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A Review on Image Classification

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ABSTRACT

Image Classification is a fundamental task that attempts to comprehend an entire image as a whole. The goal is to classify the image by assigning it to a specific label. Typically, Image Classification refers to images in which only one object appears and is analyzed. The use of machine learning and neural networks is a growing trend in software development, and has grown immensely in the last couple of years in the light of an increasing need to handle big data and large information flows. This paper shows the image classification can be done using two techniques, convolution neural network and machine learning vision kit.

Keywords: Image classification, convolution neural network, machine learning vision kit, deep learning, supervised, unsupervised.

1. INTRODUCTION

What is Image?

An image, digital image, or still image is a binaryrepresentation of visual information, such as drawings, pictures, graphs, logos, or individual video frames. Digital images can be saved electronically on any storage device.

What is Classification?

Classification is the process of identifying and grouping objects or ideas into predetermined categories. In data management, classification enables the separation and sorting of data according to set requirements for various business or personal objectives.

What is Image Classification?

An image classification is a technique that is used to classify or predict the class of a specific object in an image. The main goal of this technique is to accurately identify the features in an image. Simply, image classification is where machines can look at an image and assign a (correct) label to it. It's a key part of computer vision, allowing computers to see the world as we do. And with the invention of deep learning, image classification has become more widespread.To increase performance the application of neural networks to learning tasks that contains more than one hidden layers. Deep learning is part of a broader family of machine

learning methods based on learning data representation, as opposed to hard code machine algorithms.

One of the most frequently used deep learning method for image classification is the convolutional neural network (CNN). CNN learns directly from the image data, thus eliminating manual feature extraction.

Structure for performing Image Classification

1. ***Image Pre-processing:*** The aim of this process is to improve the image data (features) by suppressing unwanted distortions and enhancement of some important image features so that the computer vision models can benefit from this improved data to work on. Steps for image pre-processing includesReading image, Re-sizing image, and Data Augmentation (Gary scaling of image, Reflection, Gaussian Blurring, Histogram, Equalization, Rotation, and Translation).
2. ***Detection of an object:*** Detection refers to the localization of an object which means the segmentation of the image and identifying the position of the object of interest.
3. ***Feature extraction and training:*** This is a crucial step wherein statistical or deep learning methods are used to identify the most interesting patterns of the image, features that might be unique to a particular class and that will, later on, help the model to differentiate between different classes. This process where the model learns the features from the dataset is called model training.
4. ***Classification of the object:*** This step categorizes detected objects into predefined classes by using a suitable classification technique that compares the image patterns with the target patterns.

Image Classification techniques can be categorized into two category such as:

- Supervised image classification techniques
- unsupervised image classification techniques

Supervised classification

Supervised image classification methods use previously classified reference samples (the ground truth) in order to train the classifier and subsequently classify new, unknown data. Therefore, the supervised classification technique is the process of visually choosing samples of training data within the image and allocating them to pre-chosen categories, including vegetation, roads, water resources, and buildings. This is done to create statistical measures to be applied to the overall image.

Unsupervised classification

Unsupervised classification technique is a fully automated method that does not leverage training data. This means machine learning algorithms are used to analyze and cluster unlabeled datasets by discovering hidden patterns or data groups without the need for human intervention. With the help of a suitable algorithm, the particular characterizations of an image are recognized systematically during the image processing stage. Pattern recognition and image clustering are two of the most common image classification methods used here. Two popular algorithms used for unsupervised image classification are 'K-mean' and 'ISODATA.'

2. METHODOLOGY

Image Classification can be achieved using Machine Learning, Image classification with machine learning leverages the potential of algorithms to learn hidden knowledge from a dataset of organized and unorganized samples (Supervised Learning). The most popular machine learning technique is deep learning, where a lot of hidden layers are used in a model.

Image Classification can be done by using

1) Convolution Neural Network
2) Machine Learning Vision Kit

What is Convolution Neural Network?

A CNN is a framework developed using machine learning concepts. CNNs are able to learn and train from data on their own without the need for human intervention. In fact, there is only some pre-processing needed when using CNNs. They develop and adapt their own image filters, which have to be carefully coded for most algorithms and models. CNN frameworks have a set of layers that perform particular functions to enable the CNN to perform these functions.

The basic unit of a CNN framework is known as a neuron. The concept of neurons is based on human neurons. These are statistical functions that calculate the

weighted average of inputs and apply an activation function to the result generated. Layers are a cluster of neurons, with each layer having a particular function. A CNN system may have somewhere between 3 to 150 or even more layers: The "deep" of deep neural networks refers to the number of layers. One layer's output acts as another layer's input.

CNN layers can be of four main types: Convolution Layer, ReLu Layer, Pooling Layer, and Fully-Connected Layer.

- **Convolution Layer:** A convolution is the simple application of a filter to an input that results in an activation. The convolution layer has a set of trainable filters that have a small receptive range but can be used to the full-dept of data provided. Convolution layers are the major building blocks used in convolutional neural networks.
- **ReLu Layer:** ReLu layers, also known as Rectified linear unit layers, are activation functions applied to lower overfitting and build the accuracy and effectiveness of the CNN. Models that have these layers are easier to train and produce more accurate results.
- **Pooling Layer:** This layer collects the result of all neurons in the layer preceding it and processes this data. The primary task of a pooling layer is to lower the number of factors being considered and give streamlined output.
- **Fully-Connected Layer:** This layer is the final output layer for CNN models that flattens the input received from layers before it and gives the result.

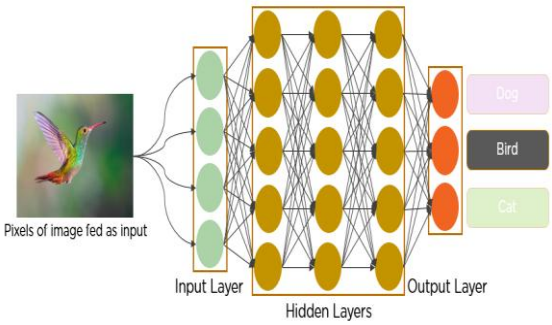

Fig 1: Working of Convolutional Neural Network

What is Machine Learning Vision Kit?

ML Kit is a mobile SDK that brings Google's on-device machine learning expertise to Android and iOS apps. ML Kit is powerful yet easy to use Vision and Natural Language APIs to solve common challenges in your apps or create brand-new user experiences. All are powered by Google's best-in-class ML models and offered to you at no cost.

ML Kit's APIs all run on-device, allowing for real-time use cases where you want to process a live camera stream for example. This also means that the functionality is available offline.

With ML Kit's image labeling APIs, you can detect and extract information about entities in an image across a broad group of categories this API is intended for image classification models that describe the full image. The Image Labeling APIs support different image classification models.

- **Base model**

ML Kit's base model returns a list of entities that identify people, things, places, activities, and so on. Each entity comes with a score that indicates the confidence the ML model has in its relevance. With this information, you can perform tasks such as automatic metadata generation and content moderation. The default model provided with ML Kit recognizes more than 400 different entities. The default image labeling model can identify general objects, places, activities, animal species, products, and more.

- **Custom TensorFlow Lite models**

Use other pre-trained models from TensorFlow Hub or your own custom model trained with TensorFlow, AutoML Vision Edge or TensorFlow Lite Model maker.

3. ADVANTAGES OF DEEP LEARNING VS. TRADITIONAL IMAGE PROCESSING

In comparison to the conventional computer vision approach in early image processing around two decades ago, deep learning requires only the knowledge of engineering of a machine learning tool. It doesn't need expertise in particular machine vision areas to create handcrafted features.

In any case, deep learning requires manual data labeling to interpret good and bad samples, which is known as image annotation. The process of gaining knowledge or extracting insights from data labeled by

humans is called supervised learning. And the process of creating such labeled data to train AI models needs tedious human work — for instance, to annotate regular traffic situations in autonomous driving. However, nowadays, we have large datasets with millions of high-resolution labeled data of thousands of categories such as ImageNet, LabelMe, Google OID, or MS COCO.

Example of manual image annotation for supervised training of deep learning algorithms. In a video frame, the bounding boxes for the class "person" are drawn.

4. FUTURE SCOPE

The future of image processing will involve scanning the heavens for other intelligent life out in space. Also new intelligent, digital species created entirely by research scientists in various nations of the world will include advances in image processing applications. Due to advances in image processing and related technologies there will be millions and millions of robots in the world in a few decades time, transforming the way the world is managed.

- **Powering self-driving cars**

In the last years, self-driving cars are the buzz in the auto industry and the tech alike. Autonomous vehicles are already being actively tested on U.S. roads as we speak. Forty-four companies are currently working on different versions of self-driving vehicles. Computer vision is one of the main technologies that makes these advancements possible, and is fuelling their rapid development and enhanced safety features.

- **Boosting augmented reality applications and gaming**

Augmented reality experiments have long tantalized people's imagination. With image classification, transposition of digital information on top of what we see in the world is no longer a futuristic dream. Unlike virtual reality, augmented reality does not replace our environment with a digital one. It simply adds some great perks to it.

- **Empowering educators and students**

Another inspiring application of image classification that is already being put in practice is tightly connected with education again – but this time, with people. Image classification is embedded in technologies that enable students with learning disabilities receive the education they need – in a form they can perceive. Apps powered by computer vision offer text-to-speech options, which allow students with impaired vision or dyslexia to 'read' the content.

- **Improving iris recognition**

Even though iris recognition has been around for a while, in some cases it is not as precise as it's expected to be. The advancement of image classification, however, is bringing new possibilities for iris recognition use across industries with improved accuracy and new applications. Most notably, iris identification is already being used in some consumer devices. The smartphones Samsung Galaxy Note7 and Galaxy S8, and Windows Lumia 950 are among the ones already equipped with such a capability.

5. CONCLUSION

For image classification we need a system that itself can extract features efficiently and classify them. This can be developed using CNN and ML kit. We used Convolutional Neural Network (CNN) for image classification which contains Convolayers to extract features and max pooling to decrease the size of image thus classifies the image accurately and Machine learning vision kit which contains base model and custom image classification model to tailor detection to a specific use case. The Convolution neural network and ML kit can give high accuracy compared to other classifiers. The performance and accuracy is tested on simple CPU as well as GPU.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Rui Wang, Wei Li, Runnan Qin and JinZhong Wu "Blur Image Classification based on Deep Learning", IEEE, ISBN 978-1-5386-1621-5 pp. 1-6, 2017

[2] Rastegari, M., Ordonez, V., Redmon, J., &Farhadi, A. (2016). XNOR-net: Imagenet classification using binary convolutional neural networks. Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 9908 LNCS, 525–542.

[3] Gregor, K., Danihelka, I., Graves, A., Rezende, D. J., &Wierstra, D. (2015). DRAW: A Recurrent Neural Network For Image Generation.