IMAGE BASED VEHICLE DETECTION USING LOG GABOR FILTER

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ABSTACT -On road vehicle detection is the main problem for some applications such as driver assistance systems, autonomous and self-guided vehicles.Vehicle or non vehicle classification is the important issue in the case of vehicle detection, Gabor filters are having good performance in this case. But Gabor functions have a number of drawbacks relatingto their frequency response. The main contribution of this paperis the proposal and evaluation of a new descriptor based on thealternative family of log-Gabor functions for vehicle verification,as opposed to existing Gabor filter-baseddescriptors. Thesefilters are theoretically superior to Gabor filters as they canbetter represent the frequency properties of natural images. Feature extraction and edge detection are performed to do this vehicle or non vehicle classification. Support vector machine classifiers are used to do this feature extraction. Vehicle detection algorithms are mainly having two stages, one is hypothesis generation and another one is hypothesis verification. Hypothesis generation is nothing but the quick search on the potential location of the vehicle in the image. Hypothesis verification stage is used to verify the correctness of the vehicle candidates provided by the previous stage. And also in this paper we propose accuracy of log Gabor filter as a function several parameters such as number of scales, minimum wavelength, adaptable wavelength and also the number of orientations.

Index tearms- Log Gabor filter, Hypothesis generation, hypothesis verification, Feature extraction, Edge detection.

1 INTRODUCTION

In general self-guided vehicles are the main reason for most of the accidents, due to this atleast one person dies in every minute. To avoid this, advance driver assistance systems (ADAS) take more precautions for road safety. Vehicle detection helps ADAS to avoidaccidents.According to this, the interest on vehicle detection based image analysis gets increaseddue to its low cost, flexibility and processing capabilities. The main objective of this work is to detect the vehicle using Log Gabor filter. Another one objective is vehicle detection in the high traffic intensity areas during automatic traffic control. Vehicle detection based image analysis mainly involves two classifications thatare; the object shown in the image is vehicle or non vehicle. This classification can be done with the help of twosteps, one is hypothesis generation another one is hypothesis verification.

Hypothesis generation is nothing but the quick search on the potential location of the image. And the aim of the hypothesis verification is, to verify the correctness of the vehicle candidates provided by the hypothesis generation. To detect any vehicle edge detection and feature extraction are the

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important two stages. Feature extraction can be done with a help of a Log Gabor filter bank at different scales and orientations. In this work a bank of 8 Log Gabor filters with 2 different wavelengths and 4 different orientations is used. The support vector machine classifiers are used for feature extraction. The SVM classifiers are used to classify the needed set of information from the training set of data. Edge detection is nothing but calculating the number of pixels in the edges or boundaries which are used to differentiate two objects in the in the image. This edge detection is highly helps in the case of vehicle or non vehicle identification. Edge detection is used to eliminate any discontinuity in image it will provide the set of connected curves that indicate the boundaries of objects. So with the help of filtering the sharp edges obtained from the edge detection are get smoothen.

2 RELATED WORKS

The active sensors are most commonly used method for vehicle detection. The active sensors are mainly based on three categories they are radar-based method (i.e., millimeter-wave) laser-based method(i.e., lidar), and acoustic-based method. In the radar based method the radio waves are transmitted into the atmosphere, which scatters some power back to the receiver of radar. From the received radio waves the vehicle or non vehicle identification is concluded. The laser-based method is also called as lidar method. The meaning for lidar method is light detection and ranging. In this lidar method the electromagnetic radiations are transmit and receive but they are operate in the higher frequency. These sensors are detecting the distance of the object by measuring the travel time of the signal

emitted by the sensors and reflected by the object. The advantage of these sensors is detecting the distance without requiring computing resources.

The Radar-based method can measure nearly 150 meters ahead in rain or fog but the average drivers can see only 10 meters or less. The laser-based methods are less are less expensive when compared to radar-based method. But the laser-based method is not having good performance in the case of rain and snow. Radar-based systems are less accurate than laser-based sensors. If number of cars are in the move same direction then the laser-based method did not able to detect the vehicle. The acoustic based method is based the sound. This is the main reason for the failure of this model because it did not able to find the sound received is coming from which vehicle.

The passive sensors also implemented in the field of vehicle detection. These passive sensors also called as the optical sensors. They are similar to that of normal cameras.The passive sensors are inexpensive when compared to active sensors. They have a ability to cover the vehicle in the forward and backward direction with the help of inexpensive cameras. It will provide the good visual information without requiring any modification to road infrastructures.

Kalman filter plays an important role in the vehicle detection approach. The Kalman filters are mainly used in the three dimensional based vehicle tracking. The extended Kalman filter and Kalman filters are mostly used in the visual tracking system. These filters are commonly comes under the category of linear recursive filters. Vehicle tracking using Kalman filter involves two strategies one is motion model and another one is

motion tracking. In motion model they are use the normal tracking filters the are contain the car motion model.

Motion tracking will make use of the extended Kalman filter. The performance of EKF is more accurate due to the addition of a new object function. The control system diagnosis also uses the same object function. By using this model parameter is addressed. After the matching of model parameter with the real system, the orthogonal condition for the EFK is satisfied. This Kalman filters are helpful in visual traffic surveillance system. That is it smoothly track the vehicle in traffic scenes and analyse the behaviour of vehicle. But this model only suitable for the gray scale image and in bad weather condition it will not give the good performance.

3 PROPOSED SYSTEM

The main focus of this work is on improving the performance of vehicle detection by employing a Log Gabor filter. A critical issue when perform the vehicle detection is vehicle classification. Specifically, the work propose a systematic and general Log Gabor filter approach for optimizing the parameters of a set of Log Gabor filters in the context of vehicle detection. The vehicle classification involves two particular stages; one is hypothesis generation and hypothesis verification. The first method should have clear knowledge about the vehicle in the image. This method is mainly based on some features, such as symmetry, colour, corners and horizontal edges.

The stereo based method involves two important things for vehicle detection; one is disparity map and Inverse perspective mapping. The distinct in left and right images between corresponding pixels is called disparity. This can be identified by using the disparity map. IPM identifies the left image corresponding to world coordinate and project them back on to right image. The third method concentrates on the difference between vehicles and background. The hypothesis verification involves the processing of information obtained from the hypothesis generation. It will depend upon two steps; temple based method and appearance based method. The first step will use the predefined patterns of vehicle and perform correlation between the image and temple. The appearance method will done the vehicle and non vehicle classification.

Prior to defining the Gabor descriptors, let us make some considerations related to the filtering process. Naturally, the input space is discrete, therefore in order to transfer the image (of size $R{\times}C$) and the filter to the frequency domain, the Discrete Fourier Transform (DFT) is required. Gabor energy features (which combine the response of symmetric and anti symmetric(Log Gabor filter) are thus selected. These features result in very large vectors (as large as the size of the image) and thus entail heavy training and classification. Therefore, statistical moments are usually preferred and will also be adopted. In particular, three moments are analysed: the mean, μ, the standard deviation, σ, and the skewness, γ, of the data distribution,

$$\mu_{m,n} = \frac{1}{R.C} \sum_x \sum_y |J_{m,n}(x,y)|$$

$$\sigma_{m,n} = \sqrt{\frac{1}{R.C} \sum_x \sum_y (|J_{m,n}(x,y)| - \mu_{m,n})^2}$$

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$$\gamma_{m,n} \sum_{x} \sum_{y} \left(\frac{\left| J_{m,n}(x,y) \right| - \mu_{m,n}}{\sigma_{m,n}} \right)^3$$

inputoutp | Image acquisition → Image detection using log Gabor filter → Image classification → Image verification →

Hypothesis generation → Image detection using log Gabor filter
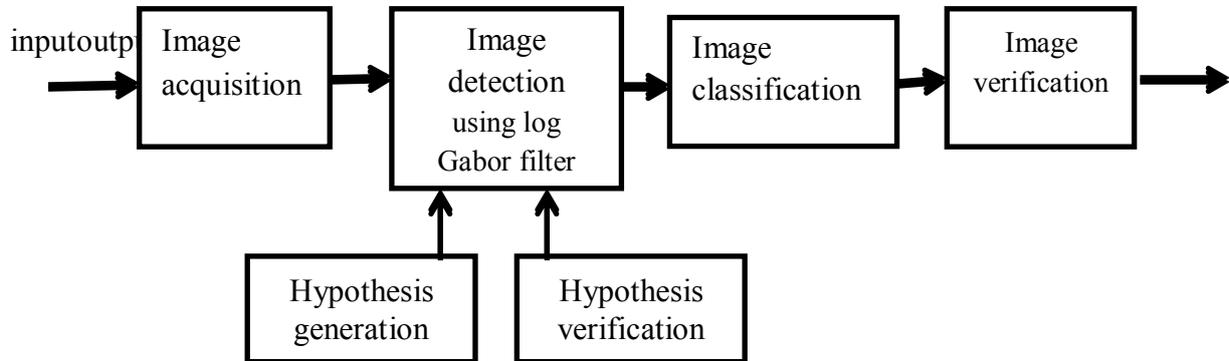
Hypothesis verification → Image detection using log Gabor filter

Fig 3.1 Block diagram of proposed work

Log Gabor-filter based descriptor is analysed as a function of several parameters. This represents the state of the art in the use of this technique for the vehicle verification task. Regarding the classification procedure, the feature vector extracted for the descriptors is fed to a Support Vector Machine (SVM) classifier. These classifiers are extensively used in the related literature owing to their good generalization, and have been reported to deliver better performance than other traditional methods.

In this section, the goal is to experimentally compare thebehaviour of the proposed log-Gabor filter based descriptorwith that of the traditional Gabor filter based approach is used. The section is divided in four blocks. In the Gabor functions, a set ofsimulations have been performed on the GTI vehicle databaseto evaluate the classification results when using log-Gaborfunctions and to find their appropriate parameter configuration.As explained, these filters have better properties in frequencythan Gabor filters: namely, they adapt better to the responseof visual neurons and achieve a larger and more efficientspectrum coverage. Observe that log-Gabor filter based descriptor results in an average gain of 0.75% with respect to the Gabor filter based descriptor.

The standard deviation, σ, of the mean accuracy obtained after repeating the experiment 10 times in order to show the statistical significance of the comparison. Note the small dispersion of the average accuracy, which is lower than the difference between the Gabor and the log-Gabor filter accuracy in all regions.As discussed before, log-Gabor functions adapt better than Gabor functions to the inherent frequency content of natural images and are able to cover a larger spectrum with the same number of filters. As discussed before, log-Gabor functions adapt better than Gabor functions to the inherent frequency content of natural images and are able to cover a larger spectrum with the same number of filters.

Thus, it is especially interesting to observetheir behaviours when decreasing the number of filters in the bank, *N*.

Observe that log-Gabor filter based descriptor results in an average gain of 0.75% with respect to the Gabor filter based descriptor. Note the small dispersion of the average accuracy,which is lower than the difference between the Gabor and the log-Gabor filter accuracy in all regions. Most importantly, in contrast to typical approaches using Gabor filter banks, a new descriptor based on log-Gabor functions has been proposed. These functions have better theoretical properties than traditional Gabor filters for natural image representation, but had not been previously used for vehicle verification.The extensive experiments enclosed in this paper confirm the theoretical superiority of these filters over Gabor filters in this field. In particular, log-Gabor filter banks are proven to yield better results than Gabor filter banks using the same number of filters due to their more effective coverage of the spectrum, and to scale better as the number of filters decreases.

4. RESULT ANALYSIS

A set of simulations have been performed on the GTI vehicle database to derive the combination of parameters of the Log Gabor filter bank that yields best vehicle classification performance. The filtered image in the input space is eventually obtained by applying the Inverse DFT (IDFT) to the product of the image and the filter in the frequency domain.

For vehicle,
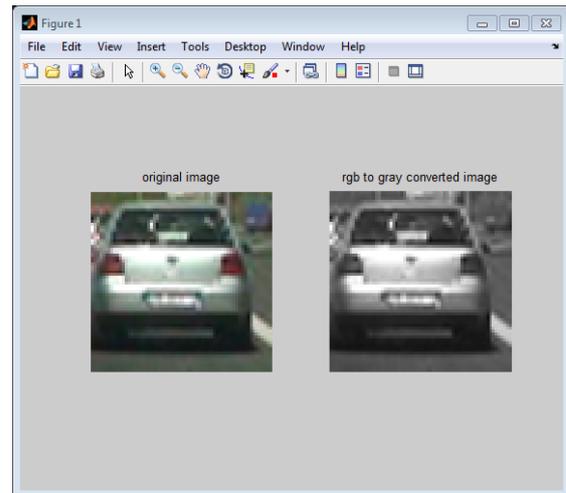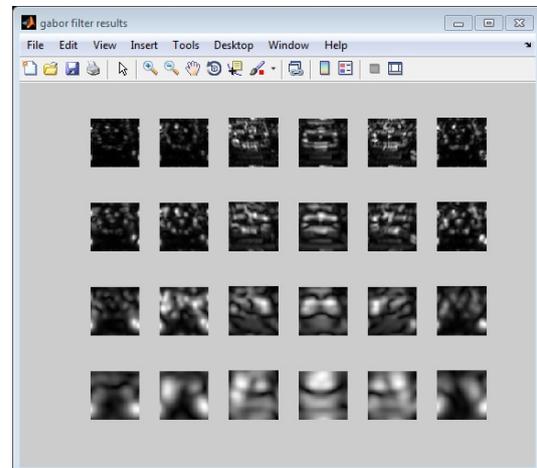

4.1(a)   Input   image   of   vehicle

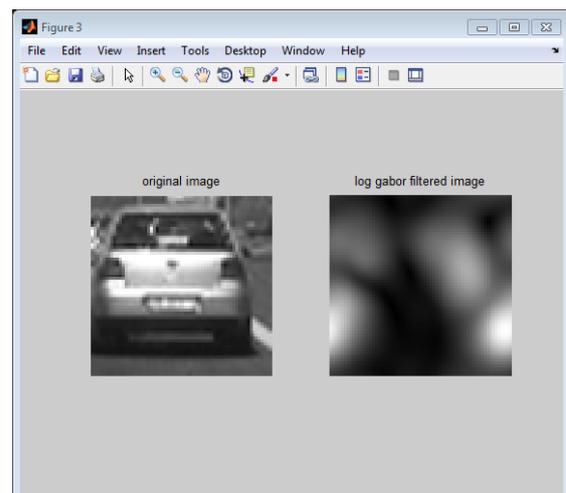Fig   4.2(a)Gabor-filteredimage   with circular Convolution of vehicle

Fig 4.3(a)Log Gabor filtered image

Fig 4.1(a) Original image.Fig 4.2(a) Gabor-filteredimage with circular convolution. Observe the artifacts produced in the imageboundaries due to luminance discontinuity. Fig 4.3(a) Log Gabor filtered imagethat is result after replicating theimage boundaries prior to filtering (the image is cropped to the size of theoriginal image), in which artifacts have been removed.

Vechile   identification,

Fig 4.4

Fig 4.4 is vehicle or non vehicle identification.

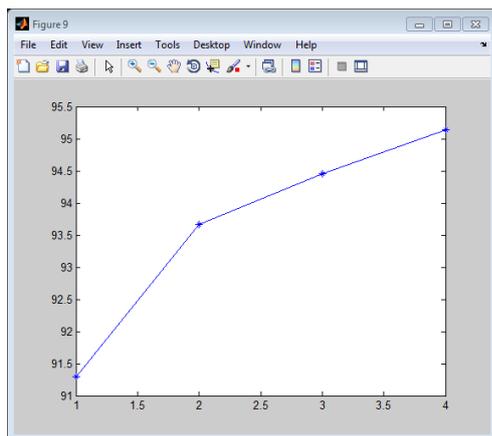The accuracy of Log Gabor filter as function of number of scale is shown below,

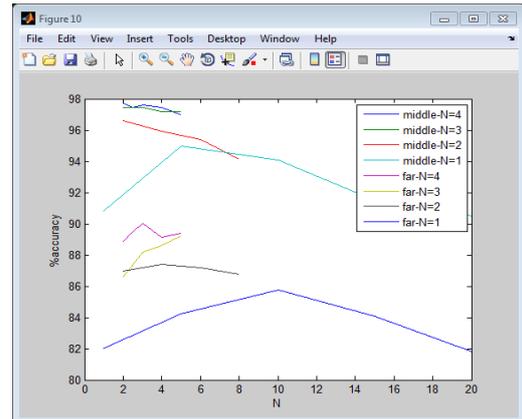Fig 4.5 Evolution of accuracy of Log Gabor filters as a function of *N*.

Fig4.6Evolution of accuracy of Log Gabor filters as a function of minimumwavelength $\lambda 0$

Fig 4.6 shows the close/middle range has been computed as theaverage of the front, left, and right rates. As expected, the solid lines corresponding to the close/middle range have theirmaximum at a lower $\lambda 0$ than their dual dashed lines at the farrange for all values of *N*.
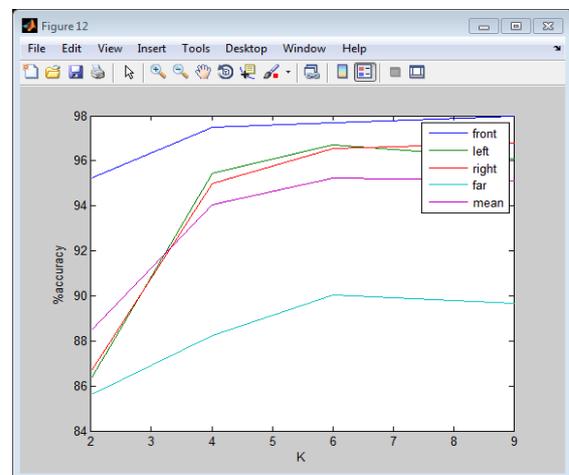

Fig 4.11 Evolution of accuracy of Log Gabor filters as a function of *K*.

Fig: 4.7 show the Evolution of accuracy of Log Gabor filters as a function of *K*for the various image regions. The red line will show the average evaluation in the figure. Here only the vertical and horizontal orientations are taken.

5 CONCLUSION

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Robust and reliable vehicle detection is the main problem for some applications such as driver assistance systems, autonomous and self-guided vehicles. On-road vehicle detection is having vehicle and nonvehicle classification problem.Log Gabor filters have been reported to show good performance in this problem. Log Gabor filtergive more information from the images than the other filters. The Log Gabor filters are having more accuracy as a function of number of scales, number of orientations and also the wavelength. Log Gabor filters are suitable for both colour image and also the gray scale image. In the bad weather condition also it will perform well.

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