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Vehicle Pattern Recognition using Machine & Deep Learning to Predict Car Model

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ABSTRACT

People's lives have changed drastically, and with more salaries and reduced vehicle prices, there are more cars on the road, causing gridlock and chaos. Manually enforcing traffic laws like the speed limit is insufficient. There aren't enough police and manpower to monitor traffic and speed. Thus, we need improved speed calculators that detect automobiles on the road and determine their speeds. Effective automobile identification and velocity measurement are needed to achieve the aforementioned proposal. OpenCV software utilizes the Haar cascade to teach our system to detect the automobile. We use a Haar cascade to identify autos and estimate their velocities using a Python script. This project's real-time application is simple, quick, and cost-effective. The instrument might also measure automobile velocities in simulation tools. This may be improved to recognize all cars and check traffic signal violators. The project may be improved by developing a larger haar cascade, which can detect more cars on the roadways. These automobiles can be found quicker and more efficiently with improved search engines.

KEY WORDS: Machine Learning, Deep Learning, Pattern Recognition.

1. INTRODUCTION

The Intelligent Transportation System (ITS) has been responsible for the implementation of a wide variety of forward-thinking ideas and approaches throughout the course of the last several years. In an ITS, cars, transportation systems, drivers, and other users interact in a dynamic manner in order to accomplish the aforementioned goals. Governments, corporations, and academic institutions collaborate [1, 2] to develop and implement sophisticated ITS in order to enhance the safety and well-being of the transportation system. The advancements in image processing and computer vision approaches are designed to provide significant benefits in the fields of traffic management, traffic monitoring and tracking, vehicle recognition and classification, and a wide variety of other ITS technologies and components such as vehicular surveillance and driver assistant systems [3]. Traditional automobile identification systems identify the vehicle's make and model via the process of manual human interpretation and recognition of the license plate, both of which have modest limits when it comes to real-time performance. To begin, each of these approaches are susceptible to a variety of dangers and have a number of different restrictions. Second, it is very difficult for human eyes to recognize and properly discern between the vast majority of various makes and models of automobiles. Thirdly, human monitoring and surveillance of numerous displays, documenting coming and leaving cars, and locating just the make and model that has to be searched for becomes an operation that is difficult and time-consuming to perform manually. The automated detection of such parameters opens up a new range of considerations, such as preventing excessive warnings to car drivers due to License Plate Recognition (LPR) failure, detecting false number plates and unauthorized vehicles, and ensuring that appropriate tolls are collected by toll collection systems, amongst other things. Recent efforts have been made to improve the performance of the traditional vehicle detection and classification system, which has resulted in the identification techniques for vehicle brands and models receiving more focus. The most important step in determining the precise kind of vehicle is doing a simultaneous categorization of vehicle makes and models using a method such as Vehicle Makes and Model Recognition (VMMR). Despite the fact that the effectiveness of these methods has been claimed to be significant, there is only a limited selection of car brands and models that are used in trials. In order to resolve a broad variety of computer vision issues, the Convolutional Neural Network (CNN) is often used. The very first effort at CNN, LetNet [4,] performed very well when it came to document identification. Alex Krizhevsky's network AlexNet[5] was outfitted and tested to recognize photos, and the results obtained were superior than those obtained by using conventional techniques for feature extraction like as SIFT, SURF, HOG, and so on. In large-scale graphical observation experiments, CNN has shown outstanding performance compared to other models, including VGGNet [6], GoogleNet [7], and numerous others. In this study, we provide a VMMR approach for extracting deep features from a pre-trained model of a CNN VGG16 FC-6 layer. The technique is described in detail in the article. You may choose an area of interest by looking at the front view of the car. The front view is a helpful source of information on the model of the car. After that, the frontal look of each model is used to derive the deep characteristics of each model. Following that, a genetic algorithm is used to choose the characteristics from the feature space that are the most prominent, and ultimately, these features are used for SVM classification.

2. LITERATURE SURVEY

Earlier investigations on the detection of vehicles focused mostly on fundamental, physically relevant characteristics including symmetrical patterns, corners, body colors, and edges [8, 9]. This sort of strategy is distinguishable from others in that it has a low environmental adaptability and the approaches used in it typically fail when used in complicated environments. Motion-based approaches are another another framework for vehicle recognition; nonetheless, poor performance was shown when the ego vehicle and subject vehicle moved rather slowly [10]. Again, design reliability provides an additional technique to identify vehicles that are plainly visible, but it is unable to deal with instances in which the vehicle is obscured [11]. The technique of multi-dimensional classification was used by Alonso et al. [12] in order to accomplish vehicle identification while it was in motion on the road. Chang and Cho [13] proposed a novel method for recognizing cars that is centered on online boosting. It addressed the many distinct challenges that come with vehicle detection in each individual domain. Convolutional Neural Network is the first option (CNN) Over the last several years, the CNN has shown significant progress in a variety of computer vision tasks. The work that was done [14] in the area of VMMR proposed by Fang et al., in which they indicated that the tasks may be carried out in a manner that progresses from coarse to fine. CNN began by locating the discriminating aspects of the vehicles, and then proceeded to extract the global and local features from the complete vehicle image as well as the parts that were singled out. In the end, characteristics were categorized with the help of SVM. Convolution neural network was proposed as the basis for a system that might be used by Ren et al. to recognize automobiles that were passing by [15]. According to Dehgan et al. [16], a CNN-based automobile manufacturers, model, and color identification system with a minimal level of complexity has been proposed. Researchers led by Huang et al. [17] investigated the feasibility of a deep CNN-based fine grain VMMR. They employ a technique called region CNN (R-CNN) to find the automobile as well as its individual components, and then they use those components' attributes to train an SVM for classification. Gao and Lee [18] proposed a method for local tiled CNN that would change the local tile configurations for the CNN weight sharing scheme. This method would be able to offer cross-sectional, rotational, and scale invariance for make and model identification. Zhang has developed a method of vehicle classification that is based on deep CNN. Within this method, a solution was given to classify automobiles in real world photos exceptionally well [19, 20]. B. Characteristics of Handmade Construction Vehicle analysis is something that may be done in a number of different scenarios. SVM and random forest classification were used by Chen et al. [21] in order to categorize the vehicles into the following four groups: automobile, truck, motorcycle, and bus. Both local and global characteristics have been included into VMMR by Abdul Maseeh et al. [22], while Hsieh et al. [23] have proposed a Speed Up Robust Features (SURF) method for the detection and identification of vehicles. This was initially recommended for the vehicle and model identification by Petrovic and Cootes [24], which provides the framework and methods for later study. The front or rear views of the car are selected because they have an efficient computing cost and differentiating qualities in the ROI. Prokaj and Medioni[25] have developed a model-based technique for the categorization of automobiles. This method makes use of 3D modeling to match the visual properties of various vehicles. Ramnath et al.[26] have presented an innovative technique for the recognition of vehicle models with 3D curve matching from a single picture. This enables the researchers' systems to test a model type form from a random view. However, the main disadvantage of this approach is that it requires a large number of calculations, which is the most significant limitation of this method. Zhan et al.[27] retrieved Harr-like characteristics from the training images in order to create a global network of appearance of fine-grain feature and then trained the features using SVM to differentiate between intra-class distinctions of vehicles. This allowed the researchers to create a global network of appearance of fine-grain feature. Zhang [28] proposed a very dependable classification system that could be created by using a cascade ensemble classifier and selecting the option to not accommodate scenarios in which there is insufficient uncertainty but an exceptionally accurate classification system must be developed. Clady et al. [29] came up with a multiclass vehicle type identification method based on directed outline points. In this scenario, the similarity between an input instance and the classes of a dataset can be determined by three polling formulas and a distance error, all of which can be combined to produce a discriminating feature. In addition, the similarity between an input instance and the classes of a dataset can be determined. Due to the fact that there are just a few subordinate groups in the study repository for each of these approaches, the restriction of the close framework is rather severe. In addition, the vast majority of these mechanisms are very dependent on low-level properties that have been created, and these qualities could not separate themselves much from other subordinate classes that have comparable characteristics.

3. PROPOSED SYSTEM

The efforts that are being made manually to prevent persons from breaching traffic restrictions such as the speed limit are not sufficient. There is not a sufficient number of police officers or other personnel available to monitor the traffic and cars on the roads and ensure that they are traveling at an appropriate pace. As a result, we need technologically superior speed calculators to be put on the roads so that they can accurately identify vehicles and determine their speeds.

The effective identification of vehicles operating on roadways and the accurate measurement of those vehicles' speeds are two fundamental conditions that must be satisfied before the concept described above can be put into practice. In order to accomplish this goal, we may make use of the OpenCV software, which is based on the Haar cascade and can teach our computer to recognize the target object, which in this instance is the automobile.

4. RESULTS

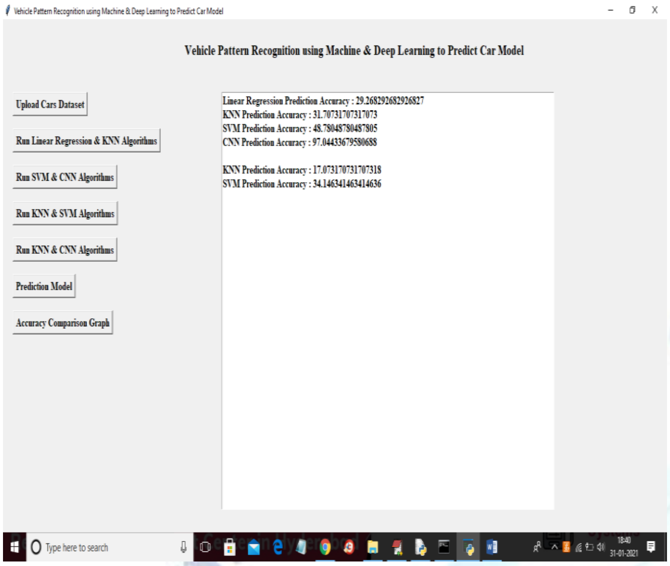

Figure 1: Accuracy of various algorithms

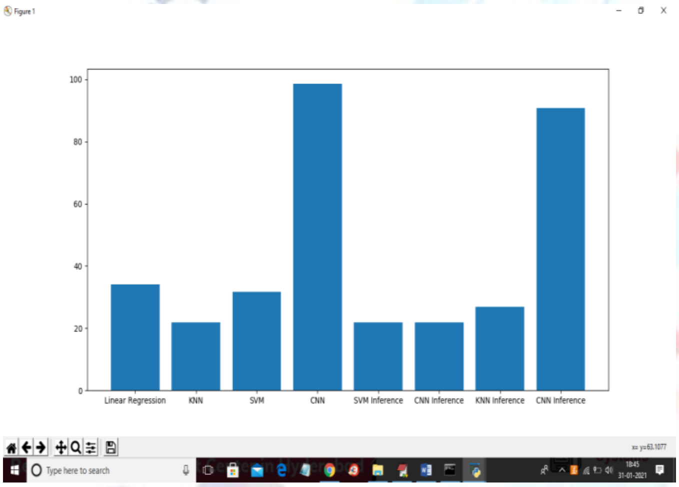

Figure 2 : Graphical representation of Accuracy of various algorithms

5. CONCLUSION

Moving vehicles may be separated into their component parts via the use of frame subtraction and masking methods. The amount of time that passes between frames and the number of corners that are detected on an object are both factors in the calculation of speed. In order to discern between a single car or several automobiles, frame masking is the last step. The speed detection was successful with an inaccuracy of +/- 2 kilometers per hour on average.

Conflict of interest statement

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

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