License Plate Recognition Using Deep Learning

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Abstract

Automatic License Plate Recognition (ALPR) used in various areas such as security, monitoring and gathering vehicle's data. This is a literature review that searches previous works about license plate recognition using image processing methods and license plate recognition using deep machine learning methods. This literature review aims to inform about differences between these methods and their efficiency. Our vision is to prove that deep machine learning methods is way more accurate and efficient compared to image processed license plate recognition. Therefore, our project name is "License Plate Recognition Using Deep Learning".

1. Introduction

As a technology that has been used in variety of fields and has multi purposes Automatic License Plate Recognition (ALPR) using image processing techniques or deep machine learning methods has been applied to identify vehicles by their license plates and it has an importance in transportation applications. Character segmentation is a key element of an Automatic License Plate Recognition system. Character segmentation extracts images of each character for an optical character recognition (OCR). For gathering the needed accuracy levels for OCR, acquiring fairly segmented characters is needed. Therefore, maintaining recognition system's quality is an important aspect for OCR accuracy.

2. Image Processing

Image processing can be clustered into a few groups such as checking for presence, object detection and localization, measurement, identification and verification. In most cases, the acquired image from the camera is not directly processed within the application. Instead, it is preprocessed, to enhance the image according to the specific task. Examples of preprocessing are noise reduction as well as brightness and contrast enhancement. Some of these steps can be done directly by the camera itself, and thus save CPU load on the host side. To use the camera as a measuring device, it must be calibrated to the physical world. [11] Furthermore, we can also determine the relationship between the camera's natural units, meaning pixels and the real-world units, like millimeters or inches, for example. With color calibration we ensure an accurate reproduction of colors. The better the preprocessing, the better the image quality the better the preprocessing, the better the image quality and the results of the image processing within your application. When it comes to locating parts, usually matching is involved. This means looking for regions that are similar to or the same as a predefined template. This template can either be also an image or a geometric pattern which contains information regarding edges and geometric features. These methods are called correlation pattern

matching and geometric pattern matching respectively. But for character recognition we use a method called optical character recognition, also called OCR. One way to manage optical character recognition is by separating the characters in the image and comparing them with a set of templates. [9] Afterwards, the software can convert the captured data into editable and searchable data. [11] A popular example for OCR is automatic number plate recognition, also known as ANPR. Each of these processing techniques covers a wide spectrum of machine vision applications but combining them can give you even more possibilities.

3. Optical Character Recognition

Optical character recognition (OCR) represents the procedure of data changes gathered from images and video records with deep learning techniques. These techniques comprise the combination of the state-of-the-art deep neural systems for both crucial tasks: plate detection, character segmentation and character recognition which are prepared and approved on artificially generated vehicle plates' dataset [6]. The different frameworks proposed in license plate (LP) detection depends on various properties. These properties utilize basic rules based on deterministic methods such as environment analyze, morphological operations and some kind of measurable analyzes while others settle on learning and grouping frameworks [5]. Context shape technique, contour detection in low light conditions and vehicle image color localization can be good example to these operations and analyzes. The second step in license plate recognition with deep learning methodologies is the character segmentation phase which organizes procedures and techniques have been performed for identify the region character in a license plate image [8]. Character segmentation based on two approaches which are reinforcement learning and hybrid learning. Reinforcement learning approach revealed by behaviorism, which arranges with actions to do for achieving the most efficient way in an environment. State, reward, policy, value and environment might be an element of a reinforcement learning. In the other hand, hybrid approach deals with speed and simplicity for segmenting the character. The last step in license plate recognition is the character recognition phase which is built on breaking down each character to constituent elements like curves and corners. In this phase, the machine will look for matching physical features and actual letters with comparing the collected previous data.

4. Deep Learning

Artificial intelligent is a field of computer engineering which is aims to create machines think, behave and act like human beings. Machine learning is subfield of Artificial intelligent. It creates a software that can predicts outcomes with experience from pervious data. And finally, deep Learning is subfield of machine learning [1]. It is inspired by working principle of human brain. The purpose of using human brain is making learning algorithms easier and better to use. Deep learning has neural networks capable of learning from data like machine learning, but deep learning is more advance with

more layers, neurons and large amount of data . Deep learning models use large set of labeled data and neural networks with many layers. Using labeled data is called supervised learning. Every neuron level selects more acceptable prediction and carry it to next level. Eventually last level come with an outcome. Complexity increase from level to level [1]. Deep learning models learn classifications from images, text and sounds. They can also achieve state-of-the-art accuracy.

Deep learning is also known as deep neural network. The “deep” expression was first used by Geoffrey Hinton who is the grandfather of deep learning . “Deep” refers to number of hidden layers in neural networks. Deep learning theorized in 80’s but it recently become popular. There are two main reasons for that. First, it requires larges amount of labeled data. Second, it requires high GPU performance which have parallel architecture. We use deep learning applications almost in every are in our life’s. For example, voice control in electronic devices, phones, automated driving cars, automatically detecting cancer cells, speech translations…

5. Image Processing with Deep Learning

Computers can automatically classify images with deep learning. They can also describe and distinguish objects in pictures. Convolutional Neural Networks are one of the common and effective neural networks to do image processing. It learns patters, takes images and classifies them according to patterns. First it takes images as input data. Then categorize them. Input data needed to label so by time deep learning model will be able to label them automatically [2]. Region based convolution neural network can be used to detect locations of objects in images. Deep learning models is very useful with their multilevel structures. It helps to classify complicated images. It is also very useful in terms of reduce computation time with high GPU performance.

6. Character Recognition with Deep Learning

If we want to create a deep learning model for character recognition, first we need to define large amount of number images as input data. Deep learning model gets these images as pixels and locate them into neurol network[3]. The neural network is enlarged as the number of input data. According to image classification neural network will has several outputs. These outputs are defining according to characters. If we want to predict the image is “1” outputs are “It is one” and “It is not one”. There are separate outputs for each object, so model can classify objects into groups. All these images train neural network. In time, it starts to learn and classify by itself.

7. Conclusion

Image processing and image processing using deep learning are relevant subjects. Both based on processing input data, but they have different mythologies. Image processing is a traditional method, better for low processing power. Image processing techniques can be used for increasing the power of deep learning. Deep learning is a rising method. It has better, faster solutions for high processing power. It also has better prediction ration with big data sets.

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