Chapter 9

Conclusion and Future Research

A comprehensive survey on the VNPR process and the existing techniques is presented, by categorizing them according to the features used in each stage. The challenges involved in each phase of VNPR system are stated. The limitations of the existing approaches for VNPR process are brought out. A comparative study of the existing approaches in terms of pros, cons, recognition results, processing speed, and computational complexity is addressed. A brief overview of the terminologies related to VNPR process is explained. In this thesis four issues have been addressed: (i) Uncertainty in localization of license plate (ii) Improper segmentation of license plate (iii) Orientation of camera, skewness of license plate or text (iv) Improvement in feature based character recognition. The specific conclusions for the above mentioned four issues are highlighted in the following sections.

9.1 Orientation of camera, skewness of license plate or text

To deal with the skewness of the text, a new approach is proposed to find the orientation of the text and thereafter to correct it for recognition process. The existing approaches are based on an assumption that the license plate text is in non-tilted position i.e. the horizontal axis of the text and car image is same. However, there is also a possibility that in spite of horizontal axis of the text being inline with that of car image; the car image itself is in tilted position. This can happen due to the wrong orientation of the camera. Such problems can be

easily dealt with this proposed methodology. For this Radon transform is used. To remove the blur affect after rotation, median filter is used. The methodology is validated on 350 tilted images. The results show the strength of the new proposed approach and make them suitable for the real world applications.

9.2   Uncertainty in localization of license plate

There are different approaches available in the literature to localize the license plate of the vehicle from a large view of image. Poor quality of image may give inaccurate results for localization. Keeping in view the limitations of existing methodologies, an approach is proposed to localize the license plate that is capable to overcome the limitations as discussed in chapter 2. The approach is based on wavelet transform and energy values of the image projection. When the vehicle is in motion, the image quality degrades and it is difficult to localize the plate, for which a robust technique is proposed based on PCA. These techniques have been validated on the sufficient set of images under varying conditions. The result of an Indian car image is shown.

9.3   Improper segmentation of license plate

It is necessary to segment the extract license plate properly for character recognition, for which there are several approaches. These approaches are not generic in the sense; they don't work for all kinds of images. The failure or inaccuracy of these approaches may be because of joined or broken characters, noise effects, etc. When image size is very large; the existing algorithms take much time due to the computational complexity. To deal with such situations, a technique based on energy curves has been proposed. The technique is demonstrated on a car image and validated on 2500 characters.

9.4 Improvement in feature based character recognition

Character recognition is a challenging task because of its style, font size and other factors that are discussed in chapter 2. Feature based character recognition consumes very less time as there is no need to process every pixel of the image. From the several existing approaches, there is no generic approach which is capable to extract the unique features of all the characters. Two methods have been proposed for this task. One is based on the snakes and PCA. The other approach is based on the vector contour of the object. The results of this approaches are beyond satisfactory. The approach is validated on 370 sample characters.

All the proposed methodologies can be applied in general security systems and car violation prevention systems.

9.5 Future Work

In our future work, the scope of the algorithm refinement for the proposed methodologies is to be analyzed to achieve much better performance. Currently there are certain restrictions on parameters like speed of the vehicle, script on the number plate which can be aptly removed by enhancing the algorithm further. A future forecast for VNPR should concentrate on multistyle plate recognition, video-based VNPR using temporal information, multiplates processing, high definition plate image processing, ambiguous character recognition and so on.