Intelligent transportation system and road safety

Basma Tamim, Mohamed Rida, Noreddine Abghour, Khalid Moussaid, Amina El Omri

Intelligent transportation system and road safety

Basma TAMIM, Mohamed RIDA, Noreddine ABGHOUR, Khalid MOUSSAID, Amina EL OMRI

Basmatamim5@gmail.com, mhd.rida@gmail.com, nabghour@gmail.com, khmoussaid@gmail.com, lomri.am@gmail.com

RESUME:

The accident rate in the world is rising every year. According to the national committee for the prevention of traffic accidents, in Morocco The human factor is responsible for more than 80% of the road accident, it occurs due to many reasons like speeding, drinking, and drug use while driving, the use of mobile, tiredness or the lack of sleep. These problems can be solved by increasing intelligence and technology with intelligent transportation systems. The driver behavior is an essential component of the driver-vehicle-environment system, so an improper driving behavior is the leading cause of the accidents and thus, the identification of inappropriate behavior is important to achieve intelligent driving and to improve road safety. We chose to work on real-time and non-intrusive techniques to identify the driver behavior in current time and without attachment which is more practical. This work gathers the cues and parameters that we will use for detecting driver behavior, especially drivers with fatigue. The facial expression of a person in fatigue or in the onset of fatigue can be detected by the face pose that gives us the frequency of head tilts, the eyelid movement which is one of the visual behaviors that reflect a person's level of fatigue, the eye gaze, the facial expression like lagging facial muscles, and the mouth movement that allows to compute the occurrence frequency of yawning over time.

Mots clés : Driver fatigue, intelligent transportation system, fatigue detection.

1 INTRODUCTION

The number of accidents in the world is increasing from day to day, a frightening number of injuries and deaths every day, the leading causes for fatal traffic accidents can be numerous but the statistics show that 20% of all the traffic accidents are due to drivers with a diminished vigilance level [7].and, on the other hand. In the trucking industry, 57% of fatal truck accidents are due to driver fatigue [2], so the prime cause of traffic accidents is fatigue and drowsiness.

These figures are worrisome and require extensive research in order to find solutions to minimize the consequences and monitor the driver's state.

To monitor a driver there is an intrusive and non-intrusive techniques that depends on whether there is an attachment with the driver or not, and a real time and non-real time techniques. The real time techniques identify the driver behavior in current time and the non-real time techniques use some tools to analyze and process the driver behavior from off line data samples collected during the course of driving.

Currently Mercedes and Volkswagen use a fatigue detector; they propose a system that takes into account a data such as vehicle speed, time, turn on turn signals and air conditioning settings. When the system detects a significant difference from the first few minutes of driving or when the driver has been driving for more than 4 hours, the system then activates a visual and audible warning to encourage the driver to take a break, so as we can deduce this system controls the parameters related to the car and not the driver, that's about car sales and in the field of research we can find techniques that are based on physiological measures like brain waves, heart rate, pulse rate, respiration [3], etc. in this case, we are talking about intrusive techniques since we have to attach some electrodes on the drivers and this condition can cause annoyance to the drivers and can be difficult to apply in everyday real life.

by analyzing the various techniques we decided to propose a non-intrusive and real time technique it's a system that uses video camera which is fixed in front of the driver in order to detect fatigue by extracting visual parameters that characterize any person in fatigue and in this article we will explain the basic parameters that will allow us to detect someone's fatigue level.

2 THE CAUSES OF DRIVER FATIGUE

Many people insist on taking the road even if they are unable to drive and feel tired, they prefer to arrive quickly without taking a break especially in a late hour and a long ride.

I did a questionnaire to understand the different causes of driver fatigue, where i asked people from different age and sex about the bad days when they feel so tired while driving and we can distinguish that what makes a driver tired can be :

- Driving at night time or in a bad circulation especially in big cities

- Driving after a long stressful day at work or a busy day with the family

- Having a bad quality of sleep the night before
- Driving after working in a bad environment (noise, heat, light, weather)

There are other conditions that play an important role in the driver state for example:

- Driving alone in a state of fatigue can worsen the situation and cause more accidents, the presence of another person in the car helps to prevent the driver in the case of drowsiness
- the age of the driver plays an important role, the elderly drivers find it difficult to make long journeys without taking break and get tired quickly especially at night

Person in fatigue show some physiological signals since fatigue can affect some organ so we can notice brain waves, heart rate, and eye blinking and physical signals which are easily observable in their facial features like eyes, head, mouth and face

Since we are working on non-intrusive technique we are going to focus on facial expressions and on multiple visual cues to reduce the uncertainty and the doubt present in the information from a single parameter.

3 FATIGUE DETECTION PARAMETERS

The symptoms of driver fatigue can be detected in different perimeters as in the photo below:

3.1 Head pose:

Head or face pose can help us to detect the driver's level of fatigue and gives us information about his attention and gaze, monitoring the face orientation and position can also help us to detect head movement like head tilts, which can be a sign of fatigue in case they are frequent.

So head tilts is a parameter that allows detecting fatigue by monitoring the frequency of the head movement and head tilts.

3.2 EYES:

Eyes can be so significant to detect someone's emotion or state so it is a key factor in detecting fatigue, the eye tracking allow us to monitor the eyelid movement, the gaze determination and the whole face orientation and so we can detect fatigue and also inattention

Below are the key factors for the detection of fatigue with the different information that can be extracted:

Eyelid movement can gives us some information about person's level of fatigue; we have the percentage of eye closure over time that can calculates by dividing the number of frames in which the eye is closed on the total number of frames for a specific time interval then we have the average eye closure speed that gives us the speed of eye closure the more the eye slowly closes the more we can say that the person is in a state of fatigue.

The eyes blink frequency that we can also conclude from the parameter 'percentage of eyelid closure', a tired person blinks more frequently than a person who is awake in addition to micro sleeps that are the short periods of sleep lasting 3 to 4 seconds [3].

The shape of pupil that diminishes in a tired person who makes an effort to stay awake it is characterized by the degree of eye opening

In some research we can find that on average if the eyes are found closed for 5 consecutive frames we can conclude that the person is falling asleep [3].

Gaze determine a person's level of vigilance, needs and attention, a fatigued person tends to have a narrow gaze, we can indicate the orientation of a person's gaze by determining the orientation of his face that represent the global direction of the gaze and the orientation of the eyes that represent the local direction of the gaze. By determining global gaze and local gaze together we conclude the final gaze of the person.

We also have the gaze distribution [3] over time to indicate the driver's fatigue or attention level and the percentage of saccade eye movement over time. Saccade eye movements represent the deliberate and conscious driver action to move eye from one to another place to detect a person's level of vigilance, a person in fatigue tend to move his head rarely compared to a person awake.

3.3 Mouth:

A sign that can never lie when anybody is tired or asleep is yawning it's one of the most important facial expression of a person in fatigue, that's why we are going to focus on the mouth movement and monitor every gesture to detect specifically yawning.

We can detect yawning by observing the lips when it changes the form of a closed configuration in a vertical direction, the shape of the mouth while yawning differs from a person to another it depends on the shape of mouth.

So the parameter that we will define for the perimeter of the mouth is yawning, that allow us to computes the occurrence frequency of yawning for a specific time.

The shape of mouth looks different between talking and yawning; when someone is yawning he tends to open his mouth vertically a lot and for some seconds while in talking the mouth opens moderately and often.

4 CONCLUSION:

The road is a common space that must be shared safely. However, it also represents a real and daily danger, hence the importance of monitoring the condition of a very important component in the road which is the driver.

In this article we have discussed the main factors that affect the driver's behavior and the main parameters to be put in place to monitor his behavior and detect his fatigue based on his face, his eyes and his mouth, the next step is the identification of the face in an image as well as the eyes and mouth to monitor the points mentioned in the article.

5 REFERENCES

[1] Rishu Chhabra, Dr.SeemaVerma, and Dr.C.Rama Krishna. "A survey on driver behavior detection techniques for intelligent transportation systems ", 7th International Conference on Cloud Computing, Data Science & Engineering - Confluence. Noida, (India),2017.

[2] Zhiwei Zhu and Qiang Ji. "Real Time and Non-intrusive Driver Fatigue Monitoring", 2004 IEEE Intelligent Transportation Systems Conference Washington, D.C. (USA), October 3-6.2004.

[3] Mandalapu Sarada Devi and Dr Preeti R Bajaj. "Driver Fatigue Detection Based on Eye Tracking", First International Conference on Emerging Trends in Engineering and Technology. Nagpur, Maharashtra, (India), 2008.

[4] Fu Xianping, Men Yugang and Yuan Guoliang. " A Driving Behavior Retrieval Application for Vehicle Surveillance System", I.J.Modern Education and Computer Science, vol. 2(2011), DOI: 10.5815/ijmecs.2011.02.07

[5] Luis M. Bergasa and Jesus Nuevo. " Real-Time System for Monitoring Driver Vigilance", IEEE Transactions on Intelligent Transportation Systems, vol. 2 (2005), **DOI:** 10.1109/TITS.2006.869598

[6] Wang Rongben, Guo Lie, Tong Bingliang and Jin Lisbeng. " Monitoring Mouth Movement for Driver Fatigue or Distraction with One Camera", IEEE intelligent Transportation Systems Conference. Washington, D.C., (USA), 2004.

[7] L.M. Bergasa, J. Nuevo, M.A. Sotalo, and M. Vazquez,"Real-time system for monitoring driver Vigilance", Proc. Intelligent Vehicle Symp., Parma(Italy), 2004