CHAPTER 6

SUMMARY, CONCLUSION AND FUTURE WORK

This chapter presents the outcomes of the study undertaken in this thesis to investigate the problem of Content Based Image Retrieval using color and shape features and; concludes with a number of possible avenues for future research being identified.

6.1 Summary

This research work presents a highly robust and efficient shape descriptor based content based information retrieval system using shape descriptor have been developed that is capable of performing optimal shape detection and associated information retrieval even in the diverse realistic environmental conditions, such as illumination, cluttered background and various viewpoints.

The three main approaches employed in this thesis are:

1. Topological Structure and image properties: The proposed system studies topological structure and various properties of the image to extract the boundary information by using different edge such as Sobel, Prewitt, Canny, Laplacian operators and Euclidean, Canberra and Manhattan distance measure to retrieve the similar images.
2. Key point detection approach: It employs generalized distance transform, canny edge detector, deformation cost based feature extraction have been employed that eliminates the possibility of irregular points and thus makes accuracy optimized. Linear support vector machine and K-NN classifier has been implemented to classify the images based on extracted features from the detected key points.
3. Hybrid Method: A part tree is constructed to segment the image by using part-template method. The HOG features combined with the key point shape features found very effective in shape identification.

Simulation with Wang and Corel 5k datasets having diverse non-rigid objects with numerous viewpoints has exhibited that the proposed system can provide optimal solution for content based image retrieval for huge datasets.

6.2 Conclusions

In this thesis a highly robust and efficient shape descriptor based content based information retrieval (CBIR) system using shape descriptor have been developed that is capable of performing optimal shape detection and associated information retrieval even in the diverse realistic environmental conditions, such as illumination, cluttered background and various viewpoints. The proposed system employs generalized distance transform based key point detection and associated feature extraction for shape detection purpose. Here, canny edge detection paradigm has been used to identify key points on the strong edge maps that makes shape description swift and efficient. Further, to enhance performance a deformation cost based feature extraction have been employed that eliminates the possibility of irregular points and thus makes accuracy optimized. Linear support vector machine has been implemented to classify the images based on extracted features from the detected key points. Simulation with Wang and Corel 5k datasets having diverse non-rigid objects with numerous viewpoints has exhibited that the proposed system can provide optimal solution for content based image retrieval for huge datasets.

The results obtained affirm that the proposed system provides on average 97.11 % and 97% precision and recall respectively considering only shape feature using Wang dataset. Meanwhile, it has exhibited approximate 96.9% of sensitivity and 99.7% of specificity. The accuracy of proposed system using shape descriptor for Wang dataset is 96.20% for SVM classifier. For comparison analysis with SVM we have used K-NN classifier which gives better results for similar datasets considering same parameters. The results obtained affirm that the proposed system provides on average 97.93 % and 97.40% precision and recall respectively considering only shape feature using Wang dataset. Meanwhile, it has exhibited approximate 97.40% of sensitivity and 99.711% of specificity. The accuracy of proposed system using shape descriptor for Wang dataset is 97.40% for K-NN classifier.

The results obtained affirm that the proposed system provides on average 95.09 % and 93.42% precision and recall respectively considering HOG feature in combination of shape feature using Corel dataset. Meanwhile, it has exhibited approximate 93.42% of sensitivity and 99.32% of specificity. The accuracy of proposed system using HOG

descriptor for Corel dataset is 94.25% using SVM classifier. For comparison analysis with SVM we have used K-NN classifier which gives better results for similar datasets considering same parameters. The results obtained affirm that the proposed system provides on average 97.57 % and 96.53% precision and recall respectively considering HOG feature in combination of shape feature using Corel dataset. Meanwhile, it has exhibited approximate 96.53% of sensitivity and 99.59% of specificity. The accuracy of proposed system using HOG descriptor for Corel dataset is 96.55% using K-NN classifier.

The results obtained affirm that the proposed system provides on average 93.93 % and 91.67% precision and recall respectively considering only shape feature using Corel dataset. Meanwhile, it has exhibited approximate 91.67% of sensitivity and 99.15% of specificity. The accuracy of proposed system using shape descriptor for Corel dataset is 92.64% using SVM classifier. The results obtained affirm that the proposed system provides on average 96.42 % and 93.16% precision and recall respectively considering only shape feature using Corel dataset. Meanwhile, it has exhibited approximate 93.55% of sensitivity and 99.27% of specificity. The accuracy of proposed system using shape descriptor for Corel dataset is 93.40% using K-NN classifier.

The results obtained affirm that the proposed system provides on average 97.56 % and 99.72% precision and recall respectively considering HOG feature in combination of shape feature using Wang dataset. Meanwhile, it has exhibited approximate 97.52% of sensitivity and 97.50% of specificity. The accuracy of proposed system using HOG descriptor for Wang dataset is 97.50% using SVM classifier. The results obtained affirm that the proposed system provides on average 98.33 % and 98.00% precision and recall respectively considering HOG feature in combination of shape feature using Wang dataset. Meanwhile, it has exhibited approximate 98% of sensitivity and 99.77% of specificity. The accuracy of proposed system using HOG descriptor for Wang dataset is 98.20% using K-NN classifier.

Thus the proposed system can be employed for numerous realistic scenarios. The system can further be explored to incorporate with HOG descriptor for content based image retrieval.

6.3 Future Work

As far as the future directions of research presented in this thesis are concerned, there are a few interesting observations. Initially Soft computing has proved better in vision analysis. Image attention models based on soft computing techniques like fuzzy systems, neural networks and genetic algorithm scan be another interesting area to experiment with. Secondly, a combination of the techniques experimented with in this thesis might give a direction to further improvise the performance of the CBIR system. Finally a hybrid system can exploit the best features of every technique and help to enhance the retrieval performance. The outcome of this research is expected to help in building robust computer vision applications.