

$$h(t) = g(t) - b\hat{g}(0) = ke^{j\theta} (w(at)s(t) - \frac{b}{a}\hat{w}(\frac{f_0}{a})w(bt))$$

$$\hat{h}(f) = \frac{k}{a}e^{j\theta} (\hat{w}(\frac{f-f_0}{a}) - \hat{w}(\frac{f_0}{a})\hat{w}(\frac{f}{a}))$$

It is convenient, to let $b=a$, in which

$$h(t) = ke^{j\theta} w(at)(s(t) - \hat{w}(\frac{f_0}{a}))$$

$$h(f) = \frac{k}{a}e^{j\theta} (\hat{w}(\frac{f-f_0}{a}) - \hat{w}(\frac{f_0}{a})\hat{w}(\frac{f}{a}))$$

4. Log-Gabor Filters

As stated in Section I, the properties of Gabor filters involve two important drawbacks. On the one hand, their bandwidth must be limited in order to prevent a too high DC component. Hence, a larger number of filters is needed to cover the desired spectrum. On the other hand, their responses symmetrically distributed around the center frequency, which results in redundant information in the lower frequencies that could instead be devoted to capture the tail so images in the higher frequencies.

An alternative to the Gabor filters is the log-Gabor function Introduced [2]. The frequency response flog-Gabor filters in polar coordinates [3]

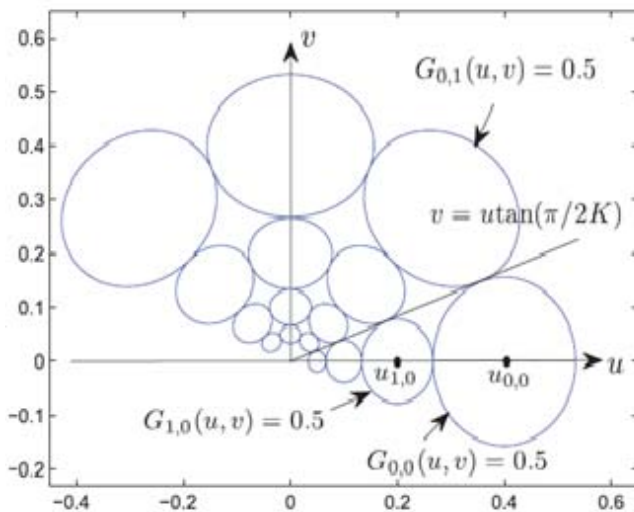


Figure 1: Frequency response of the Gabor filter bank. The contours indicate the half-peak magnitude of the filter responses in the Gabor filter family. The filter parameters used here are $K=4, N=4, a=2,$ and $F0=0.4$.

Results in redundant information in the lower frequencies that could instead be devoted to capture the tails of images in the higher frequencies.

An alternative to the Gabor filters is the log-Gabor function Introduced [4]. The frequency response of log-Gabor filters in polar coordinates is given by [5]

$$LG_{m,n}(f, \theta) = \begin{cases} \exp\left\{-\frac{(\log(f/F_m))^2}{2(\log\beta)^2}\right\} \exp\left\{-\frac{(\theta-\theta_n)^2}{2\sigma_\theta^2}\right\} & f \neq 0 \\ 0 & f = 0. \end{cases} \quad (5)$$

5. Random Forest

Random forests are defined as “a combination of tree predictors such that each tree depends on the random vector sampled independently and with the same distribution for all the trees in the forest “.Image recognition is emerging as an active research area with numerous commercial and law enforcement applications. Although existing methods perform well under certain conditions, the illumination changes, occlusions and recognition time are still challenges problems. Random forest deal with the above challenges in image recognition. Random forest is a tree based classifier the consists of many decision trees. Each tree gives a classification and the output is the aggregate of these classifications. The proposed algorithm first extracts features from the image using the Gabor wavelet transform and then uses the Random Forest algorithm to classify the images based on the extracted features. But the Gabor wavelet transform leads to high feature dimensions which increases the cost of computation. The proposed algorithm makes use of a Random Forest that selects a small set of most discriminate Gabor wavelet features. Only this small set of features is now used to classify the images resulting in a fast vehicle recognition technique. Finally, the problem of occlusion images is tackled by taking advantage of the randomness in forest building. In a randomized tree, the split at each node happens by using only randomly selected subset of all the features. Therefore, any occlusions are likely to affect only a small portion of the trees. In this paper the Random Forest technique is used to classify three types of classes; they are 1. Human on the road 2.Plain road 3. Vehicle on the road. These three different classes are classified by the Random Forest method. It will set these classes as three sub classes and compares with the required image by its features.

6. Support Vector Machine (SVM)

SVM stands for Support vector Machine. The first half set of the data is set as vehicle and the next half as non-vehicle. The solution to an SVM is global and unique. Two more advantages of SVMs are that have a simple geometric interpretation and give a sparse solution. The computational complexity of SVMs does not depend on the dimensionality of the input space. SVMs use structural risk minimization. SVMs are less prone to over fitting.

7. Simulation and Results

The tool used in this paper is MATLAB. It is because; it is the simplest code and is compatible with other software and to easy to set up while dealing with hard ware and processor kit. Log Gabor filter obtained various orientation and verification is done using SVM and Random Forest to obtain the results.

1. Plane road input images



Command window results: Plane Road

2. Human input images



Command window results: Human

3. Vehicle input images



Command window results: vehicle

8. Conclusion

In this Random forest method and SVM are playing key role vehicle and non vehicle. In this Random forest method the classes are different according to their classification it deals with vehicle, non vehicle and identification. For application the database required more images of different classes. To compare required image with database images we use an log

Gabor filter. The Log Gabor filter is better than the Gabor filter due to increased bandwidth and reduction in DC components. The Log Gabor filter functions have better theoretical properties than traditional Gabor filters, but they had not been previously used for vehicle identification. They adapt better than Gabor functions to the inherent frequency content of natural images and are able to cover large spectrum with same filters. Moreover, the cost can be reduced by reducing the filter bank. Random Forest is effective compare to SVM as classifier. Random forest can classify huge amount of data in to different classes.

Visakhapatnam, affiliated to JNTU Kakinada, India. He is interested in the fields of Image Processing.



Mr. I. Krishna Rao obtained his B.Tech.degree from Sivaji University, in the year 1990. He obtained his M.Tech. degree from Rajasthan Deemed University, in the year 2008. He has 10 years experience in teaching. Presently working as a Professor in the department of ECE, VIIT, Visakhapatnam. He own 8 papers in various National and International conferences and journals.

References

- [1] Z. Sun, G. Bebis, and R. Miller, "On-road vehicle detection: A review," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 28, no. 5, pp. 694–711, May 2006.
- [2] C. Rotaru, T. Graf, and J. Zhang, "Color image segmentation in HSI space for automotive applications," *J. Real-Time Image Process.*, vol. 3, no. 4, pp. 311–322, Dec. 2008
- [3] L.-W. Tsai, J.-W. Hsieh, and K.-C. Fan, "Vehicle detection using normalized color and edge map," *IEEE Trans. Image Process.*, vol. 16, no. 3, pp. 850–864, Mar. 2007.
- [4] C. Hoffmann, "Fusing multiple 2D visual features for vehicle detection," in *Proc. IEEE Intell. Veh. Symp.*, 2006, pp. 406–411.
- [5] J. Hwang, K. Huh, and D. Lee, "Vision-based vehicle detection and tracking algorithm design," *Opt. Eng.*, vol. 48, no. 12, pp. 127201-1–127201-12, Dec. 2009.
- [6] T. Wang, N. Zheng, J. Xin, and Z. Ma, "Integrating millimeter wave radar with a monocular vision sensor for on-road obstacle detection applications," *Sensors*, vol. 11, no. 9, pp. 8992–9008, Sep. 2011.
- [7] K. Yamaguchi, A. Watanabe, and T. Naito, "Road region estimation using a sequence of monocular images," in *Proc. 19th Int. Conf. Pattern Recognit.*, 2008, pp. 1–4.
- [8] J. Lou, T. Tan, W. Hu, H. Yang, and S. J. Maybank, "3-D model-based vehicle tracking," *IEEE Trans. Image Process.*, vol. 14, no. 10, pp. 1561–1569, Oct. 2005.
- [9] Z. Zhang, T. Tan, K. Huang, and Y. Wang, "Three-dimensional deformable-model-based localization and recognition of road vehicles," *IEEE Trans. Image Process.*, vol. 21, no. 1, pp. 1–13, Jan. 2012.
- [10] J. Zhou, D. Gao, and D. Zhang, "Moving vehicle detection for automatic traffic monitoring," *IEEE Trans. Veh. Tech.*, vol. 56, no. 1, pp. 51–59, Jan. 2007.
- [11] T. Gandhi and M. M. Trivedi, "Video based surround vehicle detection, classification and logging from moving platforms: Issues and approaches," in *Proc. IEEE Intell. Veh. Symp.*, Jun. 2007, pp. 1067–1071.

Author Profile



P. Pradeep Kumar obtained his B.Tech. Degree from Chaitanya Engineering College affiliated to JNTU Kakinada, Andhra Pradesh, India in the year 2011. Now he is pursuing M.Tech. (Final year) from Vignan's Institute of Information and Technology,