ISSN (Print) : 2320 – 3765
ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 6, June 2016

Detecting of Vehicle Logo using Ada Boost

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ABSTRACT: Today, brands play an important role in the world economic market,in such a way that each brand possesses a symbol or logo. The present study aimed at detecting the logo of vehicle manufacturers' brands using AdaBoost. The results show that the proposed algorithm, with amean accuracy of 90.5% and the mean standard deviation of 1.75 has been able to identify the learnt logos. In other words, the proposed algorithm can approximately distinguish 9 out of 10 logos accurately. In this proposed method, the image in which a logo might be presented and another logo, as a test, will be given to the algorithm. If there is any logo in the image, the logo will be compared with the test logo and if both logos match, a message indicating the congruency of the logos will be displayed on the screen.

KEYWORDS: logo recognition, AdaBoost, neural network.

I.INTRODUCTION

Logo or icon representing the manufacturer of a product is defined in the whole world and this icon is so valuable in today economic world. The aim of the present study is to identify the logo using AdaBoost. In so doing, the logo presented in the image will be identified, then it will be separated and compared with database logos. The first step is the detectingof logo in the image to ensure if there is any logo in it. Afterwards, the logo will be separated and then compared with the proposed sample. If both match with each other, the logo of the image will be considered as the certified logo. In the present study, 10 vehicle samples, with various logos, were evaluated using AdaBoost. This number is intended as the baseline data to identify different types of logos. It is noteworthy that, learning of these logos is realized by the learning-based neural network. The results obtained from this study indicate the power of this method in learning the instructed logos. Therefore, the combination of AdaBoost and artificial neural network provide us with a strong technique in order to detect and identify the instructed logos in a short time and with high accuracy presented in the results.

II.LITERATURE REVIEW

Plethora of research has been carried out in the field of detecting of logo in images.Among these research, we might refer to the research carried out by Bagheri et al [1] in which the researchers applied a fusion method calledDempster-Shafer to recognize logo in an image. In another study by Lowther et al [2], the researchers were trying to find logo using the features of higher-order spectra and classification by the nearest neighbor of the next layer of the received images.Mostafa Salam [3] utilized the techniques of recognizing the edges and morphological filters to recognize and separate the logo in the image.Zhuang et al [4] proposed a fast method; however, the only purpose was to recognize the logo in the image taken from a vehicle; therefore, no method for detecting and matching existed. Psyllos et al [5] describe a method for detecting and detecting of the logo in the images taken from the front view. Some researchers focused on the speed of the analysis and the detecting of logo.Yunqiong et al [6] proposed a new method which is fast in the detecting of the vehicle logo in an image to compare it with the logos available in the archive to recognize the logo of the give vehicle. The increase in the detecting speed has been obtained at the expense of the increase in detecting error in the image. Dai et al [7] using a fusion method byTchebichef invariants and SVM classifier succeeded in proposing a method to recognize the vehicle logo in the image.Although the proposed method is very accurate, but due to heavy computations, the speed of algorithm calculation is lowwhich, in turn, leads to the inability of the proposed algorithm in real applications. Sulehria et al [8] published a paper in which histograph was used to identify logo. In this study, first the License Plate is recognized and then the vehicle logo is identified. Afterwards, the identified logo will be compared with the logos in the archive which lasts 1230 ms. This method relies on the License

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ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 5, Issue 6, June 2016

Plate to identify logo. Sam et al [9] utilized a fusion method by AdaBoost andTchebichef Radial Moment to recognize the vehicle logo; however, another method is proposed in this study to improve the recognition.

III.PROCEDURE

The reading flowchart and image logo detecting by AdaBoostis seen in Figure 1.

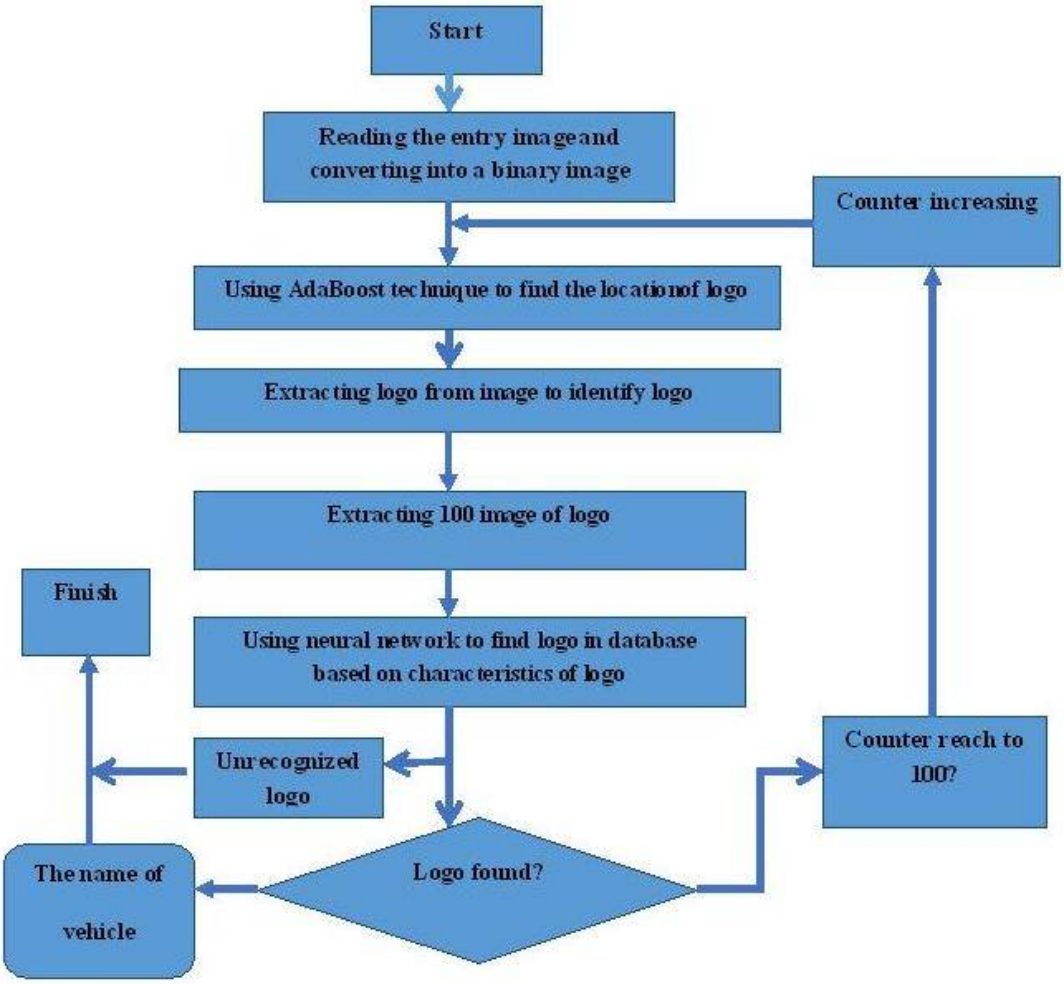

Figure 1. Flowchart of the logo detecting procedure

Considering the above flowchart, the following steps will be taken to identify a logo.
Step 1
The image of the vehicle having a logo will be fed into the program (Figure 2). This colorful picture, with the size of 463*664, is taken by a camera.

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ISSN (Online): 2278 – 8875

International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Figure 2. The image of the vehicle with logo

Step 2
To lower the volume and increase the computation speed, the image will convert into a binary image using the Equation (1) (Figure 3).

Figure 3. Converting the colorful image into Binary image

$$dst(x,y) = \begin{cases} \max Valuen \Rightarrow if Src(x,y) > T(x,y) \\ 0 \end{cases} \quad (1)$$

Step 3
AdaBoost Algorithm
AdaBoost is the short form of "Adaptive Boosting", and is a machine learning algorithm formulated by Yoav Freund and Robert Schapire. In fact, AdaBoost is a meta-algorithm which is used to enhance performance and to fix the problem of unbalanced layers along with other learning algorithms.In a classifier algorithm, each new stage will be setin favor of the falsely classified samples of the previous stages.AdaBoost is sensitive to noisy data and outliers. In summary, the boosting of one meta-algorithm will be achieved in supervised learning techniques, a branch of machine learning, which improves the detecting of efficient parameters in a problem. AdaBoost is the best known boosting algorithm which is widely used in learning problems. AdaBoost is in fact a classifier which works based on a large number of weak learners. These learners, by their own, cannot function as a favorable factor for classifying a phenomenon; however, a combination of all of them makes a strong classifier.
AdaBoost classifier act like a deep binary tree at each stage to carry out a learner-based evaluation. If the evaluated factor does not possess the conditions of a learner, it will immediately be returned;

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International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 5, Issue 6, June 2016

otherwise, it will proceed to the next stage. The ideal form is when none of the learners return the evaluation factor. Figure 4 presents the hierarchical procedure of AdaBoost.

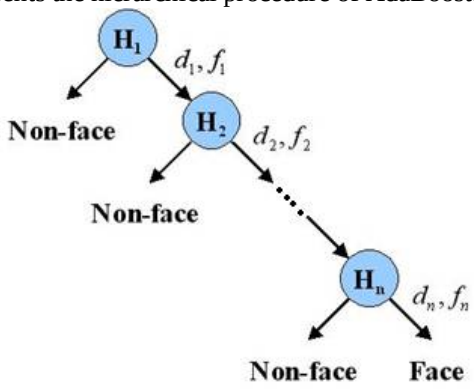

Figure 4. Approval or disapproval process of a phenomenon based on theweak learners in AdaBoost

To recognize the logo at this stage, the logo limit will be identified by the AdaBoost proposed algorithm (Figure 5). As it can be seen in this figure, the program will select the part of the image which contains a logo and prepares for logo recognition.

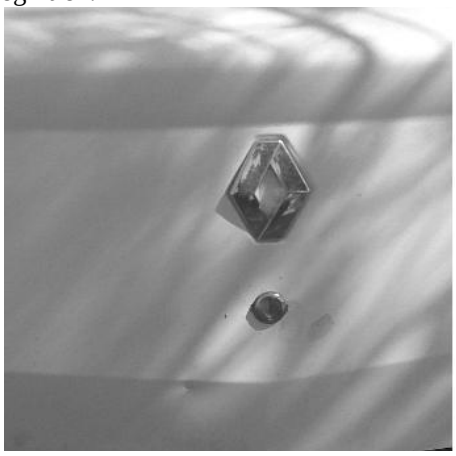

Figure 5. detecting of logo limit

Step 2

Basic Information

To do experiments on the logo exists in the world, 10 vehicles with different logos were investigated. These logos were considered as the database for the present study (Table 1).

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Table 1.Vehicle Brands samples for testing

No	Vehicle Name	Manufacturer	Logo
1	Samand	Iran Khodro	
2	Saba Pride	Saipa	
3	Renault L90	Renault	
4	Camry	Toyota	
5	Santa Fe	Hyundai	
6	Peugeot 206	Peugeot	
7	Sportage	Kia Motors	
8	Mercedes	Benz	
9	Murano	Nissan	
10	X5	BMW	

In this step, a logo will be introduced to the program as the reference. In the following figure (Figure 6), 100 important points of this reference are identified by artificial neural networks.

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International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering

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Vol. 5, Issue 6, June 2016

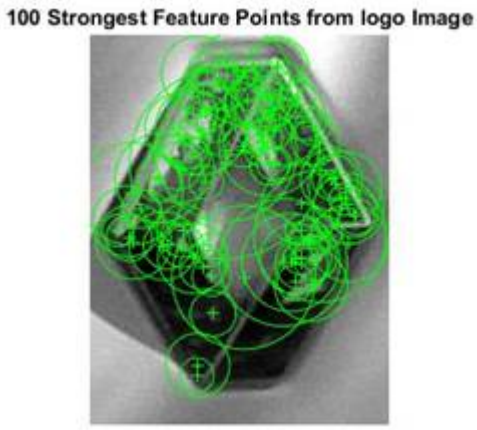

Figure 6. Recognizing 100 points from important points of the reference logo

Step 5
In this step, 100 important points of the image containing a logo will be separated to be able to recognize the logo and compare it with the reference logo (Figure 7).

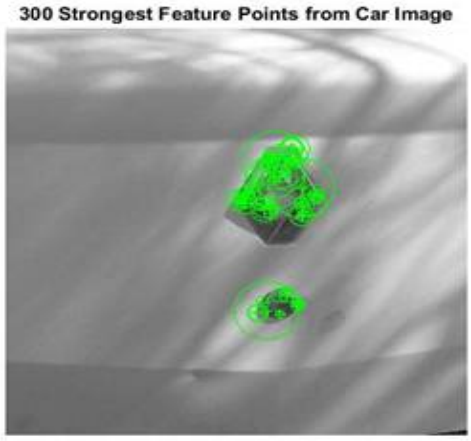

Figure 7. Recognizing 100 points of the important points of the image with logo

Step 6
In this step, the 100 points of the reference logo and the image with logo identified in the two previous steps will be compared. If similarities exists, we might conclude that the reference logo matches the image logo (Figure 8).

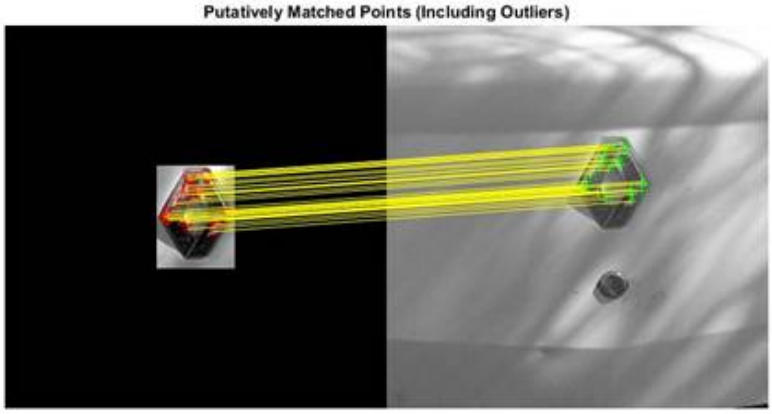

Figure 8. Comparing 100 points of the reference logo with the image logo

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Step 7
The logo within the image will be displayed after recognition. In Figure 9, the recognized logo will be separated from the image.

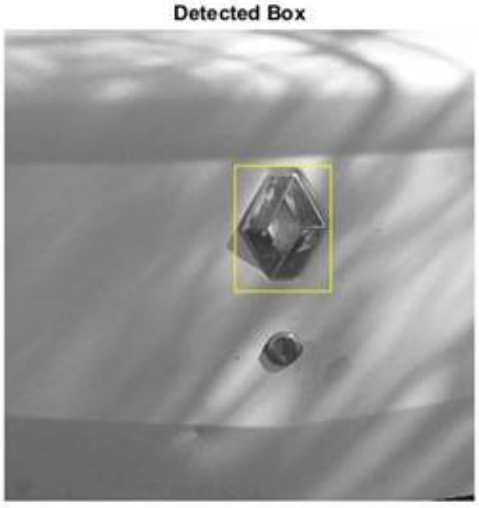

Figure 9. The detected logo

If the image logo does not match with any of the logos in the archive, no sign of matching will be displayed on the screen. Figure 10 presents this mismatch.

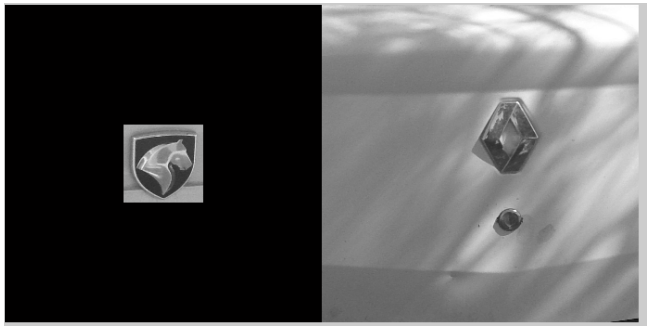

Figure 10. Mismatch between logo and the image logo

IV. RESULTS

The results indicate that three cases were recognized with 100% accuracy and the lowest accuracy was 68% and 76% which is due to the high resemblance of the two logos. This resemblance misguides the proposed algorithm. In other cases, the accuracy is above 90% which is considerable as acceptable.Standard deviation indicates the error in identifying logo. Based on the obtained results, it can be said thatthe standard deviation was zero in three of the 10 samples which indicates the high accuracy. In general, the proposed algorithm, with the mean accuracy of 90.5% and mean standard deviation of 1.75 was capable of recognizing the learnt logo with an acceptable accuracy. The standard deviation can be estimated using Equation (2).
(2)

$$SD = \left(\frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2 \right)^{0.5}$$

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} (x_i)$$

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In this equation, n is the number tested and x is the accuracy obtained in each run of the algorithm for ten examples of a logo. The results of using AdaBoost and experiments for recognizing the existing logos in database are presented in Table 2.

Table 2. Results of investigating 10 sample logos with the images provided

No	Vehicle Name	Manufacturer	Accurate Recognition Mean Percent	Standard deviation
1	Samand	Iran Khodro	100	0
2	Saba Pride	Saipa	94	1.2
3	Renault L90	Renault	99	.5
4	Camry	Toyota	76	2.4
5	Santa Fe	Hyundai	68	4.2
6	Peugeot 206	Peugeot	100	0
7	Sportage	Kia Motors	92	2
8	Mercedes	Benz	97	2.6
9	Murano	Nissan	79	4.6
10	X5	BMW	100	0

V. CONCLUSION

This project can be used at the broadercommercial and industrial level if the scope is expanded and if a more extensive archive including other logos and brands are complied.

1. With providing better solutions and novel ways of image processing and neural networks, filtering can operate at higher speeds and more efficiency.
2. By increasing the number of sample logos in the archive, the number of samples to be tested will increase.
3. Developing the program to separate and distinguish the name and model of different vehicles having logo.

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