Detection of Personal Vehicles Stopping on the Road in a No Parking Area Using Support Vector Machine

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***Abstract*—Traffic jam is an important issue in the lives of people in the capital city. To reduce this problem, the researchers are interested in developing a personal vehicle recognition system that is stopping on the road in a no parking area. With the application of Support Vector Machine by receiving the signal from the CCTV camera to improve the image and find the specific characteristics of the car stopping on the road in a no parking area. Then learn to recognize the parking behavior of a personal car, that stopping on the road in a no parking area, using the Linear Regression. The experiments showed that recognition of personal cars parked on the road in a no parking area had the accuracy at 87.56 % which could implement to detect the car parking in a no parking area.**

I. Introduction

According to the Global Traffic Scorecard Report of the Year 2016 Global Traffic Report [1] found that Thailand is the world's number one of traffic jam. This traffic problem in Thailand had cause from many problems for example people do not drive discipline, stopping on the road in a no parking area, the lack of lane, also the sale of goods obstructing traffic [2]. In this article, the researchers proposed a vehicle recognition system that stopping on the road in a no parking area. To detection of personal cars parked, the process begins with memorizes the system about scenario of the local road and shape of car then train the characteristic of car parking with window slide technique. Next use the Local Binary Patterns (LBP) and the Histograms of Oriented Gradients (HOG) to classify the characteristics of personal cars stopping on the road in a no parking area. A Support Vector Machine (SVM) is used to group all available areas in the window slide process. Finally, the method used by the majority vote is to evaluate the car stopping on the road in a no parking area. Using binary results defined by SVM. The major difference with the previous approach was the use of the HOG feature with the SVM to recognize the car stopping on the road in a no parking area. In addition, the researcher's system was designed to be used for traffic images recorded by CCTV cameras.

II. Related Works

Techniques for analyzing accidental images in the analysis of road accidents. For example, accidental image analysis using the Hidden Markov Model (HMM) to classify events, various accidents [3]. It provides 4 types of roadside monitoring techniques, including parked vehicles, slow-moving vehicles, vehicle parts and lane changes [4]. However, Ikeda's research has not yet been able to detect car accidents on the road using a technique called "Image Tracking" [5] and HMM is used to detect collisions of cars, [6] which HMM used to detect unusual events on the road. In addition, research on car brand recognition (logo) with the LPR (License Plate Recognition) system (Intelligent Transportation Systems: ITS) is becoming more important. The current driving supervision of the car will control the speed. The license plate must be checked to verify the car properly [7]. Vehicle Logo Recognition that identifies the vehicles that can differentiate a vehicle's logo with Vehicle Manufacturers Recognition (VMR) [8]. In recognition of the car's logo. Detect vehicles from stereo cameras to detect vehicle models and create models of recognition using the HOG, LBP, and Haar features [9]. Bringing stereo cameras and HOG, LBP and Haar features together will allow real time vehicle classification.

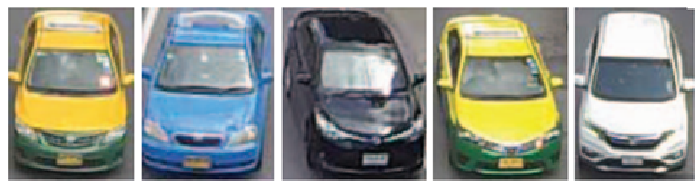

Fig. 1. Personal car data set. [10]

III. Methodology

This section can be divided into three stages: Preprocessing, Feature Extraction and Classification.

A. Preprocessing

Preparation of information before the recognition of the format to distinguish image data types. At this stage, the image of the car will be selected. Experimented with a series of images of personal cars prepared in fixed light conditions. There are 1087 free background images. Reduce the image size to 180 $\times$ 200 to practice in the recognition system shown in Fig. 1.

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B. Feature Extraction

In the extraction step, the HOG method is used to store the gradient values 0°-180°using the direction value of 6 bin and set the Grid value to 8 × 8 as shown in Fig. 2.

Fig. 2. Separation of image features. [11]

C. Classification

The image identification will be tested with the prepared personal car data set. Randomly selected data in each group of 1087 data sets, using 761 images for training and 163 images for testing. Selected by SVM method and Linear Regression. Then evaluate the efficiency of the classification rate which is based on the percentage accuracy of correctly classified images relative to the total number of images. The experiment was conducted for 15 cycles and the mean was obtained. Example of discrimination as shown in Fig. 3.

IV. Experimental and Result

Experiment on recognizing a personal car parked illegally. The Linear Regression algorithm in SVM has been implemented and received from CCTV cameras. Improve picture quality to suit your application and adjust contrast and noise. Bring images to distinguish features or region of interest. Bring images to distinguish features or areas of interest. Bring the features you want to practice and learn in the recognition system to classify. The training and test results shown in Table I.

TABLE I
Training and Testing of Car Recognition.

Training Confusion Table		
Output/Target	***Non-vehicle***	***Vehicle***
Non-vehicle	321 (42.2 %)	18 (2.4 %)
Vehicle	9 (1.2 %)	413 (54.3 %)
Test Confusion Table		
Output/Target	***Non-vehicle***	***Vehicle***
Non-vehicle	65 (39.9 %)	12 (7.4 %)
Vehicle	7 (4.3 %)	79 (48.50 %)

From table I, the experiment used 1,087 images which 761 images in training and 263 images in testing. The result showed that the learning image between image with car and without car (only lane scenario) had the accuracy at 42.2 % (correct 321 images from total 761) and the object learning which is car, the accuracy rate was 54.3 % (correct 413 image from total 761). In the part of training for recognition and in the test section, it can detect the road or in the absence of the correct car 65 out of 163 images or 39.9 % and correctly check the car 79 images or 48.5 %. Detecting a car stopping on the road in a no parking area. There must be additional features a car with a space in front of the car about 1 meter and the car was parked in the same place for 10 minutes is considered a personal car parked on the road in the park. Table II shows that the experiment using the illegally parking 225 cars can be detected cars a total of 197 cars that unlawful parking at 87.56 % of accuracy.

Fig. 3. Identification of individual cars.

TABLE II
System Performance Analysis.

Total vehicle	*Vehicle detected*	*Accuracy (%)*
225	197	87.56

V. Conclusion

Performance evaluation results for personal car illegally parking recognition on the road by applied SVM to receive CCTV image. Improved image clarity to distinguish specific features and was processed using the Linear Regression. From the results found that the system was able to recognize the personal car unlawful parking on the road, with the accuracy rate of 87.56 %. Can be applied to enforce traffic law effectively. Verification is provided to allow the driver to check his driver's license and verify other information to make the system more clear, such as using HMM, CNN, ANN, 3DCNN or RNN.

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