# Automatic Number Plate Detection using Neural Networks

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***Abstract-*** ANPR (Automatic number plate recognition) is a very popular technique that applies OCR approach for the careful reading of vehicles' number plate. This approach may use CCTV cameras for vehicles' number plate recognition. The law enforcement agencies can make use of this approach to collect toll in electronic manner and to monitor the mobility of vehicles on the road. The vehicles' images clicked via camera can be stored using ANPR. The images clicked via cameras, the tag content and the driver's image can be stored using ANPR technique. An approach named morphological scanning can efficiently scan the complete image and take out the region of license plate. Split-and-merge is a one more efficient segmentation approach. The identified license plate can be segmented wholly using this approach. This work implements NN approaches for the recognition of segmented license plate. The recommended approach achieves character reorganization accuracy of 91%.

***Keywords-*** License Number Plate, Detection, NN, Split and Merge

## I. INTRODUCTION

Image is a network, a cluster of components called components in the square frame which are organized as lines and sections. IP (Image Processing) is a procedure applied to change a picture into digital shape and apply few operations on this picture for getting an improved picture and concentrate valuable knowledge [1]. A picture may contain sub-pictures here and there alluded to as required regions. This idea mirrors the truth that pictures normally have accumulations of articles as the premise for a locale [2]. In an advanced IP framework it ought to be possible to implement particular IP tasks to locales which are chosen as it were [3]. Along these lines one a player in an image may be prepared to enhance shading interpretation and other is selected to handle the smother movement haze. It is essential for an image to be available in digital format for image handling [4]. In recent times, image sampling is carried out to convert a simple image into digital image. Sampling process reduces the consistent mark to discrete mark. After that, the quantization of each pattern or pixel is carried out using a fixed amount of bits. A processor handles the digitized picture. The image handling demonstrates a higher outline by changing it primarily over into uncomplicated mark [5]. The testing of this outline is carried out over an appearance. LPR (License plate recognition) is an image-processing innovation. This innovation is utilized to perceive automobiles on the basis of number plates [6]. This mastery is ahead of time prominence in safety and activity establishments. This framework uses PC vision. PC vision is a technique which makes use of a computer for extracting the abnormal state information from a digital picture. There are some futile regularity amid various number plates, for example, its measurement and the blueprint of the number plate [7]. Automatic Number Plate Recognition (ANPR) is an extremely accurate system having the ability to read vehicle number plates without human involvement. This system makes use of images captured in different brightness conditions. This system detects characters within the given images and verifies the character orders as being those from a vehicle number plate. This framework makes use of character recognition for converting an image to text. At last, this system provides a set of metadata that detects an image comprising a vehicle number plate and the related decoded text of the same number plate [8]. Hence, ANPR is a prominent technology using which the number plate of vehicle can be found out. This technology, in turn, forwards this information to the next phase known as computer processing. This stage can interpret, store or match the achieved information for creating an application based on ANPR [9]. In current scenario, law enforcement agencies also make use of this technology for tracing the activities of offenders. In UK motorways, this technology is used to detect the speed by calculating the standard speed of the vehicle [10]. Moreover, this technology is used in large number of applications to facilitate the security and well being of the people and to support efficiencies through which someone communicate with transport and vehicle based framework. The number plates may be curved regarding the location of camera. There, deformation may occur in the characters retrieved from these number plates. In addition, input characters may be loud, busted or partial. It is required for the character recognition methods to stand with these faults. This work develops a new character recognition technique to serve a specific purpose. There are mainly three steps included in this technique [11]. These steps are character categorization, topological sorting, and SO (self-organizing). At first, the differentiation of input character is carried out as mathematical or alphabetical. For this purpose, the semantics making license numbers are used. The second step computes the topological attributes of the input character. ANN is a very important tool of machine learning. These are brain-inspired systems. The main aim

behind designing ANNSs is to copy the way of human learning. The use of neural networks is quite popular in image processing [12]. For example recognize characters written by hands; matching one picture with other in a database; with minimal loss of content performing data compression on an image. Some other applications include RADAR signature scrutiny, voice recognition, share market forecast. These issues include massive volume of data, and relationship complexity amid different metrics.

## II. LITERATURE REVIEW

Suvarnam, et al. (2019) [13] presented the fusion of CNN-GRU model for recognizing characters of the vehicle's number plate. This work implemented CNN for extracting features. This work made use of GRU to assign a sequence to features without segmentation. At last, the recommended model was employed for character recognition. The preparation of this model was carried out on a particular dataset. In contrast to conventional schemes, a deep learning approach provided more satisfactory results. The recommended model achieved testing and training accuracy of 100% and 90% respectively.

Min, et al. (2019) [14] presented a novel scheme for locating the number plate. The new scheme was founded on the plate pre-detection algorithm and a novel paradigm called YOLO-L. The novel paradigm improved two factors for locating the region of number plate in precise manner. Initially, this work used k-means++ clustering algorithm for selecting the optimal number and magnitude of plate aspirant sets. Secondly, this work modified the composition and deepness of novel paradigm. Plate pre-identification approach could differentiate number plates from identical things in efficient manner. The tested outcomes depicted that the recommended scheme achieved precision rate and recall value of 98.86% and 98.86% respectively. The recommended approach proved more efficient that the state-of-the-art approaches.

Khan, Muhammad Attique et al. (2018) [15] presented a new LNP (License number plate) system. This system used entropy-based features selection approach with SVM. There were mainly three steps included in the recommended framework. These steps were identified as preprocessing and segmentation of character region, features extraction of ROI, and features union by the new approach. The achieved simulation outcomes revealed that the new approach was able to resolve different issues related to the recognition of number plate. This work considered various performance metrics for authenticating the outcomes of recommended scheme. The recommended approach achieved highest accuracy of 99.5% in the recognition of number plate. The Simulation outcomes revealed that the recommended approach outperformed the other existing approaches.

Sharma, (2018) [16] presented a research work based on Nepali VNPR (Vehicle Number Plate Recognition) system. Initially, the image of vehicle plate was captured using a digital camera. Further, the processing of image was carried out for getting information of the number plate. A real image of a vehicle is captured and processed using various algorithms. The recommended system applied template matching methods for recognizing the license plate. The testing of new system was carried out using 90 patterns in different circumstances. In this works, various tests were carried out for evaluating the efficiency of phase correlation and NCC (Normalized Cross Correlation) techniques. The achieved outcomes revealed that NCC approach showed more accuracy than the phase correlation method in the recognition of license plate. This approach achieved better accuracy of 67.98% than phase correlation accuracy of 63.46%.

Singh, et al. (2018) [17] presented a study to reduce the criminal activity like stolen vehicle, road traffic monitoring that involve use of motor vehicles. In proposed technique a copy of challan will be sent to their email id and their mobile number. Challan can be issued for various reasons like documentation not complete or helmet not their or any issue. Using that extracted image i.e. the vehicle number we will be comparing that number from our database to check whether that vehicle belongs to correct person or not and we will also be checking the documents belongs to that vehicle are complete or not. Using that detail, we will be giving challan if they are suspected.

Shreyas, R. et al. (2017) [18] proposed Automatic Number Plate Recognition (ANPR) System which is based on an image processing technology. The proposed system can be mainly used to monitor road traffic activities such as the identification of vehicle during traffic violations such as speed of vehicle and to detect at the street traffic signals lane violation. From the captured image using image segmentation technique the vehicle number plate region will be extracted. And the technique used for the character recognition on number plate is Optical character recognition. The system design also involves the design and development of GUI using Matlab, to ease the user in step by step recognizing the characters and numbers from the vehicle license plate and displaying on the desktop GUI screen.

## III. RESEARCH METHODOLOGY

This study is based on the license plate reorganization from the moving vehicles. In this work, two scenarios are created for the recognition of license plate. The following are the steps which are followed for the number plate detection:-

**1. Input Images: -**This is the first step, in which number of images is given as input for the training purpose. The training

set will be prepared which will applied for the classification purpose

**2. Apply Watershed Algorithm: -** The watershed is a traditional segmentation algorithm. Segmentation refers to the division of different entities in a picture. This approach starts from the markers defined by the client. This algorithm uses pixels values as a local topography (elevation). This algorithm does the flooding of basins from the markers till the basins featured to several markers not come together on watershed lines. In various conditions, the selection of markers is done as local minima of the picture, out of which the flooding of basins is carried out. The watershed algorithms depend on the demonstration of a picture as a topography respite. Here, the every picture component represents its height. These algorithms can do the processing of both 2D 3D images. Hence, the term component combines the words pixel and voxel. In order to achieve more improved result, the implementation of watershed segmentation is generally carried out to the outcomes of the distance change of the picture instead to the real image. Therefore, the respite comprises minimums, watershed lines and slopes. This algorithm also uses the idea of a region having components of similar height. The main task in this segmentation method is to determining the position of all watershed lines is the major task of watershed segmentation. Up till now, different researchers have presented a lot of watershed algorithms with and without constructing watershed line.

**3. Apply SVM Classifier: -** SVM is mainly a supervised machine learning algorithm. This algorithm needs some training data for the classification of feature points. It is a binary classification model. Therefore, this algorithm has the ability of classifying just two classes at a time. This algorithm classifies points by generating a hyper plane in the feature space. In this process, the positive vectors occur on one side while all negative vectors occur on the side opposite to the hyper plane. In general, these algorithms carry out classification in linear manner. However, these algorithms cam also efficiently perform classification in non-linear manner. For non-linear classification, these algorithms use kernel function to map inputs into big magnitude element spaces. The binary nature of these classifiers limits their ability to just few classes. However, large number of applications requires the classification of greater than two classes. The multi-class classification issue of SVM can be resolved using two techniques. These techniques are OAO (One-Against-One) and OAA (One-Against-All). The multiclass SVM makes use of a voting approach for the classification of classes.

One – Against – One (OAO): This method generates SVM classification models for all pairs of classes. The result of classification represents the class occurring frequently amid the two pair of classes. In case of the equal appearing of both class pairs, the selection of class is done in random manner like the output label. The major issue is that the number of classification model goes on increase with the amount of classes.

One – Against-All (OAA): The number of generated binary SVM classification models should be equal to the amount of classes in this method. The training of every classification model is carried out for distinguishing one class from the residual classes. The final outcome represents the class having the maximum margin with the SVM classification model.

**4. Apply KNN classifier: -** K-Nearest Neighbor (K-NN) is a simple, easy to follow, adaptable and one of the popular ML algorithms. This algorithm finds its applicability in a number of areas. It is a non-parametric and lazy learning algorithm. It is called non-parametric because it does not assume for fundamental data allocation. This means that this model formation is derived from the dataset. As a Lazy algorithm, it does not require any training data objects for generating model. The testing stage makes use of all training data. This phenomenon accelerates the training process and makes the testing stage very slow and costly. K-NN is a simple algorithm. This algorithm stores all the existing cases and does the classification of novel data or case on the basis of a similarity measure.

The output is a class membership in K-NN classifier. The classification of an object is carried out on the basis of majority votes of its neighbors. The object is assigned to the class most frequent amid its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is just allotted to the class of that solo closest neighbor. This algorithm makes use of a distance measure for determining the most similar K patterns with respect to a new input in the training dataset. Euclidean distance is a very famous distance measure used for the input variables with real value.

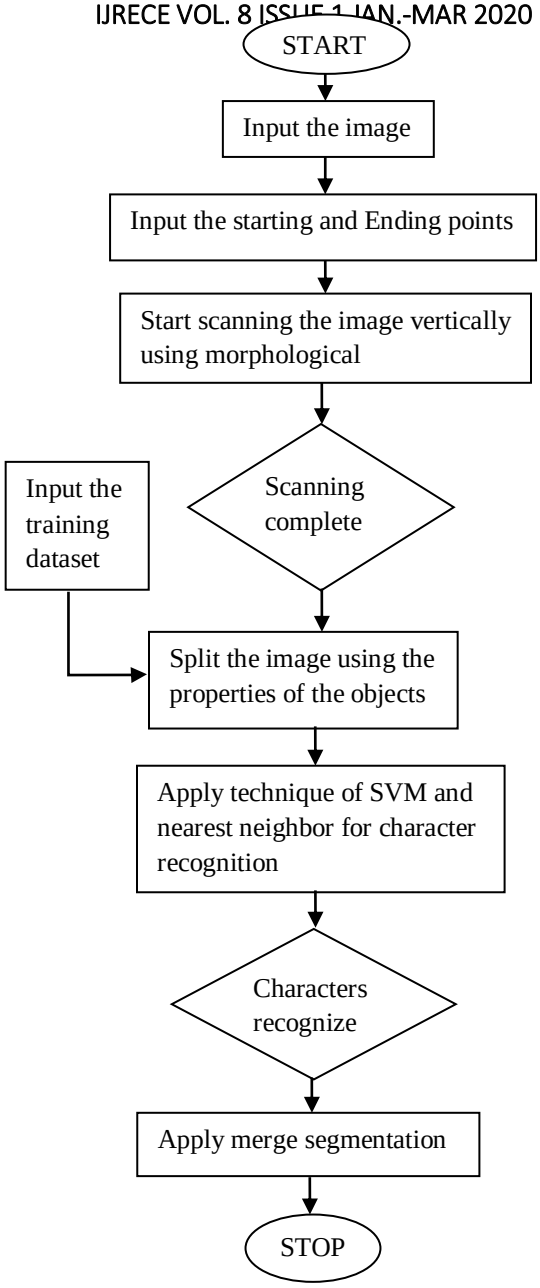


Fig.1: Proposed Flowchart

## IV. EXPERIMENTAL RESULTS

Dataset Description: The dataset is collected from the different sources for the number plate detection. In the dataset the number of images is large in size and also quality of the image is great. The dataset is used by the object detection methods or frameworks which can mark with the bounding boxes. The dataset contains the various type of images which needs to format according to type which can be further processed for the number plate detection. The images which can be processed further can have the noise or images are not of proper size. The technique of pre-processing can be applied which can remove noise from the image and also update size of the image.

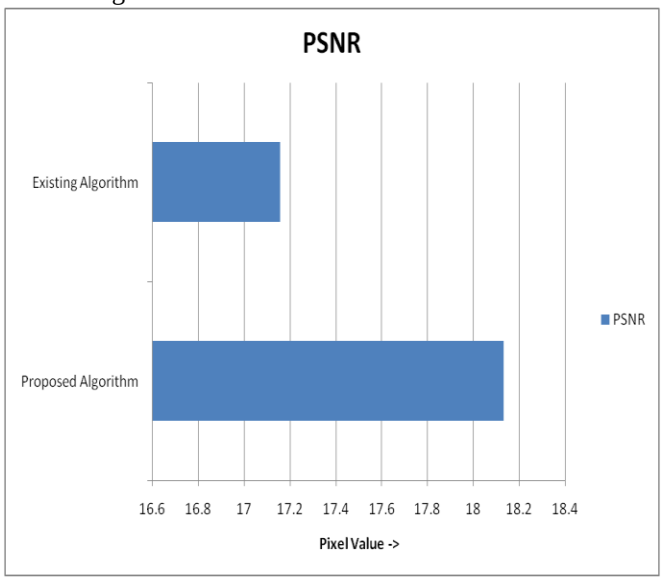


Figure 2 shows that the recommended approach achieves better PSNR than the earlier approach in license plate recognition.

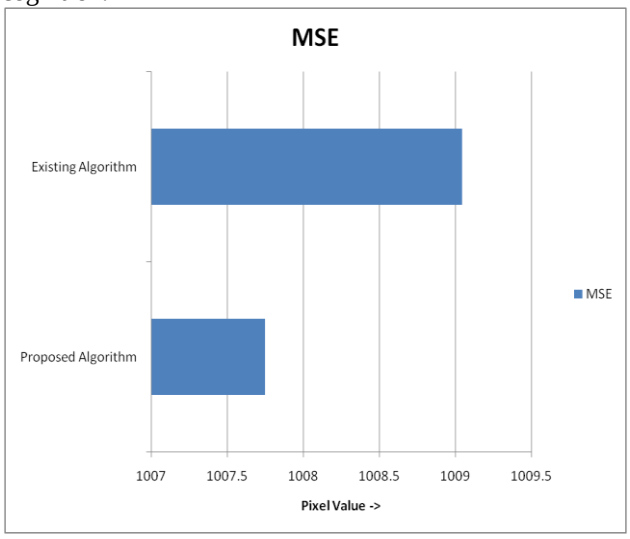

Fig.3: MSE Comparison

Figure 3 show that the recommended approach achieves lesser MSE value than the earlier approach. This happens because of the implementation of KNN for license plate recognition.

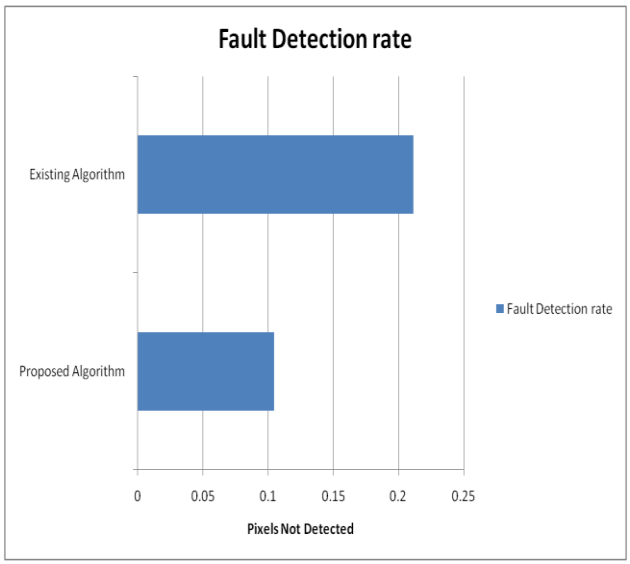


Fig.4: Fault Detection rate

Figure 4 show that the recommended approach has lesser rate of fault detection than the earlier approach. This happens because of the implementation of split and merges segmentation and KNN classifier.

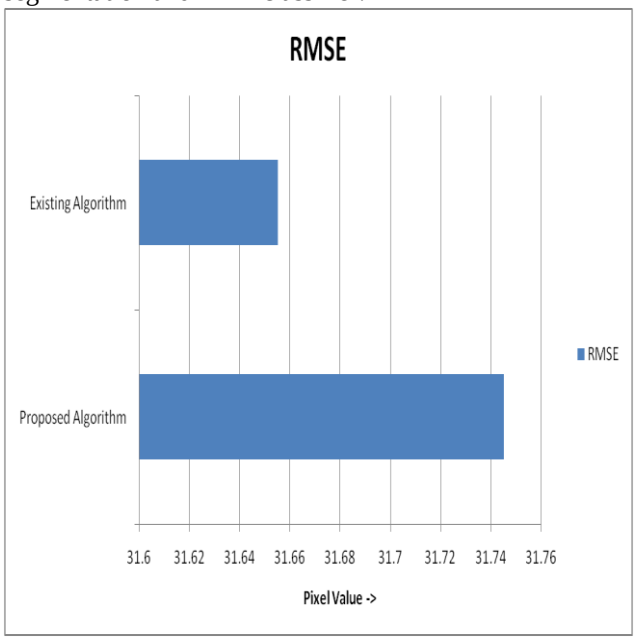


Fig.5: RMSE Comparison

Figure 5 shows that the recommended and earlier approach is compared in terms of RMSE value. The new approach achieves better RMSE than earlier one because of the implementation of KNN classifier.

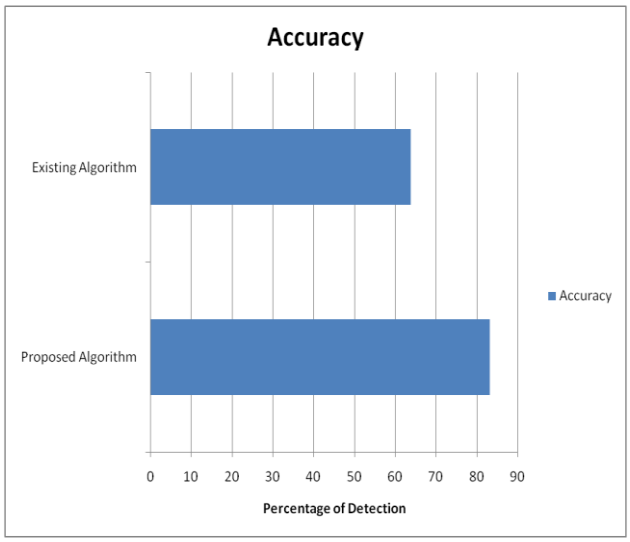


Fig.6: Accuracy Comparison

Figure 6 shows the comparison of new and earlier algorithm in terms of accuracy. The implementation of KNN classifier increases the accuracy of new algorithm at steady rate.

## V. CONCLUSION

The conclusion here is that the proposed technique works on the morphological, split and merge segmentation and neural networks. The split and merge segmentation will be implemented to divided the number plate characters and each character will be treated individually. The character in the number plate will be matched with the pre-defined dataset to generate final output. In the proposed technique it is been analyzed that far number plates are not detected properly. In this work, improvement will be proposed which will be based on the Euclidian distance. The simulation is performed in MATLAB and it is been analyzed that accuracy of proposed modal is 91 %. In future proposed technique will be implemented for detecting the car license plate color and decided that whether car is personal or public transport.

The proposed technique will be based on neural network, in this work car and body will be recognized to detect type of car In future proposed technique will be applied to detect the car number plate color and decided that whether car is personal or public transport.

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