An Overview of the Type of Vehicle Detection Techniques

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ABSTRACT:
Today, large-scale vehicles are scattered in different parts of the city and therefore need to be controlled by programmed systems. Applications of these systems include traffic control, urban planning, driverless vehicles, parking lot management by announcing the arrival of a vehicle, detecting stolen or offending vehicles, and so on. Due to challenges such as the multiplicity of objects in the image, weather conditions, different colors and designs of the type of vehicles and very diverse images from different angles of a vehicle in the section identifying the type of vehicles in the photo, Films, moving images, etc. have led to a variety of research, and in this article we will examine some of the techniques.

KEYWORDS: Neural Network, Convolution, Vehicle

1. INTRODUCTION

As humans, we easily observe and identify different people and objects during the day, but this is a difficult and complex task for a car. In this study, the goal is to identify objects such as cars by the car.

Today, we see that large-scale vehicles are scattered in different parts of the city and therefore need to be controlled by programmed systems. Applications of this system include the following:

1) Traffic control systems (for example, traffic volume checking or identifying violators)
2) Urban planning
3) To identify a car whose photo was taken on the street
4) Driverless vehicles
5) Any system that intends to drive on the street and in environments including vehicles.
6) Manage parking lots by announcing the car entering the desired location by the car (or for example to open automatically in the parking lot when the car is in front of it)
7) If the characteristics of the vehicle such as color, model, license plate, etc. can be identified by the vehicle, it can be used to identify the stolen vehicle, violator or any case that is being pursued.

Finding a car in the picture is a bit complicated because, for example, the human face has a simpler structure and less flexibility, but cars have very different shapes and colors because their designs are different. Challenges ahead to identify the vehicle in the image are:

- Very diverse images from different angles of the car
- Variety in cars for example passenger cars, buses and…
- Different colors and designs of cars
- Pictures at night or day
- Images in different weather conditions such as snow, rain or sun or cloud

What is the benefit of recognizing a vehicle in an image?

To answer this question, it is not bad to mention some examples of applications that we are witnessing now. For example, city-wide traffic control cameras detect an object at a speed higher than the allowable speed, in which they first identify the vehicle and then the license plate.

Vehicle recognition is used in many cases, some of which we refer to here, and we examine the various methods of identifying the type of vehicle in the image or objects in the image in general.

To determine if a vehicle is parked in restricted areas, identify the vehicle model, identify the type of vehicle in the aerial imagery, and remove it from the image (as Google did in Google Maps to remove humans from aerial imagery due to Their privacy) can be used for this project. Because in all the mentioned cases, first the location of the vehicle in the image must be identified, and then the next steps must be taken.

Of course, it should be noted that some of the techniques used to find the image of the vehicle can be used to identify other objects in the image, such as face

or bicycle, etc., because in these areas there are almost the same challenges. has it.

Given the challenges raised in this article, we examine a variety of methods for identifying the type of vehicle.

2. A VARIETY OF TECHNIQUES TO DETECT THE TYPE OF VEHICLE

2.1. Set the threshold value on traffic images

This is the simplest way to detect a moving car and is based on the fact that the moving object will have a different light density shape from the background image. By setting a light intensity threshold in a small area of the image, you can distinguish the car from the background image. This method is highly dependent on the threshold value, which is also determined based on the optical density of the image of a particular vehicle and its background image model. [1] Optical variation can be used to optimize the threshold value, but, detection and misdiagnosis of vehicles due to shadows moving with the vehicle during the day, which has the same light intensity as the environment Are around, it is inevitable.[2]

2.2. Detect the edges of traffic images

The performance of this method is based on the features that are present in the edges of the object in the digital image taken from video surveillance cameras such as cars. [4] This method, since it is not a comparison method between two images related to two frames, can also detect stopped vehicles. Morphologically moving edge object detection methods have a wide range of applications. [5] In this method, vehicle edges are displayed relative to road edges. Using the image histogram, along with a series of morphological operations, the properties of the image edges in the spatial domain can be obtained. Methods for detecting three main types of discontinuities in image intensity, namely point, line and edge, can be evaluated in this method. [18] Apply mask to image. For example, in this method, by applying a 3. 3 mask, we can calculate the sum of the values of the intensity levels of the area surrounded by the mask, in the coefficients of the mask. Detecting a single point in an area of an image with a constant or near-constant intensity is conceptually very simple. The only point is that the maximum response of the mask is when the center of the mask is located on a single point. [19] Also when the center of the mask is in areas of equal intensity is zero.

2.3. How to aggregate features and track a moving object

This method causes pattern recognition based on the dimensions and shape of the car, or the geometric features of the car in general. Coding will then be applied to these geometric features of the vehicle. [3] These codes can be generated based on the temporal signal of light intensity at any point in the image. Then, by using these codes and their relationship with the physical concepts of motion, we can predict changes in the behavior of the model obtained from cars.

2.4. Optical flow method

The approaches to the optical flow method take advantage of the fact that the path of each object changes slightly as it moves, while a fundamental change occurs in the corners of the image where the object is moving in and out. It is from the background. [24] The light stream is a spatial mapping of the image pixel in a frame and at a specific time to a place and time other than the next or previous frame.[25] Shows temporary changes in the gray surface structure in the image series. This method also provides information about the relative displacement of the pixels and the spatial structure of the images. Various approaches have been proposed for accurate and effective estimation of light flux. [26] In general, they can be divided into the following groups:

1- Gradient Base 2- Correlation Base and 3- feature-based and multiple methods.

2.5. Data analysis technique

It is necessary to teach the algorithm by analyzing the data and using a lot of images in which images the car is or is not. Meaningful features are then extracted from the image and the car detects where the vehicle is or does not exist at all. [17]

Components of a car vision system:

- One or more digital and analog cameras
- An intermediary that prepares the photo for processing
- A processor like DSP
- Car vision software
- Input and output hardware for reporting results

2.6. A sequence of images

The scene is assumed to be dynamic. The car has three ways to find the car: 1) Remove the field with specified methods. 2) Extract properties with methods. 3) Using methods, separate different formats in the image, and recognize moving objects in the image.

In this method, the images related to the camera and the three-dimensional points of the scene are simultaneously estimated in the form of a mode vector, In this way, first, the background of the image is removed, then the image features are extracted and the three-dimensional position of the image is determined on a line that is connected to those points from the center of the camera and with a high uncertainty at a depth of 0.5 to 5 meters with uniform distribution. Then in each new frame, by repeating the properties, the degree of uncertainty is reduced. [17]

2.7. Use the feature Haar-like

The basic idea is that an object is defined as a cascade according to the simple properties that the classifier organizes in several steps. The proposed system works based on an artificial neural network. This method organizes the image into a cascading classification and then passes a series of filters to obtain the original image. [23]

2.8. Binary objects

Binary objects are classified in a statistical framework. Then a set of properties is examined and evaluated. Finally, we come to the part where we talk about the middle ground. In this method, comprehensive hierarchical classification is performed for the car, which can be used to determine whether the desired part is a part of the car or not.

In this method, when we analyze the image, a series of 0s is obtained. [17]

Application of binary image analysis:

- Check the sections
- Text document processing
- In industry and production

2.9. Classifier design

It is a method that can detect whether there is a machine image or not. The difference between this method and the second method is that in this method, in addition to the shape characteristics of the body, both color and shape properties, and color characteristics are used alone. All this information is enough to classify the image. [27]

2.10. Using the size and angle of the gradient vector

First, the size and angle of the gradient vector of all image pixels are calculated, then the non-maximum pixels and the pixels with weak gradient size are removed. In the next step, the remaining pixels are multiplied based on the gradient angle in both horizontal and vertical planes. The self-correlation coefficients of the edge are then calculated at each level. [27]

2.11. Identify the type of vehicle-based on the network R-FCN

The idea of this method is based on a deep and completely separate learning network and uses the R-FCN framework and the combination of the vehicle database in ImageNet. In this method, hard online sample extraction (OHEM) is used to optimize network parameters. After repeated iterations for network training, the R-FCN model is finally obtained from vehicle target detection. According to the simulation results of this method, the efficiency is 87.48% . [6]

2.12. Type of vehicle classification based on convolution neural network

In this method, the type of vehicle classification is presented based on the deep learning technique. This system consists of two stages. In the first step, we use data amplification to increase the data set problem and imbalance. In the second stage, a torsional neural network is used. [7]

(CNN) or a convolution neural network has different models and architectures. This network is taught using the parameters obtained from the data set. This system is part of an integrated program that allows automatic management of traffic signals based on the type of automatic vehicle detection. [11]

2.13. Vehicle type identification based on compression and deep learning techniques

This method uses compression sensor (CS) theory to generate a competency map for labeling vehicles in an image and uses the CNN scheme to classify them. Salinity map for an image search for vehicles Objective: This step was created using the saliency map to minimize redundant areas. CS is used to measure the desired image and obtain the measurement range. Because the data in the measurement domain is much smaller than the data in the pixel domain, success maps can be generated more quickly. Then, based on this map, we identify the target vehicles and classify them into different types using CNN. Experimental results show that this method can accelerate the calibration steps of the CNN-based image classification window. [20]

2.14. Vehicle type detection using deep learning techniques

The Faster RCNN framework is used, which improves RPN networks and, in combination with the MIT and Caltech datasets, increases efficiency. [21]

3. CONCLUSION

Due to challenges such as the multiplicity of objects in the image, weather conditions, different colors and designs of car types and very diverse images from different angles of the car in identifying and recognizing the car type, we examined various types of artificial intelligence techniques. The use of neural networks has partially solved some of the leading challenges, but it is recommended that we use the convolution neural network due to the persistence of challenges such as tolerance to light changes and the multiplicity of images.

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