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Image Insights Android Application using ML-Kit

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A B S T R A C T

Image classification is a rapidly growing field in computer vision, aimed at narrowing the gap between machine vision and human vision. The goal is to enable machines to recognize images in the same way that humans do by assigning an appropriate class to a given image. In this study, we present an Android application named "Image Insights" that uses Google's ML Kit for image classification. The application employs a TensorFlow Lite model, which is supported by ML Kit, to classify the given images. ML Kit offers a base model that can recognize over 400 entities, as well as the ability to create custom TensorFlow Lite models. This application aims to provide users with a powerful and intuitive tool for image classification that can be used in a variety of settings.

Keywords: Image classification, computer vision, machine learning vision kit, TensorFlow lite model, android studio

1. Introduction

Image classification is a computer vision technique that identifies images based on their visual content. As machine learning becomes more popular, deep learning and neural networks gain popularity. A classifier analyses vast quantities of data and extracts valuable characteristics for training. Image classification is the process of categorizing pixels within a digital image. For classification using multi-spectral data, each pixel's spectral pattern is taken into account. In image classification, different characteristics appear as grey levels or colours that correspond to the objects that these characteristics indicate on the ground. Digital image processing involves image classification, and distinguishing between objects can be difficult. Computer vision has benefited from image classification as a result. An image is classified into groups by classifying it.

Pictures can be divided into various groups. Examining and categorizing pictures by hand can be laborious, especially if there are many of them. Convolutional Neural Networks (CNN) and Google's Machine Learning Kit (ML-Kit) are two methods for classifying photos The use of image classification in autonomous driving is a great example of its application in the real world. image classification may be used for a variety of purposes, involving automated picture organizing, stock photography, and video websites, visual search for raised product discoverability, huge visual databases, and image and face recognition on social networks. As a consequence, image categorization has emerged as a critical job in the field of computer vision. In conclusion, image classification is a crucial component of digital image analysis, and it has numerous applications in the real world. Automated image classification using computer vision is essential for tasks involving a large number of images.

2. Literature Review

Numerous projects and ideas have emerged for image classification on new platforms or to replicate well-known applications. However, despite the abundance of resources available, there is currently no definitive reference document that can be considered as a suitable guide for this field. As part of our research, we discovered that several previous projects related to our theme had been developed using older technologies, such as neural networks. While these were functional applications, these technologies do have their limitations. As a result, it is essential to continue exploring new and innovative approaches to image classification that can overcome these limitations and improve the accuracy and efficiency of this critical field. To overcome these limitations, we have introduced image classification using Google's Machine Learning Vision Kit, which provides higher accuracy. This technology utilizes advanced machine learning techniques and has several benefits over older technologies. By incorporating this technology into our project, we aim to improve the accuracy and efficiency of image classification.

[1] Christoph Sager, Christian Janiesch, and Patrick Zschech's work "A Survey of Image Labelling for Computer Vision Applications" presents a systematic approach to the job of manual labeling in computer vision. They organize this task depending on the work organization, user interface design possibilities, and user support strategies. The study's authors identified five key use archetypes that are regularly employed in the field of computer vision. Complex scene comprehension, diagnosis and categorization, picture retrieval, instance identification, and statistics production are examples. They also covered the major application areas where computer vision is widely employed, such as autonomous driving, healthcare, mapping, and surveillance, research, and broadcasting. Their research provides valuable insights into the challenges associated with image labeling and the various aspects of

computer vision. It highlights the importance of understanding these factors to develop more efficient and accurate image classification systems in the future.

[2] The paper "ML Kit in Firebase for App Development" by K. Lakshmi, Atmakur Vani, Banda Srinivasulu, and Kadapa Shaikshavali introduces the capabilities of Firebase ML Kit. This software development kit provides a comprehensive set of features for mobile app development, leveraging Google's expertise in machine learning. The library is designed to be user-friendly, allowing developers to easily incorporate machine learning operations into their Android and iOS apps, regardless of their level of experience with the technology. With the growing need for intelligent data processing in today's fast-paced world, the ML Kit in Firebase is a valuable tool for building advanced applications.

[3] In the article "Image Recognition Method Based on Deep Learning" authored by XinJia, a comprehensive overview of deep learning techniques and their recent progress is presented, along with their applications in vision tasks. The paper also highlights the challenges and future trends in designing and training deep neural networks. The author's insights on this topic are highly valuable for researchers and practitioners in the field of image recognition and deep learning.

[4] In the paper titled "An Overview on Image Classification Methods in Image Processing," K. Ganapathi Babu, Dakannagari Harith Reddy, P. Divya Teja, and C. Yosepu provide a brief yet informative overview of various supervised classification methods used in image classification. Images are represented by pixels, and image classification involves grouping these pixels into different classes. Non-parametric approaches are commonly used for image classification. This survey covers different classification methods and their limitations, providing readers with a diverse understanding of the topic. Overall, this paper presents concise knowledge on image classification methods and is a valuable resource for those interested in the field of image processing.

3. Analysis of Problem

Technology is evolving rapidly, leading to the development of new ways to automate tasks. For example, self-driving cars, delivery drones, and automated manufacturing systems are all products of technological advancement. Image classification is a crucial tool in automating tasks and enabling machines to understand their environment. For example, self-driving cars use image classification to identify traffic signs, pedestrians, and other vehicles on the road.

Systems like self-driving cars, robots, and automated machines rely on image classification to navigate their surroundings. For example, warehouse robots use image classification to recognize different items and pick them up for delivery. Image classification can also aid visually impaired individuals by helping them classify objects and images in real-time to identify their surroundings. For example, a smartphone app that uses image classification can help a visually impaired person recognize objects or people around them and navigate their surroundings. One of the significant advantages of image classification is that it does not require an internet connection, making it useful in areas with limited connectivity. For example, an agricultural drone can use image classification to identify crop health and pests without an internet connection.

Image classification works based on manually built datasets, allowing accurate classification of objects and images based on their class. For example, an image classification model can accurately classify dog and cat images based on a dataset of labelled images of dogs and cats.

4. Proposed Work

Our system proposal uses Machine Learning Vision Kit to classify input images, and we have created an Android application named "Image Insights" utilizing Android Studio. The application can identify and extract information from a wide range of categories. We chose Machine Learning Vision Kit for the training process as it can recognize over 400 entities and supports custom TensorFlow Lite models, resulting in highly accurate image classification.

Our proposed system involves an Android mobile application that can classify images and identify flowers in real-time using the device's camera or gallery. The flower identification feature focuses on five specific flower categories. The application displays the image classification results in terms of accuracy percentage. Our system aims to provide a user-friendly and efficient way for users to identify flowers with high accuracy.

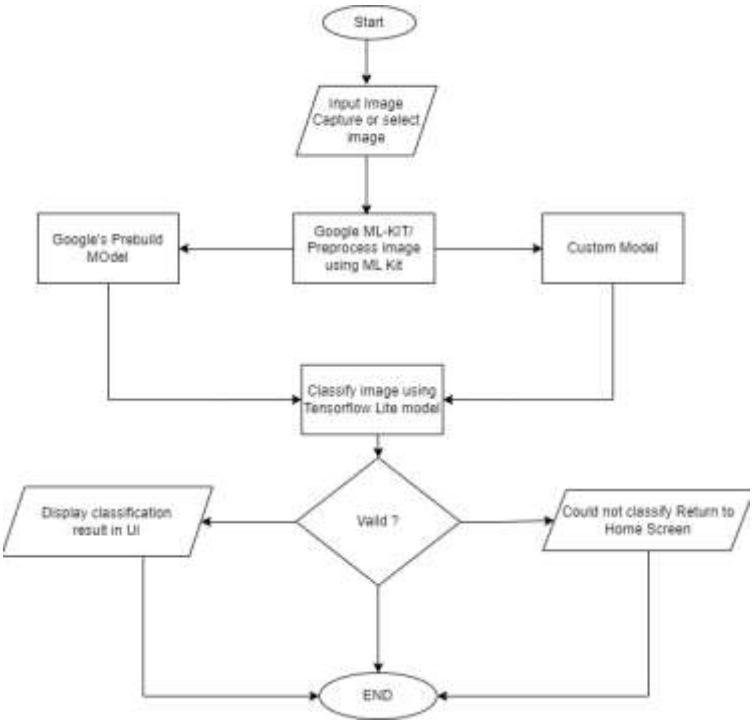

Fig. 1. Flowchart of System

5. Objective

Using image classification, pixels in a picture are categorized according to their land cover, which is then analysed to produce themed maps. Each pixel's spectral pattern is used for classification in multispectral data. To accurately represent each ground cover in the image, each feature should be given a distinct colour or grey level that matches its type. Digital picture analysis is crucial in sectors like environmental monitoring and urban planning.

6. System Requirement

Our project's system requirement specification outlines the necessary requirements for the project.

Machine Learning Vision:

Machine learning (ML) is a type of artificial intelligence (AI) that enables software applications to predict outcomes without being explicitly programmed to do so. It uses historical data as input to predict new output values. Machine learning is important for businesses to gain insights into customer behavior, operational patterns, and develop new products. Many leading companies, such as Facebook, Google, and Uber, rely on machine learning for their operations.

TensorFlow Lite:

TensorFlow Lite is a collection of tools designed to support developers in running machine learning models on mobile, embedded, and edge devices. It is an open-source deep learning framework that is cross-platform and can convert pre-trained models in TensorFlow to a format that can be optimized for either speed or storage

Java:

Java is a programming language and computing platform that was released by Sun Microsystems in 1995. It has evolved over time and is now used in many applⁿ and services. Many new and innovative products and digital services rely on Java as it provides a reliable platform.

XML:

XML (Extensible Markup Language) is a markup language that is similar to HTML, but without predefined tags. It allows developers to define their own tags to store data in a format that can be stored, searched, and shared. XML's standardized syntax makes it easy to share or transmit data across different systems or platforms.

Android Studio:

Android Studio is an integrated development environment (IDE) that allows developers to build apps for Android phones, tablets, Android Wear, Android TV, and Android Auto. It provides structured code modules that can be independently built, tested, and debugged

7. Implementation

Developers use Android application frameworks to create a final product that meets their needs. The android framework is the set of APIs that allow developers to quickly and easily write apps for android phones. It consists of tools for designing UIs like buttons, text fields, image panes, and system tools like intents (for starting other apps/activities or opening files), phone controls, media players, etc.

The front end of a mobile app is the part that a user interacts with and sees, including the app's design. It is essentially the user experience (UX) of the app. The front end comprises components that form the user interface and determine what the end user sees when they open the app. An example of this is the YouTube mobile app, which showcases various components and elements on its front end.

In our project we have used extensible Markup Language, also known as XML. Like HTML, XML is also a markup language. It was designed as a standard method of encoding data in web-based applications. Even so, XML is case-sensitive, requires that tags be closed correctly, and maintains whitespace. A backend is a crucial part of a software system that enables the implementation of various functionalities such as backing up user data to the cloud, serving content to client apps, facilitating real-time interactions, and sending push notifications through Google Cloud Messaging for Android (GCM), among others. The backend plays a significant role in ensuring that the app functions smoothly and efficiently, providing users with a seamless experience. In our project we have used Java as backend. Java has been the language of choice for mobile app development centered on Google's Android platform. Java is a highly popular programming language that allows for cross-platform support and ease of portability when creating apps for multiple OS and hardware types.

In this project we have used the Google's ML-Kit for developing the application on image classification. The Google's ML- kit has its own pre build dataset model which has almost 400 different classes of images. In our project we have made two fragments in which in first fragment we have used pre build model along with Ml kit which gives us the output that which classes of images are present in the given input image and in another fragment of our application we have used the custom model which we have created on teachable platform by using tensor flow lite named as "flowers. tflite". This fragment gives us the output as the class of flower to which the given image is belongs.

The working of Google's Ml kit is that it provides us the different functions such as bitmap and image labeling by using bitmap we are converting and arranging the pixels of our image in order to pass as an argument to the image labeling function after passing to this function it then processes our image according to the module provided, after that we get an output i.e., the name of the class that image is belongs.

User Interface:

Fig 2: Homepage

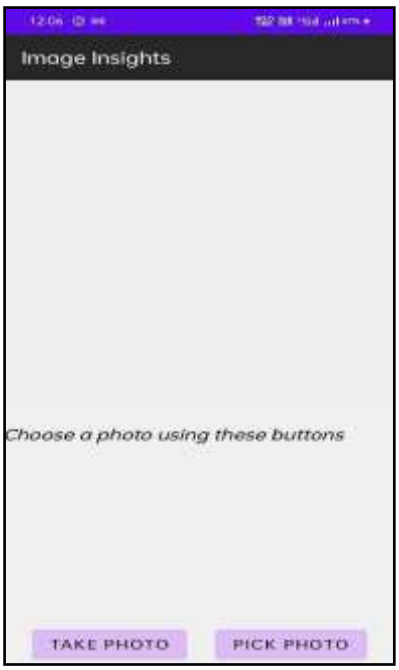

Fig 3: Activity Page

Output of first fragment i.e., Image Classification:

Fig 4: Output 1

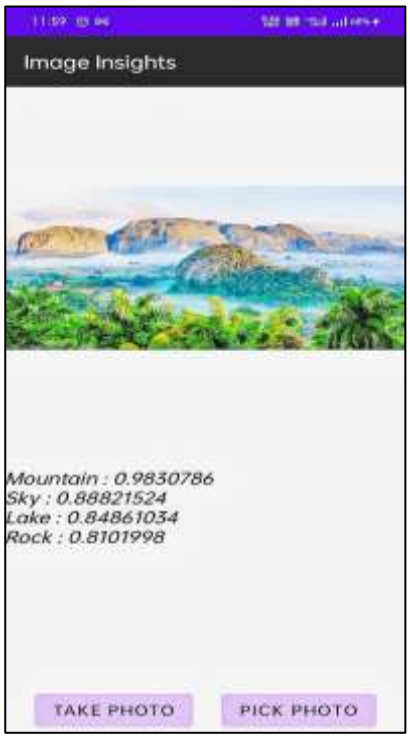

Fig 5: Output 2

Output of Second fragment i.e Flower Identification :

Fig 6: Output 3

Fig 7: Output 4

8. Conclusion

Image classification requires an efficient system that can extract features and classify them accurately. To address this challenge, we utilized the Machine Learning Vision Kit along with Google's pre-built model and our custom TensorFlow Lite model. Our resulting solution, Image Insights, was thoroughly

tested on Android mobile devices, and its user interface components were found to be highly responsive. Our study focused on the ML Kit approach, which involved building, training, and testing the model for accurately classifying images into different categories. However, it is worth noting that the processing of these images takes significantly longer than that of standard JPEG images.

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