IMPROVED ACCURACY IN AUTOMATED LICENSE PLATE RECOGNITION SYSTEM BASED ON CONVOLUTION NEURAL NETWORK COMPARED WITH ADABOOST

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Abstract

Aim: The main objective of the study is to recognize the license plate recognition system using Novel Convolution Neural Network(CNN) in comparison with Adaboost algorithm for the TRAIN dataset. **Materials and Methods:** Recognition of license plate is recognized using Novel Convolution Neural Network algorithm (N=20) and Adaboost (N=20).Convolution Neural Network algorithm is a supervised machine learning,Deep learning recognition algorithm, it is basically used for image classification and recognition because of its high accuracy. Adaboost algorithm are supervised learning models with associated learning algorithms that analyze data for classification and regression analysis. TRAIN dataset is used for recognition of license plate. **Results:** The accuracy of license plate recognition using the Novel Convolution Neural Network algorithm is 95.39% and Adaboost algorithm is 93.35%. There is a significant difference between Convolution Neural Network algorithm and Adaboost algorithm. **Conclusion:** Novel Convolution Neural Network algorithm seems to be more accurate than the Adaboost algorithm in recognition of license plate.

Keywords: License Plate Recognition System, Novel Convolution Neural Network(CNN), Adaboost, Deep learning, Machine learning, Accuracy.

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1. Introduction:

Line detection, neural networks, and fuzzy logic car license plate locating algorithms are some of the most used license plate locating techniques. (Park et al. 2018)These procedures are tough to utilize and should only be used in extreme circumstances. The key differences between license plate images and non-license plate photographs are examined in this article. Then there are a number of features that can be distinguished from one another. (Laxmi and Rohil 2014)We can locate license plates with high accuracy using the results of the powerful classifier. A characteristic is assigned to each weak classifier. (Nagare 2011)We can build a quick strong classifier by taking into account all of these weak classifiers. A good preprocessing method can remove image background's interference information while also highlighting the license plate information. (Ranjithkumar and Chenthur Pandian 2022)After edge identification, the gray image can substantially reduce the amount of data in order to screen out complexity information while retaining the image's crucial structural qualities.

There are around 216 articles published in IEEE and 56 articles published in Google Scholar for the past 5 years. It has introduced a new model called convolutional neural network model to recognize license plate with approximation success rate around 93%. (Dehshibi and Allahverdi 2012)used Adaboost algorithm for license plate recognition and improvised models to give higher accurate results than existing algorithms. used Adaboost classification technique to find the hidden patterns in the dataset for classifying the data more efficiently. The maximum accuracy achieved was nearly 95.39%.(Rusakov 2020)used fuzzy model for recognizing the license plate, it is the combination of Novel Convolution Neural Network algorithm with the Adaboost algorithm and the maximum accuracy achieved is around 95.39%.

Our institution is keen on working on latest research trends and has extensive knowledge and research experience which resulted in quality publications (Rinesh et al. 2022; Sundararaman et al. 2022; Mohanavel et al. 2022; Ram et al. 2022; Dinesh Kumar et al. 2022; Vijayalakshmi et al. 2022; Sudhan et al. 2022; Kumar et al. 2022; Sathish et al. 2022; Mahesh et al. 2022; Yaashikaa et al. 2022). All the previously existing deep learning, machine learning models show less accurate results in recognizing the license plate. So the current paper aims is to recognize the actions using Novel Convolution Neural Network Algorithm and Adaboost Algorithm with comparatively higher improved accurate results by modifying the models and choosing the larger dataset with more number of parameters and more diverse results these help in determining patterns much better compared to previous models.The aim is to improve the accuracy rate using an enhanced Convolution Neural Network algorithm in comparison with Adaboost Algorithm for license plate recognition.

2. Materials And Methods

The study setting of the proposed work is done in the Computer Vision Laboratory, Saveetha School Of Engineering, SIMATS, Chennai. The total number of groups in this project are two and the first group is the Novel Convolution Neural Network algorithm and the second group is the Adaboost algorithm(Rusakov 2020). Sample size was calculated by using previous study results, in Sample Size Calculator (clincalc.com) by keeping threshold 0.05, G power 35%, confidence interval 95.39 %.

The current dataset which is being followed is TRAIN Dataset is collected from license plate Recognition Database | Kaggle. (Nagare 2011)The database consists of 6 columns and 1000 rows. They contain data of 396 license plates. Out of these 396 samples, 130 are of cars, 130 are of bikes, 110 are of trucks, 26 are of buses.

Convolution Neural Networks Algorithm

A Novel Convolution Neural Network (CNN) is a Supervised Machine Learning, Deep Learning system that can take an input image, assign relevance (learnable weights and biases) to various aspects in the image, and distinguish between them, it is more efficient and produces more accurate results compared to Support Vector Machine algorithm. Because of its great accuracy, CNNs are employed for picture categorization and recognition. The CNN uses a hierarchical model that builds a network, similar to a funnel, and then outputs a fully-connected layer in which all neurons are connected to each other and the output is processed.

Pseudocode

Input- TRAIN Dataset
Output- Accuracy of the model

```
Import Convolutional Network Classifier
  Import Convolutional Neural Network as CNN
    filename, pathname = uigetfile({'*.jpg'; '*.bmp'; '*.tif'; '*.gif'; '*.png'; '*.jpeg'}
          'Load Image File';
            if isequal(filename,0)||isequal(pathname,0)
                warndlg('Press OK to continue', 'Warning');
                  else
```

```
image aqa = imread([pathname filename]);
imshow(image aqa);
title('Input');
image aqa = Preprocess( image aqa );
figure;
imshow(image aqa);
title('Preprocess');
image aqa = imresize(image aqa);
Compare images and gives the accuracy;
Plot the graph for accuracy;
Plot the graph for specificity;
Accuracy of the Convolutional Neural Network classifier;
```

Adaboost

The statistical classification meta-algorithm AdaBoost (short for Adaptive Boosting) is a statistical classification meta-algorithm. It can be combined with a variety of other learning algorithms to boost performance. Other learning algorithms' output ('weak learners') are blended into a weighted total that represents the boosted classifier's final output. AdaBoost is adaptive in that it tweaks succeeding weak learners in favor of instances misclassified by earlier classifiers. It may be less prone to the overfitting problem than other learning algorithms in particular situations. Individual learners may be poor, but as long as their performance is marginally better than random guessing, the final model will converge to a powerful learner.

Pseudocode

Input- TRAIN Dataset
Output- Accuracy of the model
Step 1:AdaBoost(Input,Neurons,Repeat) Create Input Database
Step 2:Input - Database with all possible variable combinations Train AdaBoosts
Step 3: for Input = 1 to End of input do
Step 4: for Neurons =1 to 20 do
Step 5: for Repeat = 1 to 20 do
Step 6: Train AdaBoost
Step 7: AdaBoost- Storage--- Save best predicting AdaBoost depending on inputs
Step 8: end for
Step 9: end for
Step 10: AdaBoost-Storage---save best predicting AdaBoost depending on inputs
Step 11: end for
Step 12: return AdaBoost-storage - Library with best predicating AdaBoost for every Variable combination.
Step 13:end procedure.

The platform used to evaluate the algorithms was Jupyter (Anaconda) software. The hardware configurations were an Intel core i5 processor with a ram size of 8GB. The Software Configuration of the system is 64-bit, Windows OS, 64 bit processor with HDD of 2TB.

Statistical Analysis

In the current Study we used a Statistical tool called IBM SPSS. Using this software's descriptive and group statistics for the accuracy values are calculated. Independent sample tests are taken and significance values are calculated. According to the analysis done between Novel Convolution Neural Network Algorithm and AdaBoost Algorithm, Convolution Neural Network Algorithm appears to perform better than AdaBoost Algorithm in all the platforms. Independent variables are distinct attributes that are helpful in prediction and dependent variables are improved accuracy values.

3. Results

Table 1 shows descriptive statistics for accuracy for both the algorithms Novel Convolution Neural Network and AdaBoost. Table 2 shows group statistics which gives the accuracy mean of 95.39% for Convolution Neural Network algorithm appears to be more when compared with AdaBoost algorithm which has only 93.35%. Standard deviation and mean errors are calculated (Standard error mean for Convolution Neural Network Algorithm is 0.229 and AdaBoost Algorithm is 0.243) Table 3 shows Independent test analysis, it gives significance 0.001. The bar chart Fig.1 shows the mean accuracy between Novel Convolution Neural Network Algorithm and AdaBoost Algorithm. From the results it is clearly evident that Convolution Neural Network Algorithm is performing better when compared to AdaBoost.

4. Discussion

In this research work the Novel Convolution Neural Network dominated the AdaBoost algorithm. Both the simplicity of the approach and the achieved accuracy confirm that the Convolution Neural Network is the way to follow for image classification problems with relatively large datasets.This technique identifies license plate, percentage with good accuracy for identification of different license plates. The improved accuracy of the Convolution Neural Network algorithm (mean accuracy =95.39%) than AdaBoost algorithm (mean accuracy =93.35%).

In employ adaboost techniques to locate license plates in a horizontal area, so just need to think about the grid search in that direction. use a fixed-size grid that moves every two pixels, and

compute the image grid to judge(Laxmi and Rohil 2014). Our strategy is to find multiple license plates and then choose the one that is most suited.The efficiency of a plate locating system is primarily determined by two critical performance parameters: location rate and location speed(Laxmi and Rohil 2014; Park et al. 2018). To conduct three types of studies, photos are sorted into day, night, and overcast days in the experiment.The major purpose of this experiment is to increase the location rate. When the location rate reaches a specific threshold, it can consider the time-saving requirements.

The core of the algorithm is based on the AdaBoost("A Fast and Robust License Plate Detection Algorithm Based on Two-Stage Cascade AdaBoost" 2014). In addition, the algorithm is efficient in terms of the processing time and accuracy ratio. AdaBoost Algorithm has accuracy of 93.35% and Novel Convolution Neural Network Algorithm has 95.39%. (Sun et al. 2021)Also compared AdaBoost Algorithm with the Convolution Neural Network Algorithm and the results shows that Convolution Neural Network (Zhang et al. 2021)Algorithm is performing better than the AdaBoost Algorithm. It has also shown similar results to that have got finally. Also performed license plate recognition on machine learning, Deep Learning algorithms and the results shows that Convolution Neural Network Algorithm perform better and have the highest accuracy among all other algorithms.

There are some limitations with the Convolution Neural Network that consists of clusters of a large number of decision trees which takes more time to get executed compared to other machine learning, deep Learning algorithms for license plate recognition. In the future work will improve this model with better features and least running time possible and getting more precise results. This might have a better future as the number of actions has been increasing every day.

5. Conclusion

In this current paper we recognized the license plate using two different algorithms, Novel Convolution Neural Network algorithm and AdaBoost algorithm. Convolution Neural Network algorithm shows higher accuracy rate and performed better at a more significant rate than that of the AdaBoost algorithm.

DECLARATIONS

Conflicts of interests

No conflicts of interest

Authors Contribution

Author DBP was involved in data collection, data analysis, and manuscript writing.

Author AM was involved in conceptualization, data validation and critical review of manuscript.

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Tables And Figures

Table 1. Accuracy Values for CNN and AdaBoost. The efficiency of CNN algorithm(95.39) is more than AdaBoost algorithm(93.35).

S.NO	CNN	AdaBoost
1	94.40	93.20
2	94.60	93.80
3	94.80	93.40
4	95.00	93.50
5	95.20	92.70
6	95.40	94.90
7	95.60	92.33
8	96.10	92.67
9	96.30	92.90

10	96.50	94.10

Table 2. Group Statistics Results-CNN has an mean accuracy (95.39%), std.deviation (0.726), whereas for AdaBoost has mean accuracy (93.35%), std.deviation (0.770).

Group Statistics					
	Groups	**N**	**Mean**	**Std deviation**	**Std. Error Mean**
Accuracy	CNN	10	95.39	0.726	0.229
	AdaBoost	10	93.35	0.770	0.243

Table 3. Independent Samples T-test - CNN seems to be significantly better than AdaBoost.

	Independent Samples Test									
	Levene's Test for Equality of Variances						**T-test for Equality of Means**			
Accuracy	**F**	**Sig**	**t**	**df**	**Significance**		**Mean Difference**	**Std.Error Difference**	**95% Confidence Interval of the Difference**	
					One-Sided p	**Two-Sided p**			**Lower**	**Upper**
Equal variances assumed	0.000	1.000	6.092	18	0.001	0.001	2.040	0.284	0.334	1.336
Equal variances not assumed			6.092	17.93	0.001	0.001	2.040	0.284	0.334	1.336

GRAPH:

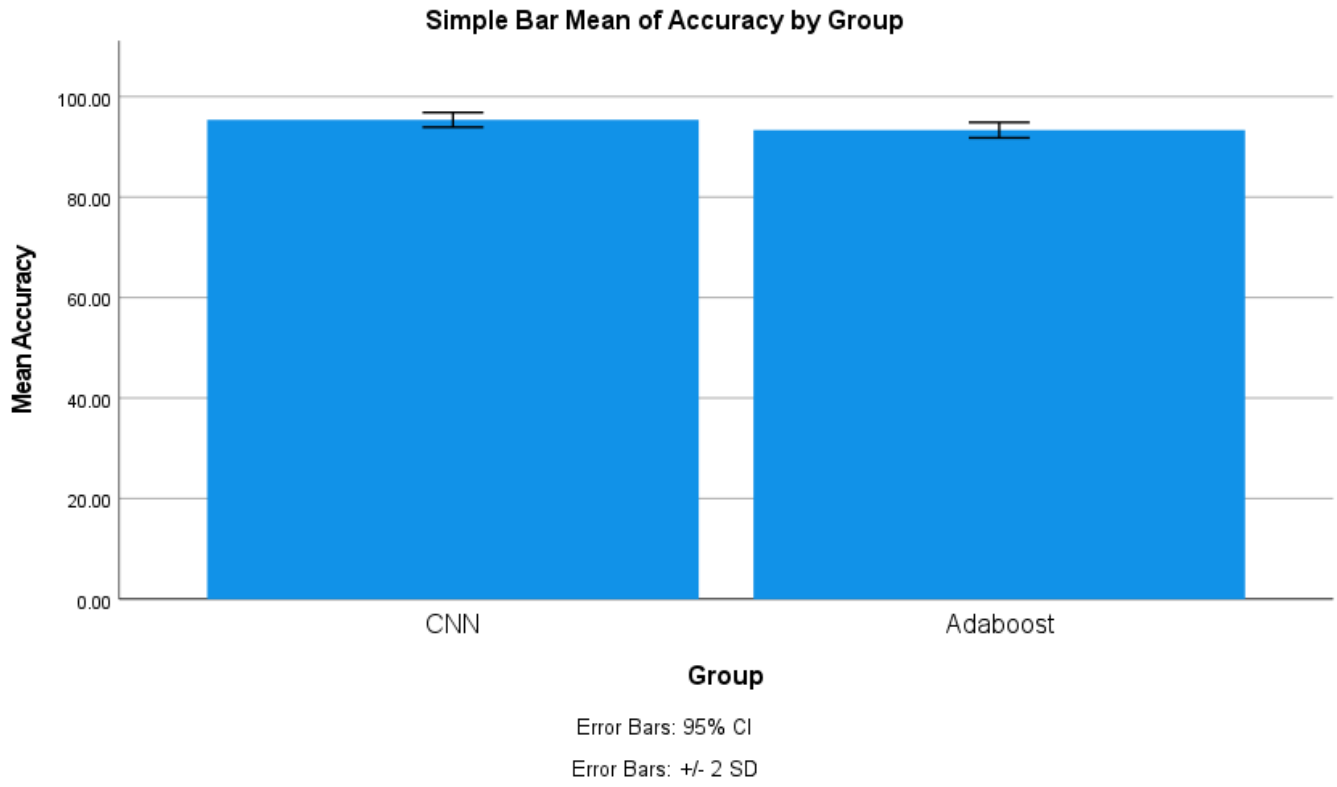

Fig. 1. Bar Graph Comparison on mean accuracy of CNN (95.39%) and AdaBoost(93.35%). X-axis:CNN, AdaBoost, Y-axis: Mean Accuracy with $\pm$2 SD.