the data based on the directory it is in.

Finally, the data set contains nearly 200-250 images of each denomination of notes, namely of 10,20,50,100,200,500 & 2000.

Chapter 6 Future Work

- In earlier works by well-known authors like Qian Zhang and Wei Qi Yan, they used the best technology and computational resources available to them at the time.

- But since then, the development of resourced has been exponential. Even the YOLO algorithm has seen at least 10 or more updates till date.

- The mobile hardware available to general public today is much more powerful than it was just 2-3 years back. With the introduction of TensorFlow-Lite mobile world has seen inclusion of data science in every second app.

- With the availability of online kernels like Kaggle and Google Colab, the task can be accomplished even on a low configuration laptop.

- By the experiment, the author expects a more precise and accurate model can be developed, which when deployed on a smartphone will be much lighter and faster than the previous versions of the same application.

Chapter 7 References

- ✓ https://link.springer.com/chapter/10.1007%2F978-981-15-6648-6_6
- ✓ https://www.kaggle.com/shobhit18th/indian-currency-notes/tasks
- ✓ https://www.kaggle.com/gauravsahani/indian-currency-notes-classifier
- ✓ https://www.kaggle.com/vishalmane109/indian-currency-note-images-dataset-2020
- ✓ https://ieeexplore.ieee.org/document/9077137
- ✓ https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/