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Currency Detection for the Visually Impaired Using Ml

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ABSTRACT - People with visual disabilities face significant challenges in recognizing paper currency due to the similarities in texture and size among different denominations. This can hinder their ability to engage in financial transactions and navigate daily life independently. Although digital payment methods have become popular, paper money remains widely used due to its convenience.

To address this issue, automatic currency recognition systems that use image processing techniques have become essential for visually impaired individuals. By utilizing Convolutional Neural Networks (CNN), these systems can accurately distinguish between different denominations of Indian currencies at any location and time. The system considers critical factors such as color, size, and texture to develop a classification model that enhances recognition accuracy. Texture, size, and color are crucial elements in accurately identifying the denomination of paper currency

KEYWORDS: Currency Recognition, CNN, Andriod Studio, tflite, Currency Detector Application

I. INTRODUCTION

Individuals with visual impairments encounter significant difficulties identifying currency notes, whether from birth or acquired later in life. A study by the World Health Organization found that out of approximately 285 million surveyed individuals, 39 had some form of visual impairment, highlighting the urgent requirement for a dependable system to assist visually impaired individuals in identifying currency. In Maharashtra, India, the prevalence of visual disability is particularly high, with roughly 165 individuals per lakh having visual impairments. Of these, 82% are blind, and 18% have low vision. An efficient and reliable currency recognition system is necessary to help visually impaired individuals recognize various denominations of currency. Advances in image processing technology and the growth of the banking industry provide an opportunity to use machine learning to create an accurate and dependable currency detection system. This system would enable visually impaired individuals to quickly and easily identify currency notes, improving their ability to conduct financial transactions independently and decreasing their susceptibility to fraud or exploitation.

By utilizing a basic CNN model and converting it into a tflite model, we can incorporate it into an Android app that is simple to install on smartphones, making it accessible to wide range of users. The goal of this research is to design a low-cost, user-friendly solution that empowers visually impaired individuals to conduct financial transactions independently and confidently. By improving their ability to recognize currency notes, we can empower visually impaired individuals to become more self-sufficient and reduce their reliance on others for financial assistance. This will improve their quality of life and their independence, and uphold their dignity.

II. LITERATURE REVIEW

[1]In this publication, the authors presented a method that involves first detecting the country of origin and then identifying the denomination of the currency. To accomplish this, various regions of the banknote were examined.

The author of [2] this put forth a method for identifying currency using a neural network. The process involved utilizing weighted Euclidean Distance for classification, as well as carrying out various data collection and processing steps

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The authors of [3] provided an overview of the characteristics of Indian currency, including a discussion on the Morphology Filtering process, segmentation, and various analyses. They then conducted a paper currency detection recognition using neural networks. The paper highlights the use of neural networks in recognizing and detecting Indian currency notes.
In [4], the author provided a comprehensive explanation of the Convolutional Neural Network (CNN), covering all its aspects.
The book [5] provides detailed information about CNNs and their various layers, demonstrated through mathematical illustrations and graphical representations. It explains the process of converting an image into a matrix format before detection and matching it with a trained model. The book covers the entire process between matrix formation and recognition, with mathematical calculations. Additionally, the effects of different convolutional kernels on horizontal and vertical edges are also discussed.
Van De Sande conducted a comparison between local color descriptors and gray value descriptors, using Mikolajczyk and Schmid's evaluation framework to determine the amount of local gray value invariants. The study found that a combination of color information and SIFT provided better results. [6]

III. METHODOLOGY

By combining advanced computer vision with machine learning techniques, the issue of currency detection for individuals who are visually impaired can be resolved. Here are a few basic guidelines that may prove useful:
Gathering information: The process involves obtaining visuals of assorted denominations from varying perspectives and in diverse lighting settings. This collection will be employed to educate the artificial intelligence program. Before analysis, it is essential to prepare the collected images. This involves eliminating any disturbances in the pictures and creating a uniform image layout while focusing on specific sections of interest - specifically where currency denominations are visible. Standardizing these photos will allow for accurate evaluation during subsequent steps of this process.

To extract significant data from pictures, computer vision techniques are employed to obtain feature sets. These characteristics can vary and may include aspects such as hue, feel, or form among others that will aid in describing the image accurately.
Instruct the AI program to learn by means of a machine learning algorithm that utilizes processed images and extracted characteristics. It is within this process that we could train such an algorithm in recognizing various types of currency denominations available for use.

After the completion of training, the machine learning algorithm can be put to use. It is possible and practical to deploy it on a number of devices including smartphones or wearable gadgets. With this development in place, these said devices have further functionality - specifically that they can capture images containing currency notes which will then proceed with identification by running through the trained machine learning algorithms; accurately distinguishing between denominations with ease.

It is possible to enhance and upgrade the algorithm by collecting more data from visually impaired users, as well as taking into account their feedback. The evolution of this technology can be a continuous process that involves constant improvement based on real-world usage scenarios. As we continue gathering information and analyzing it in depth, we may uncover patterns and trends that were previously unknown or overlooked. Moreover, conducting user testing sessions with individuals who experience visual impairments could help us identify issues early on in the development cycle before they become major problems later down the line when implementing new features or updates.
In general, this method can support individuals with sight impairments in distinguishing varying monetary bills through a more self-sufficient and convenient means of identification. As a whole, it aids those who face visual limitations by enabling them to recognize different denominations of currency notes without requiring assistance or intervention from others. This process promotes equality for all members of society regardless of their physical abilities or the challenges they may encounter.

IV. SYSTEM DESIGN

1. Android Studio
Android Studio is a software tool that helps developers create apps for Android devices. It provides various functions such as editing the app's code, designing its layout, and finding and fixing any issues or errors that may come up while

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developing the app. Overall, it's an essential tool for building Android apps efficiently, with the use of Programming languages like Java and Kotlin

2. CNN Model

Convolutional Neural Network (CNN) is an AI model used for recognizing patterns and features in visual data, such as images and videos. It consists of layers that perform operations like convolution and pooling to process the input data at different levels of abstraction. CNNs can accurately classify and identify visual elements like objects, faces, and scenes. They are widely used in computer vision, self-driving cars, medical imaging, and other fields.

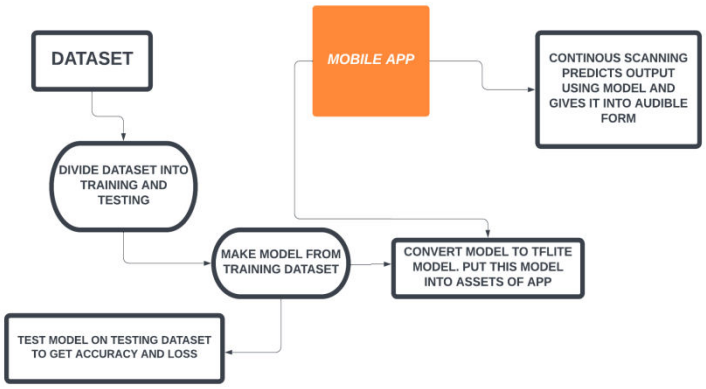

Fig -1: Flow of Currency Detection Application

3. tflite

TensorFlow Lite (tflite) is a set of tools that makes it easy to run machine learning models on different devices. It supports various programming languages and is known for its high performance. With tflite, you can perform common machine learning tasks such as an image or audio classification, text classification, pose estimation, and object detection. To represent the TensorFlow Lite model in an efficient way, tflite uses a format called Flat Buffers. This format leads to a small code footprint and high efficiency, resulting in fast inference. A TensorFlow Lite model comes with metadata that includes a human-readable description of the model and machine-readable data used for classifying images. To use a machine learning model, you need to first split the dataset into training and testing datasets. Then, you generate a classified model using the CNN classification method.

V. WORKING

The CNN model implemented in the code is a basic convolutional neural network with three convolutional layers and three max-pooling layers, followed by a fully connected (dense) layer. The model is trained to classify images into two classes using sparse categorical cross-entropy loss and the Adam optimizer. The model also uses data augmentation techniques like random flipping, rotation, and zoom to improve its performance.

1. code is an implementation of a CNN model to classify Indian currency notes. It uses the Keras API and TensorFlow backend.
2. The dataset consists of images of Indian currency notes in the denominations of 10,20,50,100,200 and 500. The image_dataset_from_directory function of TensorFlow is used to load the data.

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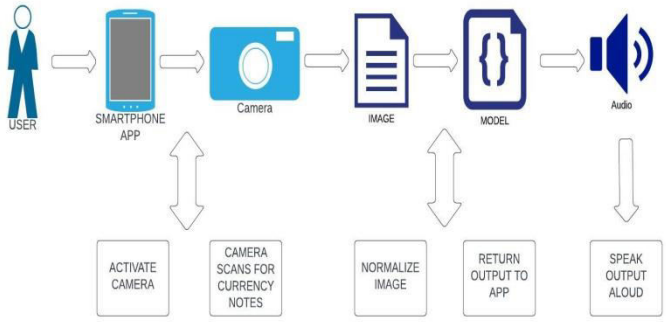
3. The images are preprocessed and normalized. Then a CNN model is created using the Keras Sequential API. The model consists of several convolutional and pooling layers backed by a flattening layer and a few dense layers. The model is trained on the data using the fit method.
4. Data augmentation techniques like random flipping, rotation, and zooming are also used to improve the performance of the model.

Finally, the model is evaluated using the evaluate method and the training and validation accuracies and losses are plotted.
After that, the created model is converted into the tflite and then added to the asset of the application.



VI. CONCLUSION

In conclusion, a Currency Detection Application can be a powerful tool for Visually Impaired persons. the use of a simple CNN converted into a tflite model and embedded into an Android app can successfully aid visually impaired people in detecting currency. This technology has the potential to significantly improve the quality of life for the visually impaired.

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