مجلة كلية التربية الاساسية
كلية التربية الاساسية – الجامعة المستنصرية
Journal of the College of Basic Education Vol.29 (NO. 119) 2023, pp. 1-9

Detection of Traffic Signs using feature based on of Speed Up Robust method

Shahad J. Shahbaz[1] **Ali A. D. Al-Zuky**[1] **Fatin E. M. Al-Obaidi**[1]*

[1]Department of Physics, College of Science, Mustansiriyah University, Baghdad, Iraq
shahadjafar@uomustansiriyah.edu.iq
prof.alialzuky@uomustansiriyah.edu.iq
*sci.phy.fam@uomustansiriyah.edu.iq

Abstract:

Variations in perspective, illumination, occlusion, motion blur, and weatherworn degeneration of signs could all be crucial in identifying road signs. The goal of this project is to evaluate the image processing technique's performance in detecting and recognizing road signs, as well as determine the optimum threshold value range for doing so. The Speed Up Robust Features (SURF) detector was tested in the current project to detect and recognize road signs through Bagdad's streets under various speeds and threshold values. The importance of the threshold's value was highlighted here to occupy an accurate detection and hence recognize road sign at final. The optimum threshold value for best detection resulted usually in the range (20-25) for all speed signs. The latter recorded its highest precision value at five threshold value while the highest precision value (i.e. 0.5) resulted for speed sign 40 followed by 60 and 80-speed signs.

Key words: Speed Up Robust Features (SURF), threshold values, true positive, false positive, precision.

1. Introduction

As the number of vehicles on road grows, traffic sign management becomes more difficult, necessitating the use of speed limit signs to warn drivers and pedestrians. The latter is typically used to regulate traffic and display the state of the road, necessitating the installation of an intelligent monitoring system [1,2]. A traffic Sign Detection and Recognition (TSDR) system assists road users by directing them and presenting them with all traffic-related information [3]. Smart cars are quickly adopting video-based driver aid systems as standard equipment. It monitors and analyses local traffic conditions, considerably enhancing driving safety. Computer vision algorithms have been studied in conjunction with one another. Diverse strategies have been used to implement driver assistance. Obstacle detection is one of these uses [4]. lane detection [5], parking support [6]. Road signs can be positioned in a number of directions and at different heights. They can also be obscured by vegetation or disappear over time due to fading [7] Here, some traffic signs will be detected and recognized using the Speeded up Robust Feature (SURF).

Many researchers adopted various techniques in detecting and recognizing road signs.

Dalve A. A. et. al. in (2016) used text or symbol detection and recognition from traffic panels. The maximally stable extremal regions (MSER) algorithm is utilized here for text detection, while the optical character recognition method is employed for recognition by using XML files for automated testing that will improve the detection accuracy [8]. Kye H.W. et. al. in (2016) used the Hough circle transformation method and SURF feature for road sign classification. The findings of such reference show that the system may be used for real-time video processing. Furthermore, the method performs better when employed on a video sequence rather than the usual approach of traffic sign detection in static photos. The system's convenience has been demonstrated by the experimental finding in-depth examination of a publically available data set in real-world conditions [9].

2. Tools and Methodology

During the pre-processing stage, finding key spots and descriptors for each image is required for matching image extraction from the shape basis in order to employ the recognition approach [7]. One of the finest methods is the feature-based algorithm known as SURF, which has been widely used in computer vision applications [10,11]. The three phases that make up SURF are feature extraction, description, and matching [12]. Due to the feature-based approaches used in SURF, it requires a lot of computation. The frame rate as a result is frequently very poor. SURF is a real-time application for portable vehicles, platforms, parallel processing architectures, and systems that must be considered by looking at the parallelism in each step in order to function [13]. Scale-Invariant Feature Transform is what gave rise to SURF (SIFT) [8] and can presented in the next figure:

Figure 1. SURF's steps [14]

The videos were recorded with the aid of a mobile camera (iPhone 12 pro max) with a resolution of 12 MP at a height (1.5-1.6) m above ground. The software program is conducted here using MATLAB (R2020a), by utilizing multiple movies for traffic signs that are no longer than five seconds for each one, with varying driving speeds through different streets of Baghdad city in day time. three samples of traffic signs are used as shown in figure 2.

Figure 2. Traffic sign symbols [15]

3. Experiments

After dividing the captured video into several frames, the first step in SURF technique as shown below involves a manual labelling process for road signs with a rectangle box using an image labeller and this can be presented in figure 3, It will be explained in Algorithm 1

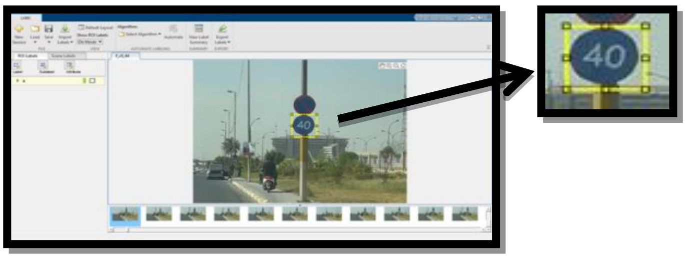


Figure 3. Labelling stage

Algorithm 1 SURF technique upon captured video

Input:

1. **the video (vid) from testing video folder(V-folder)**
2. **training file (B.xml)**
3. **Detection threshold (thd).**
4. **Data base BD-folder contains (20) traffic sign images, Jj when j=1to 20.**

the resulted recognized target (T_0):Output

:Start algorithm

1. **Read vid video file from V-folder**
2. **Determine number of frame (n) in vid file.**
3. **For i=1 to n.**
4. **Read image frame (Ii), from (vid).**
5. **Detect and configure the target with road sign using the input custom classification model (B.xml) and (thd) to determine (BBox)**
6. **Inserts a rectangle (BBox) and label it at the location in image(Ii)**
7. **Crops the target image (Ti) according to (BBox) from image (Ii)**
8. **Convert (Ti) to gray scale (Tg).**
9. **For j=1 to 20**
10. **Read Jj image from DB-folder**
11. **Detect SURF Interest Points (SIP1) in (Tg).**
12. **Detect SURF Interest Points (SIP2) in (Ij).**
13. **Cr (j)= number of matched points (SIP1) and (SIP2).**
14. **End for j**
15. **Mx=max (cr)**
16. **If Mx > 2 then**

i- Display corresponding feature points.

ii- Estimate geometric transform from matching point pairs.(T_0 =true)

17.Else No target recognized (T_0=False)

End if

18.End algorithm

procedure consists of twenty phases that lead to the creation of an xml. file, which is then saved in a designated folder (B) for subsequent use in the differentiation process. Additional movies, as well as the marking process, that were not included in the training process, could be included in such a file. As a result, the photos will be categorized as either real or false detected targets (dit). Occasionally, the computer reveals the target, but the target is undefined, as shown in figure 4.

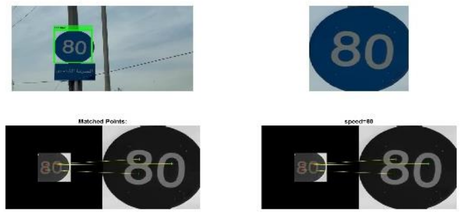


Figure 4. False positive detection

To measure SURF performance, an accuracy estimator can be adopted by the following expression [16]:

$$(P) = \frac{T_P}{T_P + F_P} \qquad (1)$$

T_P and F_P are the correct and misclassified positive instances respectively and p is the precision.

4. Results and Discussion

Figure 5 shows the result of sign detection by using SURF technique while table 1 describes the estimator's variation (i.e. dit, T_P, F_P, and P) with increasing threshold values where dit represents the total detected instances. Figure 6 depicts the changes in parameters when threshold values (Th) rise gradually. The highest detection occurs for speed sign 40 followed by 60, 80.

Figure 5. Results for SURF detector in recognizing road sign

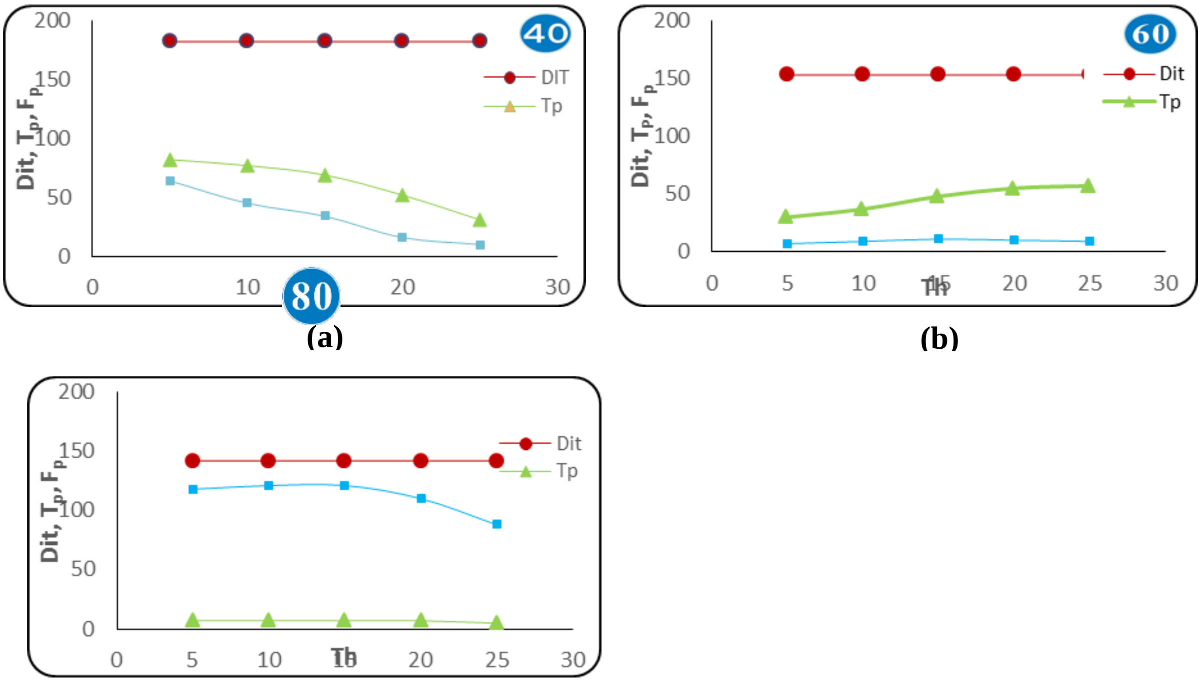
the SURF detector was used and applied upon videos frames as shown in Figure 5 through different thresholds values starting from 5 to 25 and the precision P calculated and presented in table 1.

Table 1 describes the estimator’s variation (i.e., dit, Non, tot, Tp, Fp, and P). While

Figure 6 shows the result of sign detection by using SURF technique upon the video, with increasing threshold values. where dit remains constant with increasing threshold values for all used signs. Tp's relations for all used signs except for speed sign 40 seems to be vary with a steady state while increasing threshold values while Fp's record a reverse relationship with increasing threshold values except for speed-sign 60.

Table 1. The variation of parameters with increasing threshold values for the used traffic signs

Speed 40						
Th	**tot**	**Non**	**dit**	**Tp**	**Fp**	**P**
5	836	260	576	110	196	0.36
10	904	328	576	70	178	0.28
15	950	374	576	57	137	0.29
20	1010	434	576	41	101	0.29
25	1091	515	576	13	18	0.42
Speed 60						
Th	**tot**	**Non**	**dit**	**Tp**	**Fp**	**P**
5	991	485	506	1	20	0.05
10	888	411	477	1	65	0.06
15	930	432	498	3	63	0.05
20	892	396	496	16	84	0.16
25	924	428	496	15	53	0.22
Speed 80						
Th	**tot**	**Non**	**dit**	**Tp**	**Fp**	**P**
5	746	155	591	9	427	0.02
10	770	170	600	10	420	0.02
15	790	190	600	10	400	0.02
20	820	220	600	7	373	0.02
25	917	317	600	3	280	0.01



(c)

Figure 6. Result for parameter's variation with increasing threshold values by the use of SURF detector for road sign
(a) 40 (b) 60 (c) 80

Figure 7 presents the variation of precision for all used signs. The highest precision value resulted for speed 40 followed by speed-60. A steady state appeared for speed-80, precision relations.

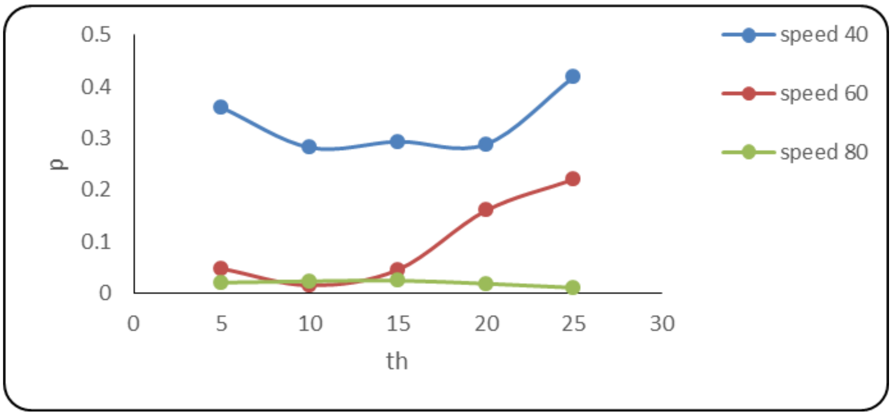


Figure 7. Precisions 'variations with increasing threshold values for all used signs

5. Conclusion

The essential problem of automatic traffic sign detection and recognition has been solved by adopting SURF approach in detecting road signs which are accurately recognized with a high degree of precision. Adopting the right threshold value affects precision results; the highest precision occurs in the threshold range (20-25) for speed sign which falls in the range (0.4-0.5), followed by 60, and 80 signs with precision scores (0.2-0.25), and (0.053-0.059) respectively with positive relations for 40 sign.

Future research aims to compare the same signs with other techniques for road sign detection to distinguish the best of them in doing so.

6.References

[1] Gopalakrishnan S. 2012 A Public Health Perspective of Road Traffic Accidents *J Family Med Prim Care* **1** 2 144–150 doi: 10.4103/2249-4863.104987.

[2] Traffic Safety Measures and Signs for Road Works and Temporary Situations Part 3 Chapter 8 in *Traffic Signs Manual Update* Department for Transport Department for Infrastructure (Northern Ireland) Transport Scotland Welsh Government.

[3] Hannan M. A., Hussain A., and Samad S. A. 2015 An Automatic Traffic Sign Detection and Recognition System Based on Colour Segmentation, Shape Matching, and SVM, *Mathematical Problems in Engineering*, Hindawi 2015.

[4] Kim S.-K. 2022 Automotive Vulnerability Analysis for Deep Learning Blockchain Consensus Algorithm, *Electronics* 11, 119. https://doi.org/10.3390/electronics11010119.

[5] Kluge K., and Lakshmanan S. 1995 Deformable-template approach to lane detection, *Intelligent Vehicles '95 Symposium*., IEEE, pp. 54–59.

[6] Jung H. G., Kim D. S., Yoon P. J., and Kim J. 2006 Parking slot markings recognition for automatic parking assist system, *Intelligent Vehicles Symposium*, pp. 106–113.

[7] *Maintenance of Signs and Sign Supports-A Guide for Local Highway and Street Maintenance Personnel* 2010 US Department of Transportation Federal Highway Administration.

[8] Dalve A. A., Shiravale S. S. 2016 Real Time Traffic signboard Detection and Recognition from street Level Imagery for Smart Vehicle *International Journal of Computer Applications* (0975 – 8887) 135 1.

[9] Kyu H.W., Maw L., Tun H.M. 2016 Real-Time Traffic Sign Recognition using SURF Descriptor *International Journal of scinctific & Tecnology research* 5 6.
[10] Zhang Z., Cao C., Zhang R., and Zou J. 2010 Video copy detection based on speeded up robust features and locality sensitive hashing, *2010 IEEE International Conference on Automation and Logistics (ICAL). IEEE*, pp. 13–18.
[11] Zhou M. and Asari V. K. 2011 Speeded-up robust features based moving object detection on shaky video, *Computer Networks and Intelligent Computing*. Springer, pp. 677–682.
[12] Murillo A. C., Guerrero J. J., and Sagues C. 2007 Surf features for efficient robot localization with omnidirectional images, *IEEE International Conference on Robotics and Automation*. IEEE, 2007, pp. 3901–3907.
[13] Bay H.,Tuytelaars T., Gool L. V. 2006 Speed Up Robust Features, *European Conference on Computer Vision*, Springer, pp 404-417.
[14] Farooq J. 2016 Object Detection and Identification using SURF and BoW Model *2016 International Conference on Computing, Electronic and Electrical Engineering (ICE Cube)*, IEEE
[15] https://www.dreamstime.com/stock-photography-traffic-signs-collection-2-image8750782
[16] Brownlee. How to Calculate Precision, Recall, and F-Measure for Imbalanced Classification. Imbalanced Classification. 2020. https://machinelearningmastery.com/precision-recall-and-f-measure-for-imbalanced-classification/.