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Enhancing Image Recognition of Damaged Number Plates in the Running Vehicle using Genetic Algorithm Compared with Bernsen Algorithm

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Abstract

Aim Innovative Automatic detection of vehicle number plates using machine learning algorithms and improving the accuracy of image recognition. **Materials and methods :** Two sample groups using 237 images from the sample dataset, which is tested at 80% for G power with t-test analysis.To improve the accuracy of recognition, the genetic algorithm is proposed and compared with the Bernsen algorithm. **Results**: Test results prove that in an uneven illuminated environment the genetic algorithm has an accuracy of 91.5 % , which seems to be better than the Bernsen algorithm accuracy of 88.9%. Since the significance is around 0.017, there is a statistically significant difference among the study group with ($p<0.05$). **Conclusion:** For distorted and damaged images, the detection and image recognition of number plates using the genetic method seems to appear better than the bernsen algorithm. Detection of violations using road side cameras can perform better with the proposed work.

Keywords

Bernsen Algorithm, Novel Number Plate Detection, Genetic Algorithms, Image Processing, Machine Learning, Image Recognition.

INTRODUCTION

The purpose of this research is to detect the accuracy rate of readability for damaged number plates. Number plate detection plays an important role in intelligent transportation systems as the population's usage of vehicles is also increasing and having trouble in traffic control (Dalarmelina et al. 2019). The applications of number plate detection are access control (Uy et al. 2016). pattern image recognition and machine learning vision.Vehicle licence plate recognition system is a mostly used component in modern intelligent traffic control, which can be applied to all sorts of vehicle management (Panahi and Gholampour 2017). Lack of accuracy in identifying the number plates can lead to high false positive

rate and hence traffic monitoring and violations are ineffective (Unnikrishnan, Romeo, and Rawther 2016).

The existing system has 230 conference papers, 40 journal papers and 4 early access articles published. In recent times machine learning has been applied in numerous applications like machine learning and pattern image recognition. It is applied in genetic algorithms and Bernsen algorithms which are getting improved results. An advanced detection system used in complex situations (Al-Shemarry and Li 2020). A robust pre-processing enhancement method is used for detecting licence plates from numerous vehicle images (Yousif et al. 2021). proposed a method for combination of gaussian filter and cumulative histogram equalization method (Al-Shemarry and Li 2020; Laroca et al. 2018) used a robust and efficient licence plate recognition system based on the YOLO Image recognition (Jamtsho, Riyamongkol, and Waranusast 2021)). It uses two modules like character segmentation and character image recognition (Liu et al. 2018). Predicted 86% of accuracy by taking hazardous images and detected licenceplate using statistical binarization and ALP method (Azam and Islam 2016). This paper was mostly cited by 72 articles, which proposed a image thresholding based bernsen algorithm for localization of the damaged number plates.

Previously our team has a rich experience in working on various research projects across multiple disciplines (Venu and Appavu 2021; Gudipaneni et al. 2020; Sivasamy, Venugopal, and Espinoza-González 2020; Sathish et al. 2020; Reddy et al. 2020; Sathish and Karthick 2020; Benin et al. 2020; Nalini, Selvaraj, and Kumar 2020). The research gap in the existing system provides less efficiency in identifying damaged number plates which automatically lead to decrease in accuracy (Liu, Yujie). Hence the number plate extraction, Character segmentation and Character recognition described in detail (Rabbani, Golam,) and shows less accuracy. The vehicle number plate identification is proposed, using segmentation technique and connected component analysis in conjunction with a character recognition (Yepez, Juan, and Seok-bum Ko. 2018.). The aim of this study is to detect the accuracy rate of readability using the bernsen algorithm compared with genetic algorithms (Panahi, Rahim, and Iman Gholampour. 2017).

MATERIALS AND METHODS

The study setting of the proposed work is done in Compiler Design Lab, Saveetha University. The number of groups identified for the study are 2. Group 1 is a genetic algorithm and group 2 is the bernsen algorithm. The sample dataset taken from kaggle.com for each group is 237 and the total dataset is divided and iterated 5 times through the two algorithms (Kim 2014). Genetic algorithm is a natural image processing algorithm, it is an optimization technique used in novel number plate detection systems. It enhances the input image with traits and recognizes each character one by one.
The Bernsen algorithm is proposed for detecting the number plate in uneven illuminations. The input image is converted from RGB to Grey form by removing the shadow of the image and this algorithm is also used in binarization techniques. A sample of the dataset with various attributes are presented in Table 1. There are totally 236 images that are considered as sample training data set images useful for the proposed bernsen algorithm in detecting the damaged number plates.

Genetic Algorithm

To start with testing first import the dataset consisting of images.assign train labels to the data and get test tables for testing the images. Testing procedure initiated with giving input images from the downloaded datasets. The Input image is preprocessed which enhances the input image making the image suitable for next level of image processing. The input image is enhanced using the gaussian filter as shown in Fig. 1, by using this process the characters in the number plate become clearly visible without any other objects. In cleaning the number plate the binarized image is converted into gray scale images by removing the noise. By using these contours the image of the car's number plate should be shown by applying ratio and the rotations. Character segmentation is an

operation that divides the image into subimages by dividing each and every character in the number plate, finally detecting the characters in text format. In Character Image recognition the characters are recognized by aspect ratio in the number plate, after finding the characters one by one it is used to check whether they have the same number plate or not.

Pseudocode For Genetic Algorithm

Let t = 0;
Create an initial population p(t);{calculat
Evaluate population p(t);{calculate the fitness function for each individual }
while not termination do
p(t) = variation[p(t)];
Evaluate population [p(t)];
p(t+1)=apply genetic operations;{Next generation.}
t = t +1;
end while

Pseudocode For Bernsen Algorithm

Input 'G' is a grayscale image vector
Set threshold value 'th'
Set window size 'ws'
For each row 1 to height -ws
For column 1 to width-ws
curr.pixel=G[row,column];
Check If(curr.pixel<avg-th)
Label Bz[row,column]=0;
else
Label Bz[row,column]=1;
Return Binarized image Bz

Software tool used for detecting the accuracy rate of damaged number plates using python programming language. Hardware configuration was Intel core i5 (2.70 GHZ) processor with 8 GB RAM and 64bit OS, x64-based processor system. The Software configuration was the Windows 10 operating system. The data was pre-processed after importing the dataset by removing noises. The dataset was splitted into two parts as training labels and testing records. The genetic algorithm and bernsen algorithms were evaluated with respect to training labels and testing records, the required parameter accuracy percentage was calculated.

Statistical Analysis

This innovative damaged number plate detection system was tested on 237 car images. Each image is different in its length and also the environment conditions. Cars number plates used for detecting damaged number plates collected from kaggle website and the dataset is splitted as 80% is used as trainingand 20% is used for testing the images. The dependent variables are pixel width, resolution, and height and width of the number plate. The independent variables are date of image, size of the image, and location information. To check with the data and accuracy reliability SPSS is used with a default alpha value of (<0.05).

RESULTS

In this innovative number plate detection research it is proved that the bernsen algorithm appears to have better accuracy than the genetic algorithm. Statistical analysis is done for comparing both genetic algorithm and bernsen algorithm using IBM SPSS version 21 tool. By taking accuracy,statistical analysis is performed in the SPSS tool. Parameters taken for comparison of both algorithms are accurate. Finally descriptive statistics applied for the dataset in SPSS.

From group statistics mentioned in Table 1 Sample data sets with 237 images depicting the number plates of various cars. It consists of attributes like resolution, height and width of the image. Also damaged car licence plates are included in the dataset which is taken from the kaggle dataset. Table 2, the mean, standard deviation and standard error mean are compared for our experimental algorithm genetic algorithm and bernsen algorithm. The Bernsen algorithm got a better mean accuracy value of 91.5 in comparison with the genetic algorithm.In the above Table 3, the independent sample t-test results are shown with equal variance assumed as one category and without equal variance as another category. It's found that the level of significance is marginally better.

Fig. 1, represents the mean accuracy between the two algorithms. Genetic algorithms appear to produce consistent results with minimal standard deviation. There is a significant difference between genetic algorithms and the Bernsen algorithm. The analysis observed that the bernsen algorithm seems to be better than the genetic algorithm in detection of damaged number plates.

DISCUSSION

In this study, observed that the genetic algorithm (91.5%) seems to have better accuracy than the traditional method of genetic bernsen algorithm (88.9.%) for damaged number plate detection. Bernsen algorithm is not accurate in classifying the segmentation of characters for large datasets. Large datasets can take more time for training and testing and also the accuracy of efficiency is less. A genetic algorithm is a complex model for detecting the images. The institution is passionate about high quality evidence based research and has excelled in various fields (Vijayashree Priyadharsini 2019; Ezhilarasan, Apoorva, and Ashok Vardhan 2019; Ramesh et al. 2018; Mathew et al. 2020; Sridharan et al. 2019; Pc, Marimuthu, and Devadoss 2018; Ramadurai et al. 2019). We hope this study adds to this rich legacy.

There are similar papers on the detection of vehicle number plates using deep learning algorithms. (Pechiammal and Renjith 2017). In this research they used gabor filtering techniques and character object recognition methods in detecting the vehicle number plate with an accuracy (79%). In this research they used a framework based on the concept of localization of multiwavelet transform and EMD analysed with an accuracy (98%) (Saini and Saini 2017). Detecting vehicle number plates in matlab using k means clustering algorithm by using image degradation techniques(Smara, Abo Smara, and Khalefah 2014; Chen et al. 2020)). accuracy (98.4%) and efficiency can be further improved by applying optimization algorithm techniques whereby damaged novel number plate detection can be predicted accurately.

CONCLUSION

In this research the bernsen algorithm seems to appear with better accuracy percentage (91.5%)in detecting the damaged number plates in uneven illuminations. The proposed method the characters in the damaged number plates are divided effectively by using a genetic algorithm.

DECLARATIONS

Conflict of Interests

No conflict of interest in this manuscript.

Author Contribution

Author YHV was involved in data collection, data analysis, manuscript writing. Author TPA was involved in conceptualization, guidance and critical review of manuscript.

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Tables and Figures

Table 1. Sample data sets with 237 images depicting the number plates of various cars. It consists of attributes like resolution, height and width of the image. Also damaged car licence plates are included in the dataset which is taken from the kaggle dataset.

File name	Width	height	class	xmin	ymin	xmax	ymax
	149	43	licence plate	283	177	432	220
	1374	294	licence plate	121	43	1495	337
	459	239	licence plate	26	15	485	254
	148	54	licence plate	48	291	196	345
	113	58	licence plate	61	131	174	189

Table 2. Group statistics results (Mean of bernsen algorithm 91.5 appears to be more compared with genetic algorithm 88.9 and Standard Error Mean for genetic algorithm is .333 and Bernsen algorithm is .943 is .445)

	Groups	N	Mean	Std.Deviation	Std.Error Mean

Accuracy	Genetic Algorithm	5	91.900	0.74503	.33319
	Bernsen algorithm	5	88.500	2.10950	.94340

Table 3. Independent Sample T- test Result is applied for dataset fixing confidence interval as 95% and level of significance as (<0.05) (bernsen appears to perform significantly better than genetic)

		Lavene's test for equality of variances		**T-test for Equality of Means**					**95% confidence interval of the difference**	
		F	**Sig**	**t**	**df**	**sig(2 tailed)**	**Mean diff**	**Std.error**	**Lower**	**Upper**
Accuracy	**Equal Variances assumed**	3.68	.017	1.707	8	.012	1.7080	1.00051	-.59917	4.01517
	Equal Variances not assumed			1.707	4.983	.014	1.7080	1.00051	-.86659	4.28259

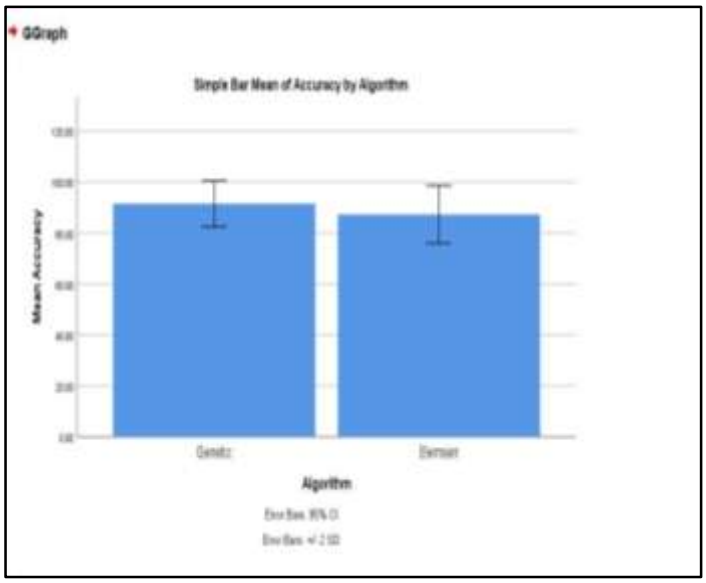

Fig. 1. Comparison of mean accuracy between Genetic algorithm over Bernsen algorithm, where the former is better than the later with 2.5% increase. X axis gives the algorithms and Y Axis: Mean accuracy of detection ± 1 SD.