License Plate Character Recognition Using Modified KNN

Tarun*, Rajni**
*M.Tech Scholar, ECE Department, D.C.R.U.S.T, Murthal
** Assistant Professor, ECE Department, D.C.R.U.S.T, Murthal

Abstract: The License Plate Character Recognition (LPCR) system is the most popular method for the mass surveillance of the automobiles nowadays. The LPCR system basically works into four steps first step is to preprocess the license plate and after that detection of the license plate is done and then extraction of numbers from that license plate is done and the four-step is character recognition which means to read out the characters of a number plate. The LPCR also some face some difficulties due to no uniform structure of number plates and illumination. The techniques developed until are mostly relied on some fixed parameters like a fixed image capturing angle and proper illumination and stationary background condition. These all techniques are varied on different factors like the processing time for a license number plate, the power consumption, its accuracy and error-free results. This LPCR system gives new vision in the intelligent transport system which opens a new way for the automobile industry towards an intelligent automobile world. Still being there are many types of research that are been carried out to develop the LPCR technique in terms of process complications. In this paper, comparison of KNN with different distance functions such as Manhattan, Spearman, Cosine, Minkowski, Euclidean is done in terms of average execution time, sample-wise execution time and recognition accuracy.

Keywords: **Offline Character Recognition, OCR, LPF, Classifier, License *Plate Recognition,* License Plate Character Recognition, *Features Extraction;* Survey, Plate Extraction, Character Segmentation**

I. Introduction

Over the past two decades, there is a boom in the automobile industry which increase the number of vehicles on road and make the transportation faster and cheaper. Till now human is employed for monitoring and controlling the traffic-related parameter which is very difficult and very complex. Thus the developed countries are now opting for the intelligent transport system to monitor the traffic. The main aim to design these intelligent systems is to monitor the vehicle more accurately and to construct an applicable scheme to control the traffic. The license plate character recognition system is an integral part of these intelligent transport system. The license plate character recognition techniques make use of image processing technique to extract the alphanumeric numbers from the vehicle license number plates and to read out the plate. This technique makes possible to recognize the number plate numbers from a moving or a stationary vehicle which makes vehicle recognition more easier. This technique is employed for various kind of uses like to automatically charge the toll fees from the vehicle owner while he passing from a tollway and to recognize the vehicle who breaks the traffic rules and in parking allocation systems.[1], [2]. This kind of intelligent system become more important when the automotive industry is going towards an intelligent vehicles world and smart roads. In such kind of application, the system recognizes the character from the license number plate and recognize it and makes a system to works in a movable and variable environment where conditions become changing. These can also be used to calculate the journey time and can also be used to control the access of vehicles in restricted areas There are also various challenges for these systems like illuminations, environmental factors, scene complexity, wrong position of the camera. Although these tasks become easier for the human it's not practical to apply it at big scale. Till now we cannot apply a fully

automated transport system in non-ideal environmental conditions.

To design a classifier for the character recognition we mainly match the templates of different specifications. To match the template by an automatic method we first set some sample templates and then we obtain some character from these templates. Then the character obtained from these templates is compare with the sample templates and the template which is closely matching with the sample templates is consider as a result of character recognition. As if the license plates are standardized means there size and the font uses in character is fixed then it's become much easier to recognize the character but this process is slow and time-consuming and as we have to work in a real environment so this method is not recommended.

In the field of character recognition, ANN is the most used type of classifier [3, 9]. These networks are capable to distinguish various classes and also separate the classes non-linearly. To get the maximum efficient results from these neural networks we have to choose the right number of hidden layers and number of neurons. Now a day's various types of multilayer neural network are being used for the character recognition eg. RBF, Kohonen, ART etc. apart from all these types of multilayer neural network the MLP is the most attention seeking neural network and gaining more popularity due to its easy structure and it can be trained easily and quick to use.

Usually, the subsystems have been divided into four parts which are Preprocessing of the license plate, License Plate Detection (LPD), Character Extraction (CE), and Optical Character Recognition (OCR). Thus in this system when the image which has license plate is the first process through the license plate detection system and after locating the position of the license plate, the next step is a segmentation and after that extraction of features takes place for each character. The classifier used here is KNN for checking the similarity between the input image and template image and thus after this, the characters have been processed from OCR system. There are some challenges which occur while extracting an image which is due to the poor quality of the image. [3].

In this paper, we present a scheme which is based on various experts schemes to increase the recognition rate of license plate characters. The input for the LPCR is the binary vectors which we obtain from the licensed number plates. In our scheme, we use a histogram of oriented gradients for the feature extraction. We can extract these features at very much low cost with the help of computational techniques and get acceptable results for the character recognition.

The complete research paper is described in four sections. The Section I describes Introduction, Section II describes Literature Review, Section III describes Proposed Methodology, Section IV describes Result Analysis, Finally Conclusion of paper.

II. Literature Review

This section will provide the brief description and highlights the contribution, remarks, and factors of the work done by the researchers. Many attempts have been made in the past to achieve the maximum accuracy while segmented the images.

Zied Select.al highlighted LP segmentation methodology that is used to compare the simulation results by an estimated result which is generated by an algorithmic method which is LP recognition, character recognition. Precision Rate, Recall Rate & F- Score were achieved up to 93.80%, 91.30% and 92.01% respectively [1].

Ana Riza F et.al highlighted about KNN Algorithm is used. In this Gaussian & tricube kernels are used. The average run time of the model was 0.034 per frame. Recognition rate for single neural network & artificial neural network was 87.43% & 86.34 % respectively. The plate recognition system using KNN in real-time was effective [2].

Liu Panet.al proposed about Convolution Neural Network. In this method, License character degradation and segmentation of character were defined. A data set of 481 images was studied. Correctness is defined in term of rank. Rank is given as 0.5031, 0.6778, 0.7630and 0.8274 respectively. Low-quality license plate character recognized with this method [3]. Sun Yuzheet.al proposed sampling based on the simplified freeman chain code and classic shape context algorithm. Recognition accuracy was

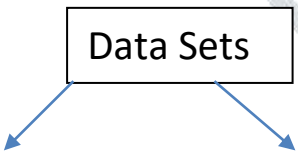
achieved up to 92.7 % [4]. Mansour Nejatet.al described Directional image projections for feature extraction using a mixture of experts which uses the multilayer perceptron (MLPs) as an expert. A DataSet of 12000 Images is used The recognition rate was achieved up to 99.68 %. Two topology expert & gating was used as learning rate [5].Wang Yutaoet.al described a hybrid method based on Wavelet Transformation and Generalized Regression Neural Network. Recognition Rate of Letter Character, Mixed Character, and Chinese Character was achieved up to 93.4 %, 91.9 % and 98.8 %[6].

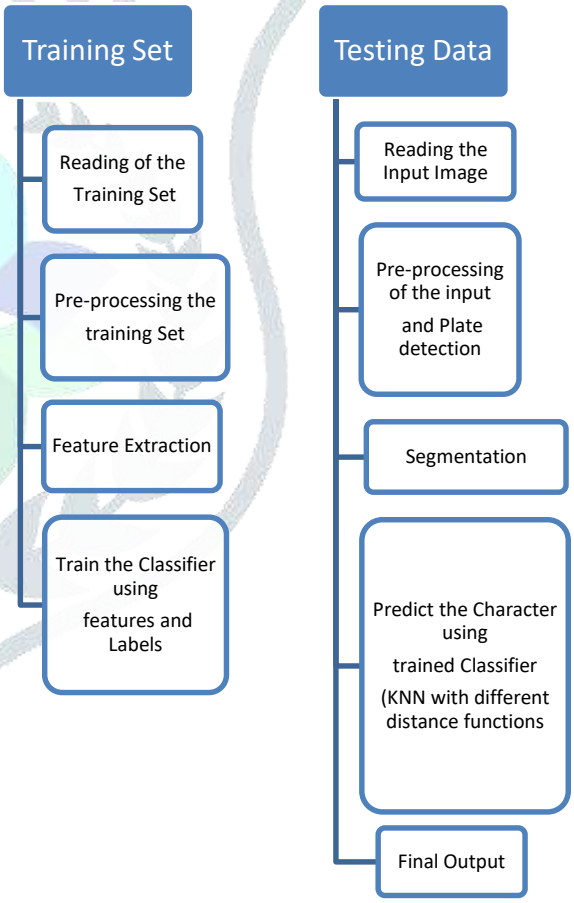
Yuan Jing I et.al proposed different OCR Method. These OCR methods include artificial neural network, probabilistic neural network, and Self-Organizing Neural Network. Recognition Accuracy for ANN, Probabilistic ANN, and Self-Organizing ANN: 95.1 %, 89.1 % and 95.6 % respectively[7].

Dickson Neoh Tze et.al highlighted about Deep Convolution Neural Network Multilayer Perceptron for MLP-3 & MLP-6 algorithm. Convolution Neural Network for CNN-3 & CNN-6. Recognition Rate with MLP-3 , MLP-6 ,CNN-4 and CNN-6 algorithm was achieved up to 99.7 % , 99.89 % , 99.69 % and 99.91 % respectively. Thus these networks can be trained by using computer characters and thus they can use for the recognition of images on the license plate with the higher accuracy [8]

III. Proposed Methodology

The data sets are basically a collection of data. It is divided into two parts: 1. Training set 2. Testing data. In this proposed algorithm the training set consists of 36 characters that composed of 26 alphabets and 10 number. The first step is to read the training set. After that preprocessing of the training set takes place. Preprocessing involves passing the image through the LPF, resizing, contrast enhancement, etc operations. After that feature are extracted using HOG technique.





HOG generalize the object in such a way that the same object (in this case a plate) produces as close as possible to the same feature descriptor when viewed under different conditions. This makes the classification task easier. The

last step in training module is to train the classifiers using features and labels. The classifier used here is KNN with different distance function. Now comes the turn of testing data. Testing data means the input image whose characters are to be recognized. The first step in testing data is to read the input image. After that preprocessing of the input image takes place. This operation is same as that of the earlier one which was done in training set phase. After that the license plate in the image is localized based on the attributes of the characters, everything else in the image is treated as noise. Hence, the plate is detected with help of edge detectors or with the help of histograms. After the extraction of the license plate, the characters are segmented by first eliminating the noise from the plate based on the properties of the characters, and then each remaining connected component is treated as a character and is segmented and extracted. If there is any noise is present during the segmentation, then it will also be treated as a character and the recognition of the plate will not be successful, on the other hand, if some character is mistaken as noise and eliminated, then also the recognition will not be successful. Therefore segmentation plays a crucial role in the recognition of characters. Now, we will compare the character of the input image with that of training set using KNN with different distance function. The distance function used in the classifier can be treated as a measure for the degree of similarity between the training image and the testing image. After comparison, the final output is read and then stored out.

IV. Result Analysis

A dataset providing information on the vehicles is taken from the internet. The data is provided in three folders:- Raw Data – contains the data in the format it was received and a sample of each format. Processed Data – the data after processing by software and the Outputs – Excel spreadsheets summarizing the data or can be taken directly from the Matlab also. In this paper, comparison of KNN with different distance functions such as Manhattan, Spearman, Cosine, Minkowski, Euclidean is done in terms of average execution time, sample-wise execution time and recognition accuracy. It has been found that KNN with Manhattan distance function shows better accuracy and execution time than the other distance functions that are Spearman, Cosine, Minkowski, Euclidean. Also, the sample-wise execution of KNN with Manhattan is appreciable than the other distance function.

Fig 2 Input license image

Fig 2 represent input license image. The input image is uploaded in the proposed algorithm. On the behalf of that algorithm recognition of characters in the license plate is detected.

Fig 3 License Plate Character Recognition

Fig 3 represent License Plate Character Recognition.

Fig 4 Individual Text & Non Text Part in License Plate

The individual text & nontext part in license plate is represented in Fig 4.

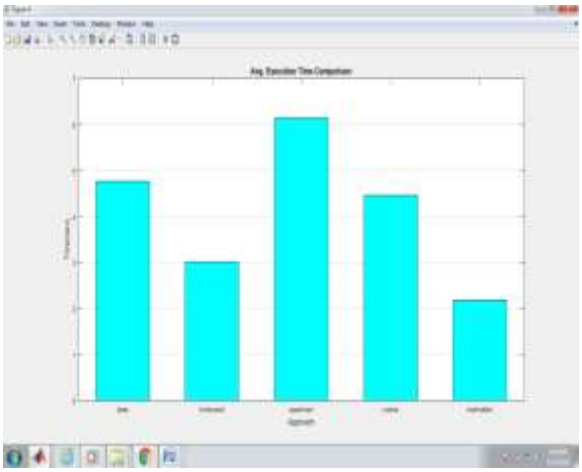


Fig 5 Comparative Analysis of Average Execution Time of KNN using a different distance function

Fig 5 represents the comparative analysis of Average Execution Time of KNN using different distance function. From the figure itself, it is clear that KNN using Manhattan distance function takes less time to execute as compared to other distance function. However, the execution time also depends on computer architecture. So, the computer having powerful processor will execute faster.

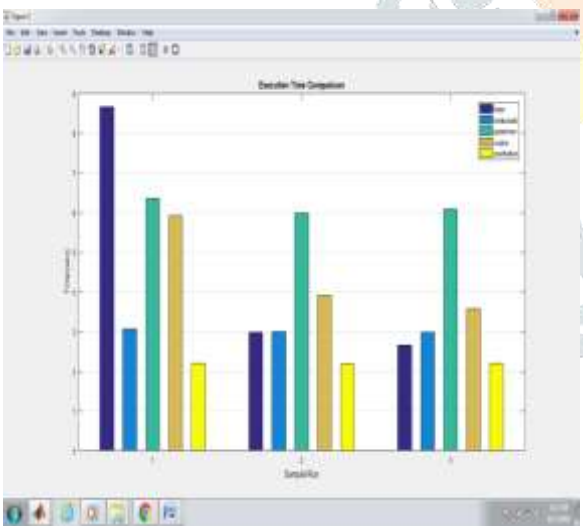


Fig 6 Sample wise execution time of KNN using different distance function.

From the figure, it is clear that KNN with Manhattan distance function will execute the images with least time and KNN with spearman distance function will take more time as compared to others for all the samples.

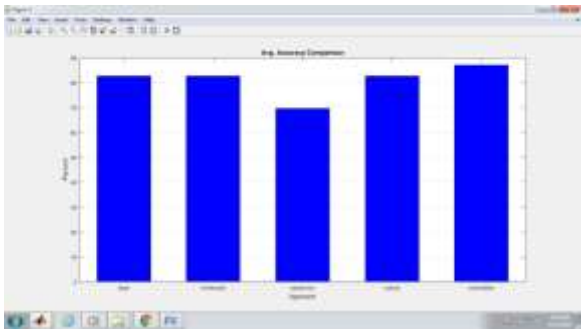


Fig 7 Character Recognition Accuracy

Fig 7 represented a comparative analysis of character recognition accuracy of KNN using different distance functions

Conclusion

In this paper, an algorithm is proposed that can detect characters in a license plate, if the image of the vehicle is within a specified range of the camera. The process is successful because of the size and feature of characters that can be separated from that of the noise. In this paper, comparison of KNN with different distance functions such as Manhattan, Spearman, Cosine, Minkowski, Euclidean is done in terms of average execution time, sample-wise execution and recognition accuracy. It has been found that KNN with Manhattan distance function shows better accuracy and execution time than the other distance functions that are Spearman, Cosine, Minkowski, Euclidean.

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