DETECTION OF CURRENCY NOTES AND MEDICINE NAMES FOR VISUALLY IMPAIRED USING DEEP LEARNING

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Abstract: **This paper is created for the visually impaired population in India. Currently 9.3 million people fall into the category of the visually impaired in India. We are expanding an application that can apprehend the currency note and offer a vocal message if necessary. In this paper, an application is developed to recognize Indian currency notes and medicines names. We have used the YOLOv5 Model for developing the application. Indian currency notes dataset is created, trained, validated, and tested by the CNN version. This CNN-based program will provide textual content and audio output based on the identified.**

Keywords: ***Yolov5 Model, CNN, Indian Currency Note***

1. INTRODUCTION

Artificial Intelligence is outgrowing in demand in every sector in recent years. Deep Learning is playing an important role in solving complex problems related to images [1]. Despite being in a digital world where UPI transactions have increased tremendously, However, there is a section of the population who are visually impaired people who are deprived of using digital transaction features [2]. We have analyzed this problem and come to a consensus that deep learning can overcome the problems faced by visually impaired people [3]. The model is more focused on recognizing the Indian currency note and medicine names. The additional feature of this model includes the audio output of the results. In this model, we have used a dataset of 'Indian Currency Note' which widely covers the currency notes which are in circulation as per RBI. For example, it excludes one rupee, two rupee, five rupee and one thousand rupee notes. The data is trained and tested which is one of the preliminary activities in order to achieve the accuracy of the model. Also we have adding medicine name detection in these. This can be used on the medicines and get the name of that medicine followed by an audio [4] [5].

2. LITRATURE REVIEW

Shelar Rutuja, More Smrut, Tapase Nisha, Sanjay Waykar et. al (2022) Curreny detection using TensorFlow. In order to get much better performance, they adopted a traditional method along with CNN.

Sagar et. al (2021) developed an Indian currency detection system that helps blind people to recognize and read possible Indian currency with 79.83% accuracy. The proposed model is based on YOLOv5 and compares the performance of YOLOv5 with the CNN algorithm for call detection.

Ahmed Yousry, Mohamad Taha and Mazen M Selim et. al (2020) Identification of Indian Currency Denomination using Deep Learning. In this Project, they have used CNN Algorithm to get the features of images as it is very fast algorithm. In addition, their result showed that the proposed model is 95% more accurate and the recognition rate has dramatically improved throughout the experiment.

Swati Sagar, Shaneen Mondal, Apurva Set, Rupwati Shah, Akansha Deshpande et. al (2016) Statement on Recognition and Authentication of Indian Currency for Blind Note recognition uses a pre-processing method, note authentication is performed through OCR method, serial number extraction, and serial number comparison with CSV file, and audio output is generated by TTS voice synthesizer [6].

Shirley Edward et. al (2015) proposed an app for blind people. The system even has the ability to tell patients when to take their medication. First aid kits are detected using visual indicators. Edge detection, color reduction is some of the method used. Each drug is registered as a sound file and image before the application runs. And finally, scanning the medicine box with the camera will tell you whether or not you have chosen the right medicine [4].

Prashengit Dhar et. al (2018) paper currency detection system. It is based upon combined features of LBP and SURF. Detection is done on the basis of training of the system over different currencies Overall accuracy of this method 92.6%.

3. METHODOLOGY

The experimental procedure is divided into – YOLOv5 Model, Evaluation Parameters

YOLO-v5 Model

The model is selected from ultralytics repository, which is the official YOLOv5 repository on GitHub. The repository is cloned along with installation of dependencies. Later, the configuration (.yaml) files are customized by providing the Currency class names 10, 20, 50, 100, 200, 500, 2000, Fifty, One Hundred, Ten and Twenty Rupees and other hand Medicine class names are Azicip 250, Minolast-LC, Moncel FX, Amoxyclav 625, Phytoral and Sumo Gel. The YOLOv5 model chosen comprises of 214 convolutional layers.

Datasets

Currency notes are collected from sources like kaggle and some currency notes are capture own. The dataset comprises of old notes of Rs 10, Rs 20, Rs 50 and Rs 100 and new notes of Rs 10, Rs 20, Rs 50, Rs, Rs 200, Rs 500 and Rs 2000 images (in .jpg format), in equal proportions. The images data comprise 225 images per class, which are captured on different backgrounds and different visual settings. Medicine dataset are captured it own. The dataset comprises of Azicip 250, Minolast-LC and Moncel FX, Amoxyclav 625, Phytoral and Sumo Gel (in .jpg format). The images data comprise 225 images per class.

Dataset Annotation: These 1275 images are then manually annotated using Roboflow annotator tool. The annotations are then exported in YOLO format (in .txt) and stored in labels directory. Split the entire dataset along with labels in 90-10% split.

Dataset Augmentation: These 1275 images are then augmented using rotation, blur and Saturation techniques to generate dataset with 3825 images. The training dataset comprise 3500 images and their labels. Remaining 325 images along with their annotations comprise the validation dataset.

Clone the YOLOv5 repository in the .py file and install required dependencies. The running environment for this model is (CPU, 16GB RAM, 1TB disk). Development packages include torch 1.13.1 and Python 3.10

Train the model: The image size is set to 416. The model epochs are set to 150 and batch size is set to 32. Set the directory path for train dataset and configuration files. Then, run the python command to train the entire dataset using YOLOv5 model. The evaluation metrics are – Precision, Recall and mean Average Precision (mAP). The losses calculated for box, object and class for each epoch.

Fig -1: Currency Model storing train data labels

Fig -2: Medicine Model storing train data labels

After all of this store the best model weights in .pt format. Then export this model to tflite model for Android Application.

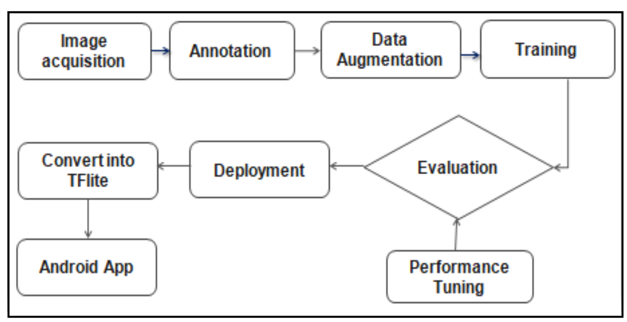

Fig -3 Basic Block Diagram

Evaluation Parameters

The evaluation metrics used to analyse the results include - Precision, recall and mAP. Higher values of recall, precision and mAP (mean Average Precision) are preferred to detect the currency notes accurately. The other metrics include box loss, obj loss and cls loss. In a confusion matrix with True Positive (TP), True Negative (TN), False Positive (FP) and False Negative (FN), evaluation score Accuracy, Recall and F1 score can be calculated.

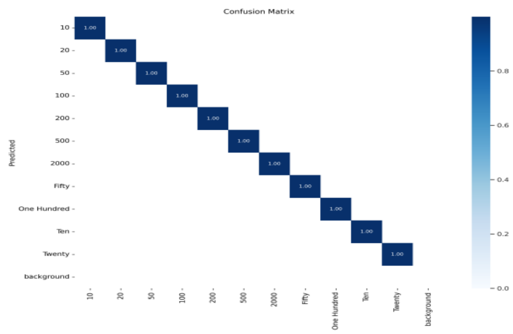

Fig. -4: Confusion Matrix of currency train data

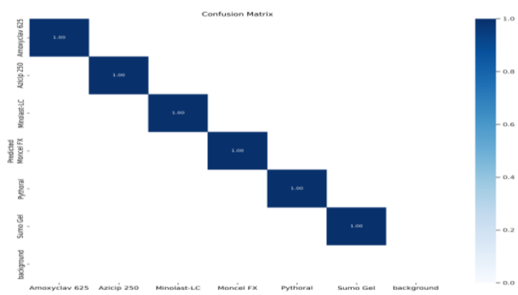

Fig. -5: Confusion Matrix of Medicine train data

Precision: Precision determines which positive are correctly identified out of the total number of true positive.

Recall: Recall identifies correctly identified positives out of the total number of identified positives.

mAP (mean Average Precision): mAP represents mean of average accuracy in recognition of currency labels. mAP evaluates the overall detection accuracy.

Model Losses: Each epoch has three losses: box loss, object loss and classification loss.

1. **Box loss:** Shows how well the algorithm determines the center of an object and predicts its bounding box.
2. **Obj Loss:** The probability that an object exists in the proposed region of interest.
3. **Cls Loss:** Classification loss represents how well an algorithm predicts the class of a given object correctly. The evaluation metrics along with the model loss for each epoch are shown in Fig 6 and Fig 7.

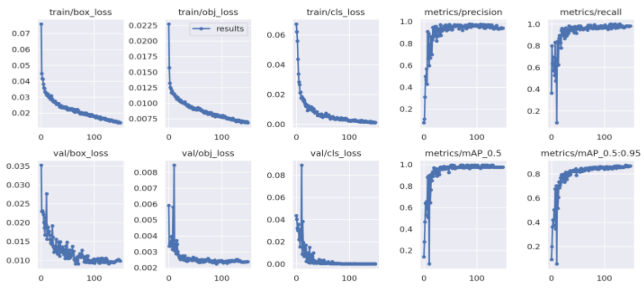

Fig. -6: Losses and evaluation metrics for 150 epochs on Currency train data

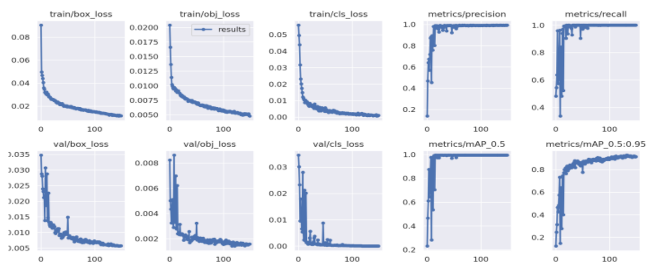

Fig. -7: Losses and evaluation metrics for 150 epochs on medicine train data

4. RESULTS

YOLOv5 detection results are shown for an image with test data (.jpg format) and the model was tested on an image with all classes.

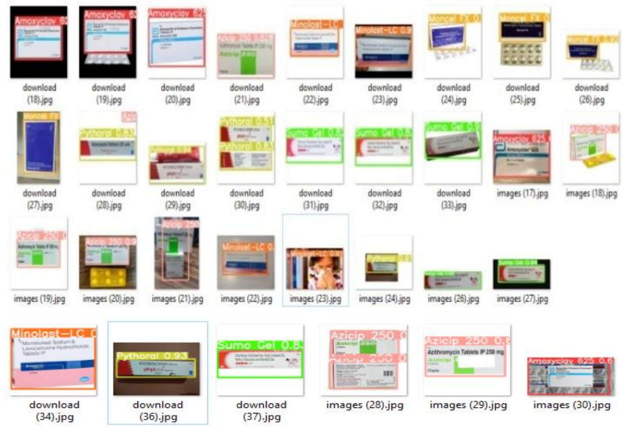

Fig. -8: Detection of Medicine Names

Fig. -9: Detection of Currency Notes

5. CONCLUSION

The main goal of this project is to create a model that recognizes Currency Notes and medicine names using deep learning for visually impaired. A proposed YOLOv5 model that primarily uses the Convolution Neural Network (CNN) framework to generate image features for training. By doing this, we can divide the image into different segments or parts to quickly and easily accurately identify banknotes and the process of medicine names.

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