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An Android Application for Indian Currency Recognition and Detection for Visually Impaired People

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Abstract: *The currency recognition system using TensorFlow is an innovative application of deep learning technology that can recognize and classify different currencies from around the world. This system uses a convolutional neural network (CNN) to extract meaningful features from banknote images, and then a classifier to predict the currency type. The training of the system is performed on a large dataset of banknote images, and the system achieves high accuracy in recognizing different currencies. The system has a wide range of potential applications for visually impaired people, including ATM machines, vending machines, and self-service kiosks, where accurate and efficient currency recognition is essential. The implementation of the system using TensorFlow provides a scalable and efficient solution that can be easily deployed on various platforms.The currency recognition system using TensorFlow is an exciting and valuable application of deep learning technology. It has the potential to revolutionize the way we handle cash transactions and improve the overall efficiency of financial systems. This abstract provides an overview of the key features and potential applications of the system, highlighting its potential to benefit a wide range of industries and users..*

Keywords*:* Deep Learning, Currency Recognition, Convolutional Neural Network, TensorFlow, Image Extraction

I. INTRODUCTION

1.1 Overview:

Visual impairment is a challenging condition that affects a significant portion of the population. For people with visual impairments, everyday tasks that most people take for granted can be difficult, such as recognizing currency. Currency identification is an essential aspect of independent living for visually impaired people, as it allows them to conduct financial transactions and manage their money.

Technology has been playing an important role in addressing the challenges faced by visually impaired people. One such technology is the development of currency detection and recognition applications that help visually impaired individuals identify and manage different denominations of currency.

According to the World Health Organization (WHO), there are an estimated 62 million visually impaired people in India, accounting for approximately one-fifth of the global visually impaired population. Of these, around 8 million people are blind, and the remaining have some degree of visual impairment. The major causes of visual impairment in India include cataract, uncorrected refractive errors, glaucoma, and diabetic retinopathy. Visual impairment has significant economic and social consequences for individuals, families, and communities, including limited educational and employment opportunities, reduced productivity, and increased healthcare costs. However, the WHO also notes that the majority of visual impairments in India are preventable or treatable, highlighting the need for improved access to eye care services and public health interventions.

This research paper will focus on the development of a currency detection and recognition application for visually impaired people. The paper will explore the different technologies used in the development of such applications, the challenges faced in creating these applications, and the impact of these applications on the lives of visually impaired people.

The paper will also review existing literature on currency detection and recognition applications for visually impaired individuals, as well as the current state of the art in this field. Additionally, the paper will discuss the potential of these

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applications for further development and implementation, and the future of currency detection and recognition technology for visually impaired individuals.

Overall, this research paper aims to shed light on the importance of currency detection and recognition applications for visually impaired individuals and how technology can play a critical role in improving their quality of life.

1.2 Motivation:

The primary driving force for the creation of this project is to provide a method for quick and simple identification of both real and counterfeit notes for visually impaired people. According to Vision Atlas, around 275 million people in India account for blindness and vision impairment. That is why we want to develop an application so that we give the power to impaired people to check the denomination of currency as well as reduce the chance of counterfeit currency.

1.3 Problem Definition and Objectives:

Problem Definition:

Currency detection and recognition application for visually impaired people to reduces the chance of counterfeit currency money as well as assist people to recognize the denomination of currency.

Objectives:

- To help visually challenged or impaired people so that they can differentiate between various types of Indian currencies through the implementation of image processing techniques.
- To get audio output regarding currency detection and recognition.
- To reduce the chances of fraud with visually impaired people.

II. LITERATURE REVIEW:

Title: Currency Recognition System for Blind people using ORB Algorithm

Author: Ahmed Yousry, Mohamed Taha, Mazen Selim

In this paper, a currency recognition system based on an Oriented FAST and rotated BRIEF (ORB) is developed. This Currency Recognition System (CRS) is used to help blind people and visually impaired people who suffer from monetary transactions in day-to-day life. This method applies some image processing operations to remove the noise as well as considers different environmental factors such as Illumination, scaling and rotation to improve the accuracy.

Title: Currency Detection for Visually Impaired People

Author: Shweta Yadav, Zulfikar Ali Ansari, Kaushiki Gautam Singh

In this paper, a currency recognition system based on Oriented FAST and rotated YOLO V3 algorithm is proposed. This system uses Artificial Neural Network for classification which increases our model's accuracy. YOLO not only classifies the image into a category but also detects multiple objects within an Image. It is also deduced that by using LBP method in identification, we can increase accuracy as well as attain a high recognition rate. We also get to know that using RGB color model in this scenario for the identification process reduces it accuracy to a great extent.

Title: Currency Detector for Visually Impaired (Study of the systems which identifies Indian Currency for Blind People)

Author: Pratiksha Ganjave, Rushikesh Markad, Gaurav Rasal, Yash Kalekar

We have various techniques for recognizing and extracting different and distinctive properties of Indian Currency Notes. This paper aims to study these various techniques and systems of automatic CRS so as to deduce which system has better accuracy than others and develop a CRS system that will help Visually Impaired People. It compares four different feature extraction algorithms (SIFT, FAST, ORB and SURF) and selection of other appropriate algorithms as per the requirements. These algorithms are tested thoroughly as per various parameters so as to check the performance of these algorithms. It is also deduced that these algorithms can be combined together to get better results. Thus, people can develop CRS systems as per their needs by comparing various algorithms and help develop an efficient system.

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Title: Fake Currency Detection System Using Image Processing and Other Standard Methods
Authors: D. Alekhya, G. DeviSurya Prabha, G. VenkataDurga Rao
This paper aims to detect fake currency through methods like watermarking, optically variable ink, latent image and techniques like counterfeit detection pen and using MATLAB. What it does is that when the MATLAB technique is deployed in mobile phones with cameras, it detects fake notes through various techniques by comparing attributes present on the notes to classify between real and fake currency notes. This in turn would help people to detect fake notes as well as control fake currency circulation.

Title: Currency Recognition System Using Image Processing
Authors: Devashree Patwardhan, Swarali Namjoshi, Vrinda Valunj, Pratibha Shikhare
This paper aims to develop a system to help people who need to recognize different currencies and work with convenience and efficiency. It captures images with the help of various equipment and then it converts the image's RGB value into HSV value and then compares its Euclidean distance with a test image to give an accurate result.

III. SYSTEM DESIGN:

3.1 System Architecture:

A system architecture, sometimes known as a systems architecture, is a conceptual model that describes a system's structure, behaviour, and other aspects. An architecture description is a formal description and representation of a system that is set up to facilitate analysis of its components' structures and behaviours. System components and created subsystems that will cooperate to accomplish the overall system might make up a system architecture.
Our system will follow the methodology as shown in the Proposed system diagram. Our Input currency images will processes like image pre-processing and feature extraction and then it would be compared with the dataset that is available with us. After that, we will train our model using algorithms such as Convolutional Neural Network (CNN) or other suitable architectures.
In system architecture, we have 5 blocks: Input Images, Image Processing, Dataset, Model Training and Result.

Fig 1: Proposed System

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IV. PROJECT IMPLEMENTATION:

4.1Overview of Project Modules:

Image Acquisition

According to our order, this is the initial step in image processing since if we don't have any images to begin with, we won't be able to carry out the other processes. We can obtain our photographs in a variety of ways, primarily through mobile phones or scanners. This procedure is taken in order to preserve every aspect of our photograph.

Pre-Processing:

Prior to being utilised as input for a machine learning algorithm or computer vision job, an image is subjected to a number of procedures or modifications known as "pre-processing." Enhancing the quality and usefulness of the image data for further analysis or processing processes is the goal of image pre-processing.

Feature Extraction:

The process of extracting features—meaningful, representative information—from unprocessed data is referred to as feature extraction. The technique of feature extraction in image processing or computer vision is locating and recognising distinctive patterns, structures, or features in an image that are important for a specific task or study. The objective of image feature extraction is to convert an image's raw pixel data into a more condensed and comprehensible representation that can be used to subsequent processing or analysis.

Modules:

- Graphical User Interface (GUI)
- Dataset Module
- Image Processing Module

4.2 Tools and Technologies Used:

OpenCV Library

OpenCV(Open Source Computer Vision Library) is an computer vision and ML library. It is mainly used for Image processing and performing various computer vision tasks. It can be used for Image detection, Face detection, etc.

For our application, we have used OpenCV library for the sole purpose of Feature extraction of our Indian Currency Notes. Feature extraction helps us to extract various attributes present in our currency notes which makes them unique and easily distinguish between different denominations through these attributes.

TensorFlow Lite:

TensorFlow Lite is a version of TensorFlow, which is an Machine Learning framework developed by Google. It is specifically designed for mobiles and other devices which have limited amount of computational resources. It allows us to deploy machine learning models on those devices. It also provides various tools and APIs for conversion of model, Deployment of our model and its execution. By using TensorFlow Lite, we can easily perform operations that require high computation resources on the devices which are not capable of supporting high computational resources.

Convolutional Neural Network:

It is a type of Neural Network Architecture that is used for Image and Video processing tasks. It uses convolutional layers unlike other neural networks for learning and extracting particular features from our input data. It is a powerful tool in the field of deep learning for image analysis and have been successful in various computer vision tasks, including image classification, object detection, and image segmentation.

MobileNet: It is a specific variant of a Convolutional Neural Network (CNN) architecture that is designed to be computationally efficient for mobile and embedded devices. It is optimized to have a small memory footprint and a low number of parameters, making it suitable for deployment on resource-constrained devices with limited computational power. It is commonly used for various computer vision tasks on mobile and other devices which perform various tasks like image classification, object detection, etc.

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So, to achieve a perfect balance between accuracy and performance of our android application, we have used MobileNet architecture for our model.

V. RESULTS

5.1 Outcomes:

We planned on developing an android application which would help visually impaired people tosuccessfully recognise various denominations of Indian Paper Currency and plan to increase the machine learning model's accuracy and efficiency of the whole process.

5.2 Screenshots:

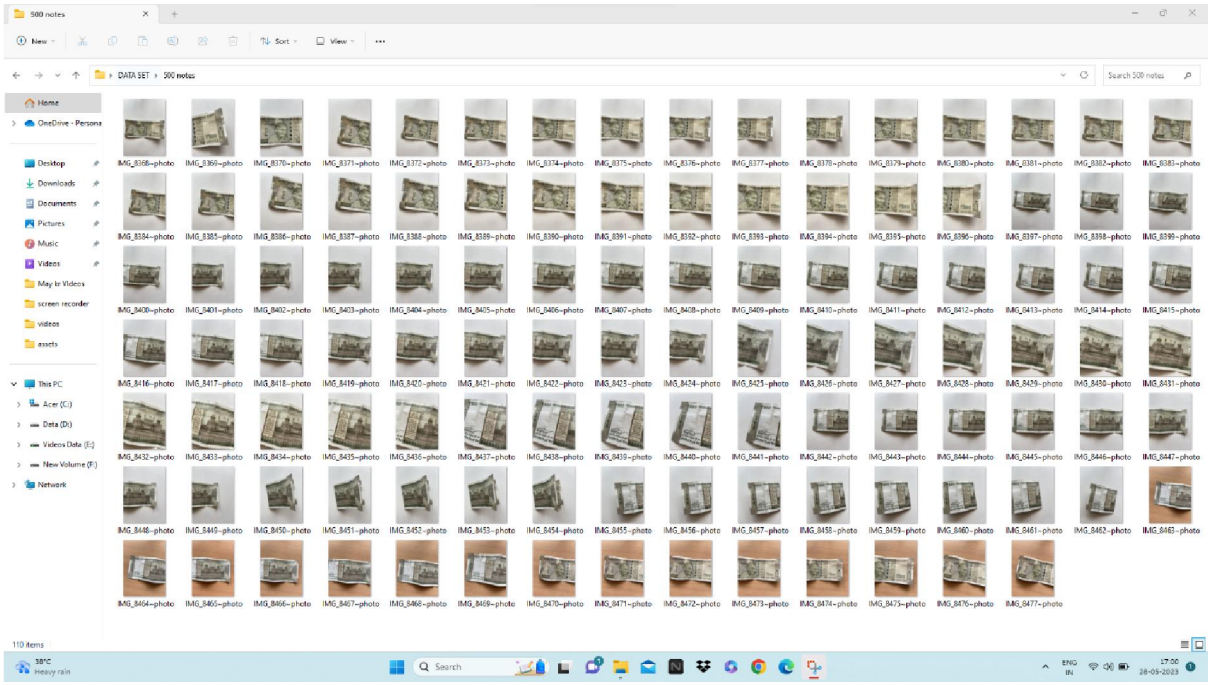

Fig 2: Dataset consisting Images of 500 Indian Currency Notes

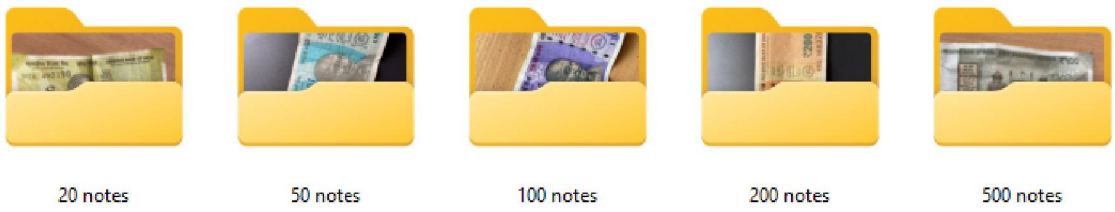

Fig 3: Dataset consisting Images of Various Indian Currency Notes

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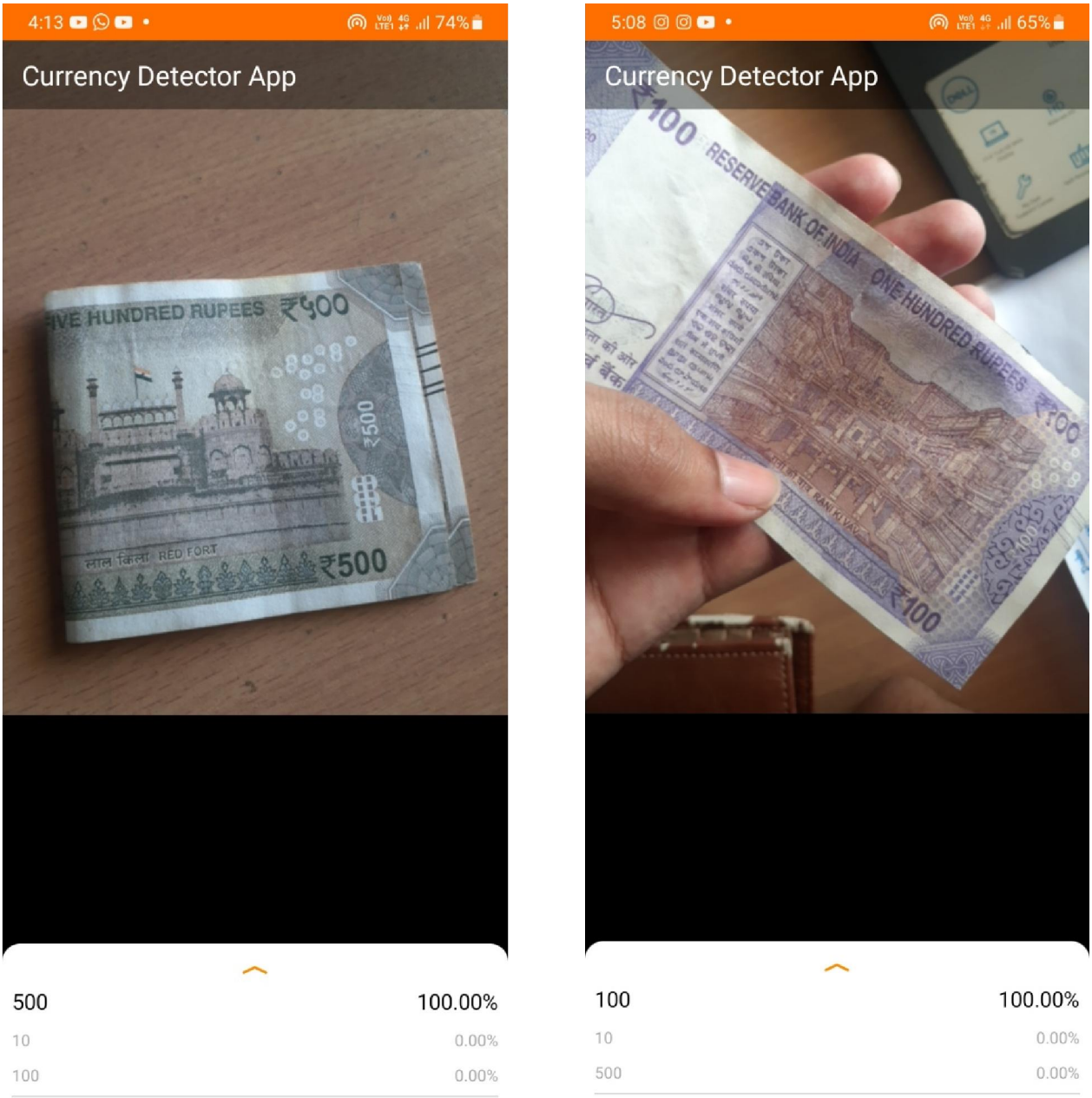

Fig 4 and 5: Results of our Android application

VI. CONCLUSION

Currency counterfeiting is a big problem all across the globe. This impacts the economies of countries as well as common people. The main purpose for developing this android application was to help visually impaired people to easily recognise various Indian Currency Notes with ease with the help of receiving audio output from our android application on successful recognition on that particular denomination.

VII. FUTURE WORK

We plan to develop a system that would be integrated in the same application which would also differentiate between fake and real currency notes. We also plan to add more currency denominations in our android application.

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