Chapter 2
An Approach to License Plate Recognition System Using Neural Network

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ABSTRACT

This chapter presents an approach for automatic recognition of license plates. The system basically consists of four modules: image acquisition, license plate extraction, segmentation, and recognition. It starts by capturing images of the vehicle using a digital camera. An algorithm for the extraction of license plate has been designed and an algorithm for segmentation of characters is proposed. Recognition is done using neural approach. The performance of the system has been investigated on real images of about 610 Saudi Arabian vehicles captured under various conditions. Recognition of about 90% shows that the system is efficient.

1. INTRODUCTION

Automatic vehicle identification system is of considerable interest because of a number of applications. It is used in many applications such as the payment of parking fee, highway toll fee collection, traffic data collection, crime prevention and so on. A number of techniques to recognize license plates have been developed during the past two decades (Sarfraz & Ahmed, 2005; Sarfraz, Ahmed, & Ghazi, 2003; Ahmed et al., 2003; Yusuf & Sarfraz, 2005; Yusuf & Sarfraz, 2006; Bakhtan, Abdullah, Rahman, 2016; CCTV Information, n.d.; Comelli et al., 1995; Hansen et al., 2002; Kim, et al., 2000; Lee et al., 1994; Naito et al., 1999; Neito et al., 2000; Nieuwoudt & van Heerden, 1996; Schalkoff, 1992; Yan et al., 2001; Wikipedia, n.d.). Several systems have been applied practically, especially into large-scale facilities. However, currently demands to apply license plate recognition into small-scale facilities are increasing. It includes, for example, managing a private parking lot and monitoring vehicle entry and exit (Naito et al., 1999).

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License plate recognition (LPR) is realized by acquiring image of either front or rear of a vehicle by using a digital camera and then by further processing to detect the license plate. So the acquisition, extraction and recognition methods play an important role in the whole process.

The steps involved in recognition of a license plate are Image acquisition, License plate extraction, Segmentation, and Recognition. Image acquisition is the first step in an LPR system. There are a number of methods discussed in the literature for the image acquisition stage. Yan et. al. [23] used an image acquisition card that converts video signals to digital images based on some hardware-based image preprocessing. Comelli et. al. (1995) used a TV camera and a frame grabber card to acquire the image for the developed vehicle LPR system. The proposed system uses a high resolution digital camera for image acquisition.

License plate extraction is the key step in a LPR system, which influences the accuracy of the system significantly. Different approaches for the extraction of the license plate depending upon the back ground color of the image are presented in (Lee, Kim, & Kim, 1994). Hontani et. al. (2001) proposed a method for extracting characters without prior knowledge of their position and size in the image. Kim et. al. (2000) used two neural network-based filters and a post processor to combine two filtered images in order to locate the license plates. Kim G. M (Kim, 1997) used Hough transform for the extraction of the license plate. The proposed approach uses matching of vertical edges and then finding Black-to-White (B/W) ratio to extract the plate. This method is computationally better than using Hough Transform (Kim, 1997). This approach involves four steps, vertical edge detection, filtering, vertical edge matching and finding Black-to-White ratio.

In the Segmentation phase, individual characters are isolated from the license plate. Various approaches have been proposed in the literature. Nieuwoudt et. al. (1996) used region growing for segmentation of characters. Hansen et. al (2002) uses the connected component method to segment the characters. The proposed approach for segmentation is based on horizontal-and-vertical projection profiles on the extracted license plate.

Recognition of characters is the last phase in the LPR system. A wide variety of approaches have been considered for individual character recognition. Cowell and Hussain (2002) discussed the recognition of individual Arabic and latin characters. Their approach identifies the characters based on the number of black pixel rows and columns of the character and comparison of those values to a set of templates or signatures in the database. Hamami and Berkani (2002) adopted a structural or syntactic approach to recognize characters in a text document, this can be applied on individual characters to get good recognition. Naito et. al. (2000) used template matching. In the proposed system, recognition is done using neural approach.

This research work proposes an approach for automatic recognition of license plates which consists of four phases in the whole process of the LPR system. These phases are Image acquisition, license plate extraction, segmentation and recognition. A digital camera starts the first phase by capturing images of the vehicle. Phase two, for the extraction of license plate, is achieved by developing an algorithm. An algorithm. for segmentation of characters, is proposed for phase three. Finally, recognition phase is achieved using neural approach. The performance of the system has been investigated on a database (Sarfraz & Ahmed, 2005) of real images of 610 Saudi Arabian vehicles captured under various conditions. Recognition of about 90% shows that the system is efficient.