

Recognition of the currency using computer vision

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Abstract—In this paper, it present an android application that can be used to recognise the currency notes. The user have to switch on the application after switching on the application camera will be opened and it will be asking the user to put a currency note in front of the camera. When the user will be putting the currency note in front of the camera the app will be taking the images of the note and that image will be sent to the CNN model in the backend. After that model will be predicting the denomination of the currency and an audio will come saying the denomination of the currency. Thus the user will be able to know the denomination of the currency.

Keywords: Android application, currency, CNN model

I. INTRODUCTION

Machine Learning and Computer Vision is a new edge technologies and every person in the tech world want to experience these technologies. These technologies have many applications and this project BLINDSPOT is based on one of the application of Machine Learning and Computer Vision that is Image Recognition. This system aims on the problem of detection of currency notes on low-power smart phones for the blind. This major problems faced by person having visual disabilities in which it is the inability to detect the currency due to similar of the paper texture and also the size between varies category. Nearly blind people are estimated worldwide, of which 247 million have low sight in their eyes and 40 million population are blind. This project adopts an technique based on computer vision on mobile devices, and also we will made an app that can run in low power smart phones.

The main thing is that the use of Android smart phone with its camera. The user should click a pic of a currency note. The user's smart phone must have good camera quality and be able to detect the image clearly otherwise the application will produce less accurate results or incorrect results. The Currency will be recognized and ready to send the output. Now the currency is identified and prepared to give output, the person will listen the denomination of the currency as the audio from the smartphone. The application will able to run on low end mobile phones. This is application where we deploy convolutional neural network model. The main motive is to help visually impaired people to recognize currency and to reduce fraud with visually impaired people on any kind of money related bills.



Figure 1: System Snapshot 1

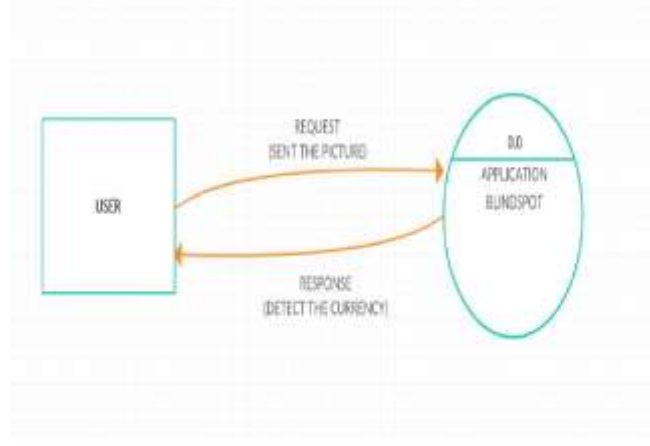


Figure 2: System Snapshot 2

II. DESIGN AND CHALLENGES

A. Product Definition

The system focuses on problem of detection of currencies bill on low power mobile phones for the blind. This is application where we deploy convolutional neural network model. The main motive is to help visually impaired people to recognize currency and to reduce fraud with visually impaired people on any kind of money related bills. These are the users who are visually impaired or very old and unable to see clearly. Visually impaired people have to depend on others for purchasing daily groceries and many times they got cheated by the shopkeeper or the person who is helping them. Now, these users can use this app to scan the Indian currency so that they don't have to depend on other and this will keep them away from fraud.



B. Feasibility Analysis

There are many applications of these machine learning technologies which we see in our daily basis. The phone, websites, apps we use all are using these technology to enhance our user experience. One of the major benefits of these technologies is that the algorithms which are built under these technologies can be used in different ways or they are multi-purpose. Similarly the CNN model which will be used in this project can be trained with different currencies of different countries and can be used by any one throughout the world. The model can be altered so that it will be able to recognize the different currency. A person can change the model to make currency recognition for the currency of their own country or it can be built as a global currency recognizer based on its implementation and training.

C. Detailed Design

The application is divided into two modules:

Module 1:-

In the first module as the user open's the application there should be a vibration in the mobile so that the visually impaired know that the application is opened and it is ready to use. If the visually impaired did not understand

with the vibration, the in this module there is function which speaks "Welcome" it means the open and ready to use.

Module 2 :-

In the second module after the user open there is various steps that need to be taken care. First steps is to see is the Camera of mobile phone is working or not, if not then it should display the message "Uninitialized classifier or invalid context". After detecting that the camera is working properly than there is four steps to detect the note with the application. The four steps are:

1) Initialize the interpreter:

In this step we begin by initializing the interpreter by loading the TensorFlow lite model and labels. Once the interpreter is loaded with the model and ready, we can start carrying out inference by preparing the input.

2) Preparing the image output

This step involves pre-processing the image and making it consumable for the interpreter it means getting the image and resize the image to specified size along with pixel format known to the model.

3) Perform inference

The pre-processed input to the interpreter and get the result.

4) Obtain and map result

In this steps we maps our resulting confidence values to labels.

III. SYSTEM DESIGN

A. System Design

The system focuses on problem of detection of currencies bill on low power mobile phones for the blind. This is application where we deploy convolutional neural network model. The main motive is to help visually impaired people to recognize currency and to reduce fraud with visually impaired people on any kind of money related bills.

B. Customer/User Profile

These are the users who are visually impaired or very old and unable to see clearly. Visually impaired people have to depend on others for purchasing daily groceries and many times they got cheated by the shopkeeper or the person who is helping them. Now, these users can use this app to scan the Indian currency so that they don't have to depend on other and this will keep them away from fraud.

1.2 Assumption and Dependencies:-

- I. We are assuming that user have smartphone which have android operating system in it.
- II. We are assuming that the smart phones of the user have good quality of camera and able to detect image clearly otherwise application will give less accurate result.
- III. User should have basic knowledge how to use this application.

Blind person: he/she use Android mobile phone. He/she will place the Indian note in front of the camera and camera will take the image and send it to Machine Learning model and predict the output. But, the He/she should take necessary steps required step in order to avoid any error when using the app.

Step wise procedure hoe the application work:

- I. Take pic with the mobile's camera.
- II. Processing the image and predicting the output.
- III According to the prediction the audio will be generated saying the denomination of currency.

take a simple click, the He/she can take advantages of this smart phone's app and also do so many actions in few minute. By using the smart phone's camera, different- different Indian currency could be recognized.

C. Design Notations

Use Case Model:-

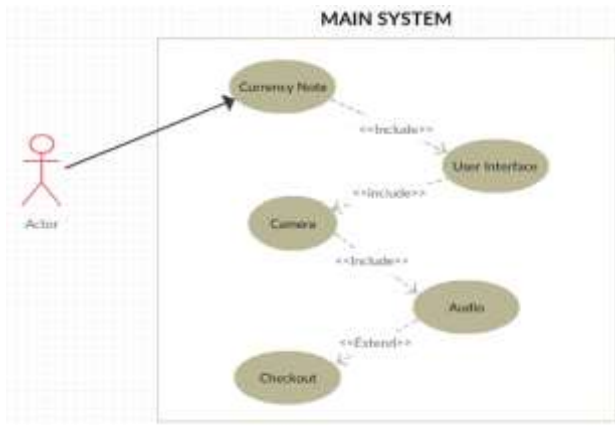


Figure 3:Use Case Model of Project

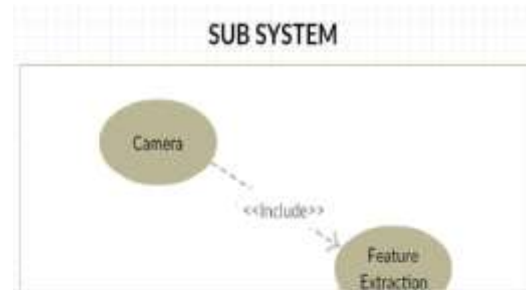


Figure 4: Sub System of Project

Flow Chart:-

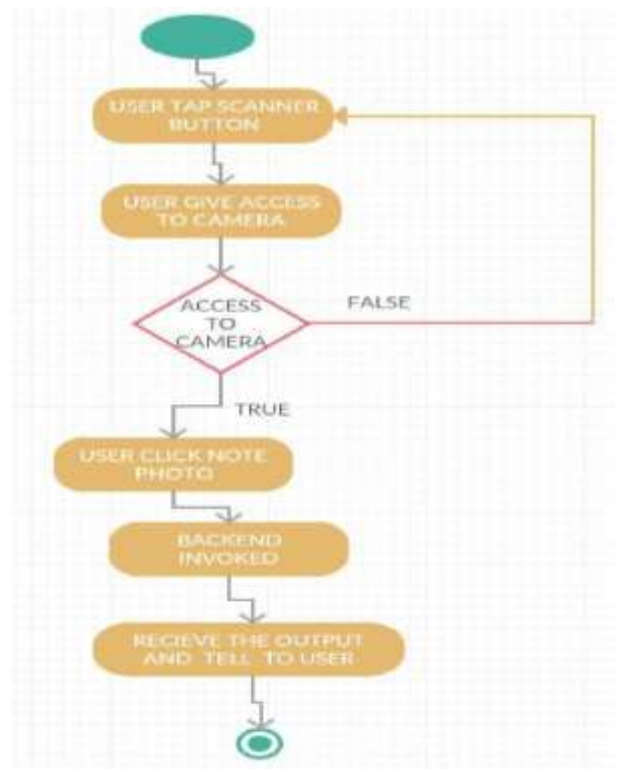


Figure 5 Flow Chart of Project

IV. EXPERIMENT

In this paper, we represented the application description includes the basic structure of the whole project as the primary part of the project is android application that can be used to recognise the currency notes. The user have to switch on the application after switching on the application camera will be opened and it will be asking the user to put a currency note in front of the camera. When the user will be putting the currency note in front of the camera the app will be taking the images of the note and that image will be sent to the CNN model in the backend. After that model will be predicting the denomination of the currency and an audio will come saying the denomination of the currency. Thus the user will be able to know the denomination of the currency. As we all know that Machine Learning and Computer Vision are powerful technologies that have transformed the world. There are many applications of these technologies which we see in our daily basis. The phone, websites, apps we use all are using these technology to enhance our user experience. One of the major benefits of these technologies is that the algorithms which are built under these technologies can be used in different ways or they are multi-purpose. Similarly the CNN model which will be used in this project can be trained with different currencies of different countries and can be used by any one throughout the world. The model can be altered so that it will be able to recognize the different currency. A person can change the model to make currency recognition for the currency of their own country or it can be built as a global currency recognizer based on its implementation and training.

A. Functional requirements

Here classified below:

1. Taking the pic.

Description:

For the smart phone's app:

The main thing is that the use of Android smart phone with its camera. He/she can click a pic of a currency note.

The user should use the camera of a smart phone of specific resolution and then take a picture of a currency note. Android Smart Phone.

An valid Indian currency note

A valid not containing the denomination in the notes.

2. Recognition of the currency

Description: The denomination of the currency note will be recognized by sending the image to the CNN model.

The currency can be recognized and then prepared to send output.

Recognition of the currency

Ready to send for output.

3. Audio output saying the denomination of the currency

Description: When the currency is identified and prepared to be used as output, users will hear the value of the currency as the sound of the audio

After getting the probability of classification the image is recognized

B. Non-Functional Requirements

1. Usability Requirement

This app can be used as a friendly. It does not requires any study to use it. The app should be as simple and therefore its user should use it easily. The interface is quite simple, straight forward so that users can understand it. The user should simply click on the click pic button without any complication.

2. Reliability Requirements

There should be no unexpected failures in this app. In order to reduce the occurrence of failures in it, this specification has been respected and follow correctly. The only problem that can happened in few case which is app don't get 100% character in the pic.

3. Performance

The application response time is acceptable. But to keep up the performance of the app, with this application user has to perform the necessary step to get the wanted result or output.

4. Portability Requirements

The app is able to work with many version of smart phones, if the Android version is updated, the app should be updated on time.

C. Pseudo Code

Pseudo Code for opening camera

STEP 1: Check the permission for accessing the camera is granted or not

STEP 2: IF not given request the permission again for accessing the camera

STEP 3: IF permission is given then call setUpCameraOutputs method. This method will handle which camera to use(if there is multiple ones).

STEP 4: Next, we have to open the camera that the setCameraOutputs method has selected for us.

PSEUDO CODE FOR PRINT TOP-K LABELS TO BE SHOWN IN UI AS THE RESULT

STEP 1: Get the top 3 priority labels

STEP 2: Map the value in STRING and FLOAT

STEP 3: Set the string textToShow with the value of labels and the accuracy.

STEP 4: Return the string textToShow

PSEUDO CODE FOR SPEAKING THE RESULT

STEP 1: Get the result from the textToShow string variable.

STEP 2: Select the first label from the string textToShow
STEP 3: If the confidence value goes above the 70 than it will speak out the currency value.

STEP 4: Step 3 will repeat until the confidence value is above 70, and if currency accuracy increases than it speak again the currency value.

V. IMPLEMENTATION

A. Implementation of the project

In this paper, we represented the application using Android Studio Software and Anaconda Software. The Anaconda Software is basically used to train the model which can detect the currency. After training the model we convert the model into TFlite model so that we can run the model in to the application because mobile devices have limitation of resources. The conversion model to TFlite model is done by running a script in Anaconda Shell. After converting the model we get the two file one is ".tflite" extension and the other is ".txt" extension the ".tflite" extension includes the model and the ".txt" extension the labels of the model.

Android Studio is used to make the application for the android devices. The application which we made through the help of android studio is basically to deploy the Tflite model into the application. The layout is designed through the extensible markup language and it connected through the java code.

After making the application now we have to deploy the application in android play store and this process involves different steps. The first steps is to registration in the google play console and familiarize yourself with the developer console. After that upload the android application package file (APK) in the developer console and then publish the application for other people to use. Our application is in the Google Plays Store with the name of "BLINDSPOT-CURRENCYRECOGNITION".

B. Post-Implementation Then Software Maintenance

After implementation the main focus is to increase the user and to engage and invite more users in our project. Making aware to the visually impaired person about this application is the main post implementation concerns. Updating the application with adding features so that it can make the visually impaired easier to use the application. The features we are going to update in our application to increase the accuracy of the model to recognize the currency. The speech can be also be changed to Hindi

because many people in India are Hindi speakers. The flashlight sensor is also will be added to the application, which will turn-on automatically when it is dark.

A member of our team checks the app on a daily basis to maintain the application and also handle the customer queries, problems they faced in using our application and what new features they want in the application . These reviews and feedback is used to develop the next update of the application.

VI. CONCLUSION

In this paper, we represented the application BLINDSPOT is based on one of the application of Machine Learning and Computer Vision that is Image Recognition. Image recognition on smart phones has many applications. The project focuses on the problem of detection of currencies bill on low power smart phones for the blind. The project adopts a method based on vision of smart phone devices, and develops an app that can run on low power smartphones. A convolutional Neural Network is made to train the model and the trained model is deployed in an android application, using that application visually impaired people will be able to recognize the currency and will be able to pay exact right amount. The application Blindspot is now deployed on the play store for people to use. These are the users who are visually impaired or very old and unable to see clearly Now, these users can use this app to scan the Indian currency so that they don't have to depend on other and this will keep them away from fraud.

REFERENCES

- [1] "Android Developer Guides"
<https://developer.android.com/guide>
- [2] "What is Functional Testing: Complete Guide with Type and Examples" Software Testing Help.
<https://www.softwaretestinghelp.com/guide-to-functional-testing/>
- [3] "Structural Testing?" Software Testing Class.
<https://www.softwaretestingclass.com/what-is-structural-testing/>
- [4] "Pseudo code:"
- [5] Community College of Rhode Island.
<http://faculty.ccri.edu/mkelly/COMI1150/PseudocodeBasics.pdf>

Result:

The user can take a picture of a currency note with the help of blindspot application. The smart phones of the user should have good quality of camera and able to detect image clearly otherwise application will give less accurate result or wrong result. The denomination of the currency note which the application is able to detect is Indian currency other than that it will give wrong output. The Currency will be recognized and ready to send the output.

Once the currency is recognized and ready to be used for output, the user will be listen the denomination of the currency as the audio sound. The application will able to run on low end mobile phones. This is application where we deploy convolutional neural network model. The main motive is to help visually impaired people to recognize currency and to reduce fraud with visually impaired people on any kind of money related bills.



Fig 6 App Icon

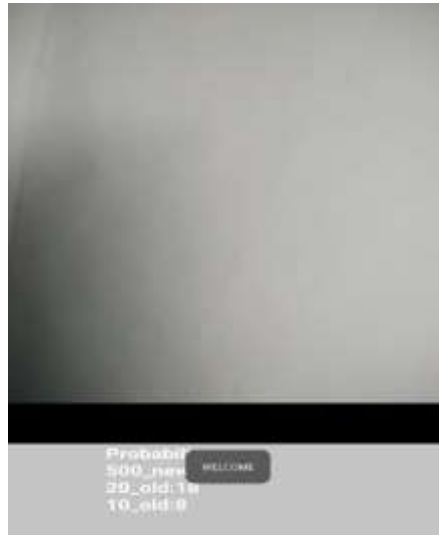


Fig 7 App starting



Fig 9 Detecting 50rs note



Fig 10 Detecting 500rs note



Fig 11 Detecting 500rs back note



Fig 12 Detecting fold 500rs note