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Design and Implementation of Intelligent Systems Detect the Driver's Lack of Concentration

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ABSTRACT: Today one of the serious challenges which the world faces is the cars accident. Accident poses irreparable damages to humans all across the globe. Many factors like technical bugs, disregarding of driving rules and loss of concentration contribute most car accidents. An experimental perspective over losing concentration proves its vital role in accidents. In this context, it is very important to monitor the driver's lack of concentration. This article tries to recommend an intelligent algorithm in order to determine driver consciousness based on visual processing, eye state is one of the most important features to detecting driver's lack of concentration. The algorithm contains two phases: 1- Face components detection, 2- Driver consciousness detection, The algorithm provides with a full-scale database so as to recover the algorithm instantly. Research findings confirm that our recommended intelligent Algorithm is 96% Successful to predict the driver consciousness. Moreover, we invent a concentration lost cautionary that was tested on a prototype that satisfied our expectations. Finally, we conclude that our recommended Algorithm can act as a deterrent against most terrible accidents successfully. We hope this algorithm reduces accident rate and create an advancement in Smart Cars knowledge.

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1- Introduction

The driver's lack of concentration is one of the main factors of traffic accidents [1, 2]. The proposed algorithm presented in this paper is based on the geometric properties of the eye intervals innovative design. The accuracy of the facial recognition algorithm is very high due to using several methods together. The algorithm identifies driver alertness exclusively for each driver based on the number of blinks, the relations between the eyelid and the duration of each blink. Designed system detects the face at the beginning of driving for each driver according to the structure of his face on basis of skin color, environmental condition and also the angle of shooting. The best eye mode diagnosis has been made by combining two distinct techniques, one for optimal detection of eyebrow another one for the eyelash. This two-step detection improves system performance Fig.1.

2- Face and Eye Detection

In this study, Viola-Jones combined with face tracking KLT feature extraction in order to optimize face detection [3, 4]. In addition, the proposed algorithm has the intelligent face region extraction with regard to skin. Then, the range of the eye is extracted from the image. In this study, more accurate detecting achieved by calculating both eyes conditions.

3- Eye State Detection Using the Interval of the Geometric Properties.

In the proposed algorithm, eyebrows and eyelashes extracted features are used in order to obtain the eyes state. The results of scientific tests show that the distance between eyebrows and eyelashes thresholds for different people under different light conditions will not be the same. In the primary number

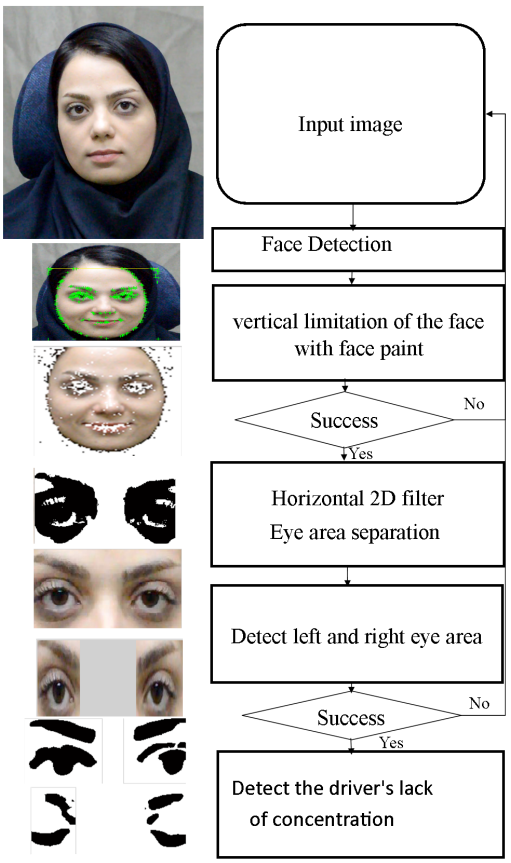

Fig. 1. Intelligent systems detect the driver's lack of concentration algorithm.

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of frames by an assumption of blinking between frames, remove errors, normalization of wrongdoing and delete flung data in regard to statical methods Eq.(1) is obtained Fig.2. To increase the accuracy of the algorithm the length derived from the difference between the highest and lowest point on the graph number multiplied by 0.66 derived from empirical statistical methods (2).

$$Plot = plot\text{-}0.1(TopPlot \ \& \ BottomPlot) \quad (1)$$

$$Thr(plot) = [\ Max(Plot)\text{-}Min(Plot)] \times 2/3 \quad (2)$$

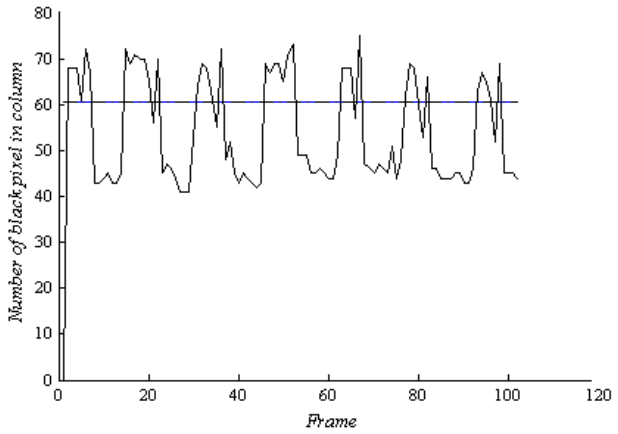

Fig.2. The resulting threshold

4- Lack of Concentration and Drowsiness Detection

Parameter based on the number of frames used for the study, according to the terms of this parameter the number of frames required to decide on the status of the driver's alertness expresses. Blink Counter (BC) parameter represents the number of frames within frames are considered closed eyes. Considering Drowsiness Parameter (DP) criteria as the criteria used to detect driver drowsiness. Another parameter, the number of the changing eye state from open to closed or from closed to open, so that is blinking, will be shown as Nb. Nb is inversely related to lack of awareness. Eye closed state is more important than the number of blinking in a timeframe, therefore the inverse square root of the parameter is added.

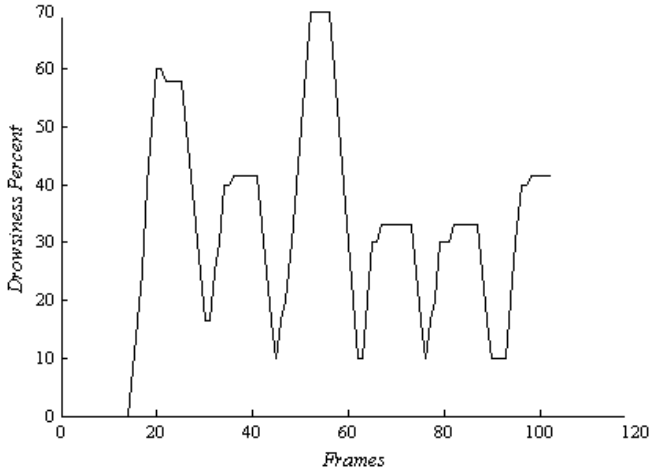

Fig. 3. Parameter specifies the percentage of driver drowsiness

$$Dp = [(bc(1+nb\hat{}(1/2))]\hat{}(-1) \quad (3)$$

5- Results and Discussion

By applying the proposed method on 10 samples of made data sets. By taking diagnostic formula, as The number of correct diagnoses blinking in the frame, Precision (4), The number of correct diagnoses blinking in all blink frames, Recall (5) , and number of correct blink of total ones, Accuracy (6). These parameters are formed on the basis of Tables 1 and 2 shows the results of them. Then the results were compared with previous papers [5].

$$Precision = Tp/(Tp+Fp) \quad (4)$$

$$Recall = Tp/(Tp+Fn) \quad (5)$$

$$Accuracy = Tp/(Tp+Fp+Fn) \quad (6)$$

Table 1. Determine the parameters used in the conclusion

State	Actual eye-blink	Actual no eye-blink
Eye blink detect	TP	FP
No eye-bilink detect	FN	-

Table 2. The results of the proposed algorithm [5]

Measure	Precision	Recall	Accuracy
Kro´lak [5]	96.95123	98.31	95.35
system accuracy	96.57	99.5	96.1

By applying the proposed algorithm on 10 other samples of datasets, the results for parameters *Tp, Fp Fn* are shown in Table 3.

Table 3. An average accuracy of the system [6]

Measure	*Fn* [%]	*Fp* [%]	*Tp* [%]
Cyganek [6]	2.97	0.13	95.35
proposed algorithm	0.15	0.7	98.1

6- Conclusions

In this paper, a new algorithm using the geometric distance eye state area properties was given which includes eyebrows and eyelashes. After simulating algorithm on the database, the accuracy of the algorithm has almost 96% success, which accuracy is better than other methods in terms of variable conditions. This work has been done and financially supported by the Advanced Vehicle Control Systems Laboratory (AVCSLab) at the Mechanical Engineering Department of K. N. Toosi University of Technology, Tehran, Iran

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