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DRIVER DROWSINESS DETECTION: A REVIEW STUDY

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ABSTRACT :

Drivers' drowsiness is among the many leading causes of road accidents around the planet. Continuous tedious driving for a long stretch of time without rest results in sleepiness and fatal tragedies. The automatic detection of the driver's sleepiness will save precious lives. In recent years, researchers have resolved those drivers with insufficient sleep and more exhaustion cause drowsiness in the driver. This paper presents a literature review of driver drowsiness detection supported by machine learning techniques.

Keywords – behavioral measures, blink pattern, deep learning techniques, driver drowsiness, eye detection, fatigue, machine learning, and yawn detection

INTRODUCTION:

There is a significant amount of data that indicates that driver fatigue is a major cause of road accidents globally. The Indian government data for the year 2019 on causes of road accidents have shown in fig.1 that drowsiness is a major cause of road accidents. Fatigue or sleepiness can be described as a physiological condition in which the body is shifting from being awake to being asleep. At this time, the driver's concentration will be impaired, making it difficult for them to make crucial decisions like applying the brakes quickly or avoiding head-on collisions.

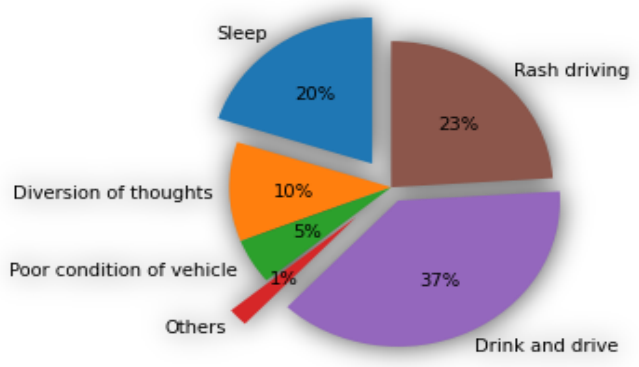

Fig 1. Accidents data as per the road crashes and casualties

There are clear indications that a driver is feeling drowsy, including frequent yawning, rapid eye blinking, difficulty in keeping their eyes open, nodding off, and changes in skin complexion due to blood flow.

These procedures to govern the level of drowsiness are categorized into three groups:

I. Physiological Measures,
II. Vehicle-based Measures
III. Behavioural Measures.

The popular drowsiness detection technique uses complicated methods, such as EEG and ECG. *Road crash injuries result in* significant *financial losses and unrepairable damage to* individuals, *their families, and* to an *entire nation*. Road traffic crashes charge countries almost 3% of their gross domestic product along with the precious lives of their people as well. "Fatigued drivers who snooze off while driving are accountable for about forty percent of road accidents", says a study conducted by "The Central Road Research Institute (CRRI)".

LITERATURE SURVEY

An automobile safety feature called Driver Drowsiness Technology guards against accidents when a driver is feeling drowsy. According to numerous studies, 20% of the incidents that occur on the roads—which account for 50% of all collisions—are caused by driver weariness. One of the major contributing elements in the numerous traffic accidents that occur around us is driver fatigue. Studies have shown that fatigue-related accidents result in 1,200 fatalities and 76,000 injuries annually. Different researchers proposed different methods for this problem so that life of various persons can be saved by adopting various measures using the latest machine learning techniques, driver's drowsiness detection is categorized into the following four kinds of measures:

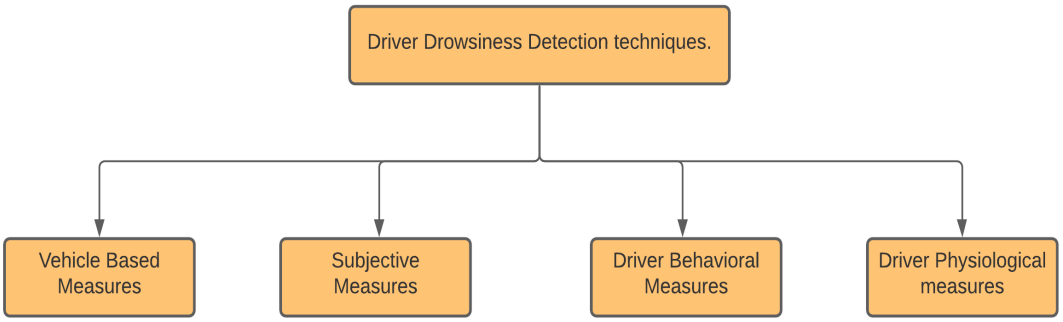

Fig. 2. Techniques of Drowsiness Detection

Vehicle-Based Measures-In this measure full assessment is measured by scrutinizing the trends in the vehicle's behavior i.e., alterations in the speed, movement of the steering wheel, etc. The difficulty that confines the use of this practice in the real environment is the strain of adjusting these algorithms to dynamic methods.

Subjective Measures-The above measures contain the part where the driver has to measure his level of sleepiness himself. Since this is impractical in real driving conditions. This approach of requiring the driver to assess their sleep level has the potential to raise their awareness, but it is a flawed method.

Driver's Behavioural Measures- In this measure, there are image processing methods that can identify the driver's actions, such as head movements, eye movements, yawning, facial expressions, etc.

The research paper [1] introduces a system called DriCare that uses video images to detect the driver's levels of weariness, such as yawning, blinking, and eye closure duration, without having the driver wear any particular gadgets. This system uses the MC-KCF algorithm and a novel method for facial area detection based on sixty-eight key points to evaluate the driver's condition. DriCare can alert the driver of their weariness by combining the features of their eyes and mouth. DriCare has an accuracy of about 92%, according to the experimental findings. The MC-KCF algorithm, which is employed in DriCare to follow the driver's face, combines CNN and MTCNN to improve the performance of the original KCF algorithm.

From a thorough search of 1020 research publications, the research study [2] gives a Literature Review of 41 papers. The report offers a thorough analysis of sleepiness detection techniques based on behavioral, driving, and physiological factors and is broken down into seven key sections. There is a detailed discussion of the benefits and drawbacks of each strategy. While none of the strategies provide 100 percent accuracy, the comparison analysis showed that methods based on physiological factors have the propensity to give results that are more accurate than those of other methods.

This literature study [3] covers the severe issue of traffic accidents brought on by drivers who are acting abnormally. The detection system is primarily concerned with identifying face features like the lips, eyes, and so on. The visibility of the iris and the condition of the eyes remain unpredictable, and evidence indicates that driver weariness accounts for 20% of vehicle collisions. There is a good chance that the driver is sleepy if they are highly disoriented or have troubled eyes. When this occurs, the system ought to alert the driver with an emergency warning. In order to safeguard drivers from serious accidents and lower the likelihood of driver inattention, this article will advocate for the use of science and technology.

This literature study [4] focuses on employing machine learning approaches to detect driver drowsiness based on behavioral measurements. To gauge the level of sleepiness, face information is employed. These indicators include head movements, yawning, and eye blinks. Although convolutional neural networks have been shown to outperform other techniques, support vector machines are still the most often utilized method in this sector.

The author of Paper [5] uses a sensor-based methodology to track the motion of the car and determine the driver's level of intoxication. A few studies have looked at physiological signs like the electroencephalogram (EEG), electrooculogram (EOG), and electrocardiogram (ECG) to assess levels of weariness. Although it is thought that the physiological signal-based system is one of the best ways to identify fatigue, because the sensors must be connected to the skin, it has the potential to irritate the skin and elicit aversion and disgust in some people.

Literature Review Table

	Author name	Algorithm Used	Parameter Used	Accuracy
1	W. Deng et al. [1]	MC-KCF algorithm	Yawning, blinking, and duration of the eye closer.	92%
2	M. Ramzan et al. [2]		Behavioural, Vehicular and physiological.	80%
3	Mr. S. Kranthi Reddy et al. [5]		Eye Aspect Ratio (EAR), Blink pattern, Camera Car dashboard, Driver fatigue.	91%
4	K. Satish et al. [18]	Handwheel Pressure and Face Detection from the camera	Controller Space Network (CAN), Face Detection, Histogram Oriented Gradient, Eyes Detection, Hardware	96%
5	Avigyan Sinha et al. [19]	YOLO (You Only Look Once	Facial Landmarks Detection, Tracking of Visual Object, Contact and Non-Contact Methods for Detecting Driver Drowsiness	97%
6	Aishwarya Biju and Anitha Edison	YOLO (You Only Look Once)	Video-Input, Face Detection by YOLOv3, Resize, Feature Learning in inception v3, Softmax Classifier	98.91%
7	M. Ngxande et al. [20]	Viola and Jones's algorithm	CNN(Conventional Neural Networks), SVM(Support Vector Machines), HMM(Hidden Markov Model)	91.6%
8	Katsuki HAYASI et al. [4]	IDD (Individualized Drowsiness Detection and IDDC (Individual Drowsiness Detection with Categorization	Heart Rate Variability, Lyapunov Exponent, Steering Instability	98%
9	Hamed Laouz [7]	PERCLOS	Vehicle-based Measures, Subjective Measures, Driver's Behavioral measures, EEG, EOG, ECG	>90%<100%
10	A.Kumar et al. [9]	Fisher's Linear discriminant Analysis (FLDA), Support Vector Machine (SVM)	Data Acquisition, Face Detection, Facial Landmarking Marking, Feature Extraction	97%

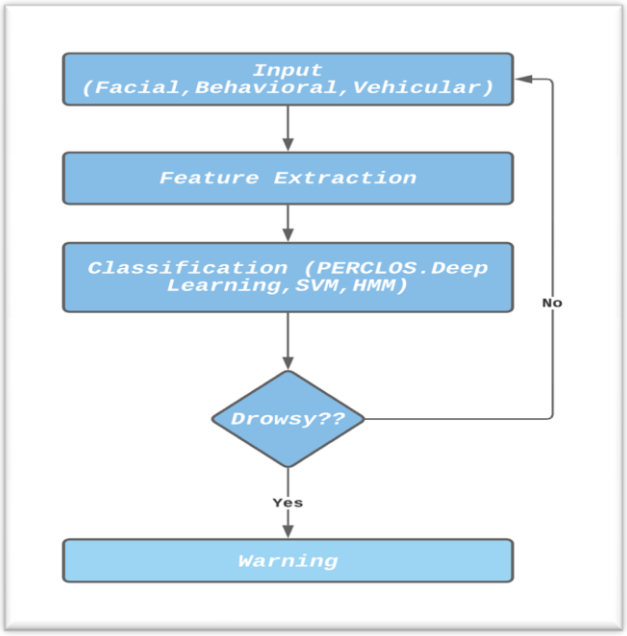

Fig. 3. Driver drowsiness detection process

CONCLUSION

In this paper, we present a comprehensive review of the various techniques used for detecting driver drowsiness and fatigue. The review focuses on both behavioral and deep learning methods that can be used for this purpose. The paper analyses the different features and measures used for categorization and examines the various algorithms used for driver drowsiness detection, including SVM, YOLO, CNN, and PERCLOS. The analysis also highlights the accuracy of each of these methods.

This system aims to identify even minute adjustments in the driver's behavior and expression that might suggest driving while fatigued. The use of various techniques to gauge tiredness is covered in the study, including vehicle-based, physiological, and behavioral techniques.

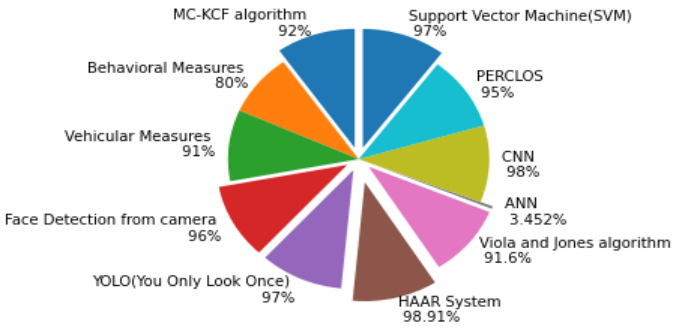

Fig. 4. Algorithm with its accuracy percentage

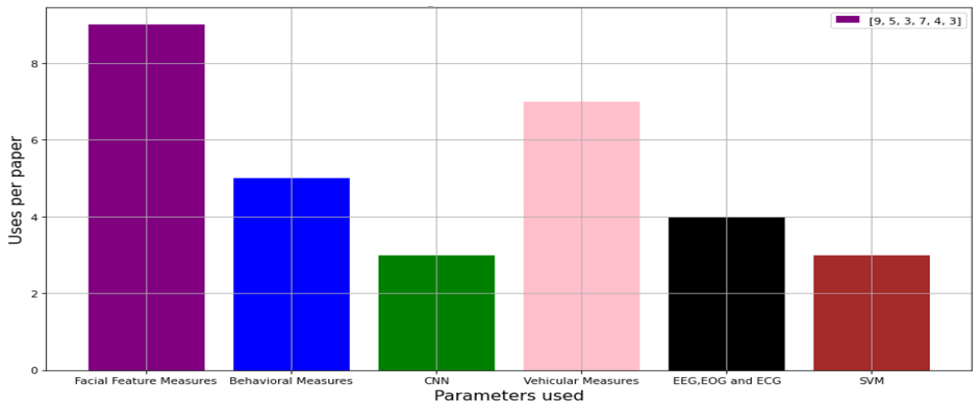

Fig.5.Parameters used per review paper

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