Project Synopsis

On

Driver Drowsiness Detection System

Submitted as a part of course curriculum for

Bachelor of Technology

In

Computer Science

Submitted by

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2021-2022

DECLARATION

We hereby declare that this submission is our work and that, to the best of our knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgement has been made in the text.

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CERTIFICATE

This is to certify that Project Report entitled "**Driver Drowsiness Detection System**" which is submitted by **Rimjhim, Sanya Singh, Sakshi Khandelwal** in partial fulfilment of the requirement for the award of degree B. Tech. in Department of Computer Science of Dr A.P.J. Abdul Kalam Technical University, Lucknow is a record of the candidates own work carried out by them under my supervision. The matter embodied in this report is original and has not been submitted for the award of any other degree.

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ABSTRACT

Drowsiness of drivers is one of the significant causes of road accidents. Every year, there is an increase in the number of deaths and fatal injuries globally. By detecting the driver's drowsiness, road accidents can be reduced. This paper describes a machine learning approach for drowsiness detection. Face detection is employed to locate the regions of the driver's eyes, which are used as the templates for eye tracking in subsequent frames. Finally, the tracked eye's images are used for drowsiness detection to generate warning alarms. This proposed approach has three stages: detecting Face, detecting Eyes, and detecting drowsiness. Image processing is used to recognize the face of the driver and then extract the image of the eyes of the driver for detection of drowsiness. The HAAR face detection algorithm takes as captured frames of image and then the detected face is considered as output. Next, CHT is used for tracking eyes from the detected face. Using EAR (Eye Aspect Ratio) the eye state is detected.

Through machine learning Algorithms, we would be recognizing not only Eyes and face movements but also certain other Actions of the driver Like Head rotations, yawning, etc.

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CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Driver’s drowsiness is one of the main reasons for road accidents. If the drowsiness of the driver can be predicted at initial stages, and if the driver can be alerted of the same then the number of accidents can be reduced. In this paper, a driver drowsiness detection system using a machine learning approach is proposed. Frontal face detection and eye detection respectively are detected in the initial stage. There are three main contributions of the object detection framework that has been used to achieve high frame rates. The first contribution of this paper is a new image representation called an integral image that allows for amazingly fast feature evaluation. It uses a set of features which are reminiscent of Haar Basis functions In order to compute these features very rapidly at many scales, the integral image representation for images is introduced.

Using a few operations per pixel, the integral image can be computed from an image. The second contribution is a method for constructing a classifier by selecting a small number of important features using AdaBoost. In order to ensure rapid classification, the learning process must exclude a large majority of the available features, and focus on a small set of essential features. This feature selection is achieved through a simple modification of the AdaBoost procedure. The third contribution of this paper is a method for combining successively more complex classifiers in a cascade structure which dramatically rapids the speed of the detector by focusing attention on promising regions of the image. This object detection procedure classifies images based on the value of simple features. More specifically it is based on three kinds of features. A three-rectangle feature computes the sum within two outside rectangles subtracted from the sum in a center rectangle. Finally a four-rectangle feature computes the difference between diagonal pairs of rectangles.

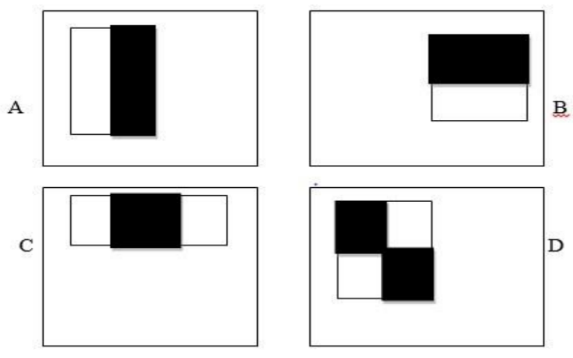

Figure 1.1 Examples for HAAR

1.2 PROBLEM STATEMENT

Drowsiness of drivers is one of the significant cause of road accidents. Every year, there is an increase in the number of deaths and fatal injuries globally.

Drowsiness and driving is a very hazardous and it is very difficult to identify. After alcohol drowsiness is the second leading cause of the road accidents. People are conscious about the risk of drinking and driving but don't realize the dangerous of drowsiness because no instruments exist to measure the driver drowsiness. Near About 20% of the total road accidents are caused by the drowsiness of the driver.

Driver drowsiness can cause several physical and economical losses.
One way to detecting driver's drowsiness is to observe the driver with his driving, if driver not concentrating on driving alerts the driver with the alarm sound. We Will be discussing the various Machine Leaning Approach For detection methods for detecting driver's drowsiness

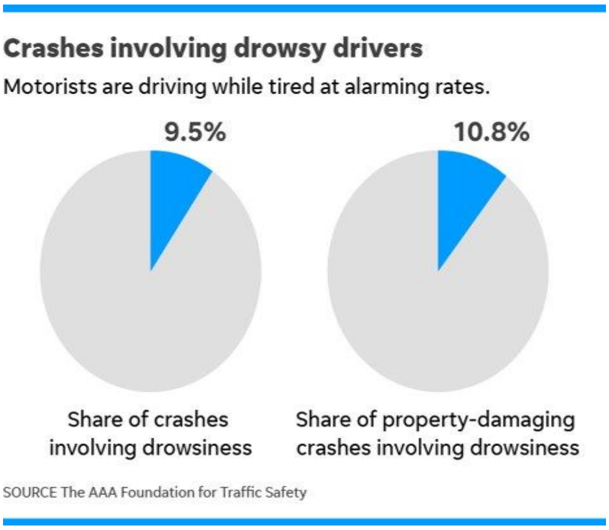

Figure 1.2 Crashes Involving Drowsy Driver

1.3 OBJECTIVE

Driver Drowsiness Detection systems (DDDS) have been proposed as specific countermeasures to reduce collisions associated with driver fatigue. These devices employ a variety of techniques for detecting driver drowsiness while operating a vehicle and signal a driver when critical drowsiness levels are reached. However, the detection of driver fatigue using valid, unobtrusive, and objective measures remains a significant challenge. Detection techniques may use lane Eye aspect Ratio (EAR), ocular or facial characteristics. Along with this of course, Drivers have a duty not to exceed speed limits, exceed maximum work limits or breach minimum rest requirements. Complementing this, entities within the chain of responsibility must take reasonable steps to prevent driver fatigue or situations that lead to drivers breaching speed limits. It provides extensive information on the alertness, driving performance, and physiological and subjective states drivers.

1.4 SCOPE

1. Future Scope work will focus on the creation of a suitable dataset that covers a wide range of different races for making more reliable drowsiness comparisons.

2. This project can be implemented in the form of mobile application to reduce the cost of hardware.
3. This project can be integrated with the car, so that automatic speed control can be imparted if the driver is found sleeping.

CHAPTER 2: LITREATURE REVIEW

2.1.Enhanced Drowsiness Detection Using Deep Learning[1]

In this paper, deep-learning-based driver-drowsiness detection for brain-computer interface (BCI) using functional near-infrared spectroscopy is investigated.The passive brain signals from drowsiness were acquired from 13 healthy subjects while driving a car simulator. The brain activities were measured with a continuous-wave fNIRS system, in which the prefrontal and dorsolateral prefrontal cortices were focused. Deep neural networks (DNN) were pursued to classify the drowsy and alert states. For training and testing the models, the convolutional neural networks (CNN) were used on color map images to determine the best suitable channels for brain activity detection in 0~1, 0~3, 0~5, and 0~1 second time windows. The CNN architecture resulted in an average accuracy of 99.3%, showing the model to be capable of differentiating the images of drowsy/non-drowsy states. The proposed approach is promising for detecting drowsiness and in accessing the brain location for a passive BCI.

2.2.Face Recognition Based On Deep Learning[2]

We evaluated the adequacy of computational algorithms as models of human face processing by looking at how the algorithms and humans process individual faces. By comparing model and human generated measures of the similarity between pairs of faces, we are able to assess the accord between several automatic face recognition algorithms and human perceivers. Multidimensional scaling (MDS) was used to create a spatial representation of the subject response patterns. Next, the model response patterns were projected into this space. The results revealed a common bimodal structure for both the subjects and for most of the models. For the models, the bimodal structure was related to combined aspects of the representations and the distance metrics used in the implementations

2.3.Face Recognition Algorithms as Models of Human Face Processing[3]

With the deep learning in different areas of success, beyond the other methods, set off a new wave of neural network development. The concept of deep learning originated from the artificial neural network, in essence, refers to a class of neural networks with deep structure of the effective training methods. AS a powerful technology to realize artificial intelligence, deep learning has been widely used in handwriting digital recognition, dimension simplification, speech recognition, image comprehension, machine translation, protein structure prediction and emotion recognition. In this paper, we focus on the research hotspots of face recognition based on depth learning in the field of biometrics, Combined with the relevant theory and methods of depth learning, face recognition technology, along the order of depth learning, based on the depth of learning face recognition, face recognition application to start research.

2.4.Driver Drowsiness Detection System and Techniques[4]

Drivers who do not take regular breaks when driving long distances run a high risk of becoming drowsy a state which they often fail to recognize early enough according to the experts. Studies show that around one quarter of all serious motorway accidents are attributable to sleepy drivers in need of a rest, meaning that drowsiness causes more road accidents than drink-driving. Attention assist can warn of inattentiveness and drowsiness in an extended speed range and notify drivers of their current state of fatigue and the driving time since the last break, offers adjustable sensitivity and, if a warning is emitted, indicates nearby service areas in the COMAND navigation system. Based on Acquisition of video from the camera that is in front of driver perform real-time processing of an incoming video stream in order to infer the driver’s level of fatigue if the drowsiness is Estimated then the output is send to the alarm system and alarm is activate.

2.5. Machine Learning Systems for Detecting Driver Drowsiness[5]

Drowsy driver detection is one of the potential applications of intelligent vehicle systems. Previous approaches to drowsiness detection primarily make pre-assumptions about the relevant behavior, focusing on blink rate, eye closure, and yawning. Here we employ machine learning to data mine actual human behavior during drowsiness episodes. Automatic classifiers for 30 facial actions from the facial action coding system were developed using machine learning on a separate database of spontaneous expressions. These facial actions include blinking and yawn motions, as well as several other facial movements. These measures were passed to learning-based classifiers such as Ad boost and multinomial ridge regression. Head motion information was collected through automatic eye tracking and an accelerometer. The system was able to predict sleep and crash episodes on a simulator with 98% accuracy across subjects. It is the highest prediction rate reported to date for detecting drowsiness.

2.6 .Embedded System for Eye Blink Detection Using Machine Learning Technique[6]

Nowadays, eye tracking and blink detection are increasingly popular among researchers and have the potential to become a more important component of future perceptual user interfaces. The real-time eye-tracking system has been a fundamental and challenging problem for machine learning problems. The main purpose of this paper is to propose a new method to design an embedded eye blink detection system that can be used for various applications with the lowest cost. This study presents an efficient technique to determine the level of eyes that are closed and opened. We offered a real-time blink detection method by using machine learning and computer vision libraries. The proposed method consists of four phases: taking frame by employing a raspberry pi camera that slotted to the raspberry pi 3 platform, utilizing haar cascade algorithm to identify faces in the captured frames, find facial landmarks by utilizing facial landmark detector algorithm, detect the eyes' region and calculate the eye aspect ratio. The proposed method obtained a high accuracy to indicate eye closing or opening. In this study, an aspect ratio method was used to implement a robust and low-cost embedded eye blink detection system on the raspberry pi platform. This method is exact resourceful, fast, and easy to perform eye blink detection

2.7.Person Head Detection in Multiple Scales Using Deep Convolutional Neural Networks[7]

Person detection is an important problem in computer vision with many real-world applications. The detection of a person is still a challenging task due to variations in pose, occlusions and lighting conditions. The purpose of this study is to detect human heads in natural scenes acquired from a publicly available dataset of Hollywood movies. In this work, we have used state-of-the-art object detectors based on deep convolutional neural networks. These object detectors include region-based convolutional neural networks using region proposals for detections. Also, object detectors that detect objects in the single-shot by looking at the image only once for detections. We have used transfer learning for fine-tuning the network already trained on a massive amount of data.

2.8. Stereo Vision-Based 3D Positioning and Tracking[8]

The evolution of technologies for the capture of human movement has been motivated by a number of potential applications across a wide variety of fields. However, capturing human motion in 3D is difficult in an outdoor environment when it is performed without controlled surroundings. IN this paper, a stereo camera rig with an ultra-wide baseline distance and conventional cameras with fish-eye lenses is proposed. Its cameras provide a wide field of view (FOV) which increases the coverage area and also enables the baseline distance to be increased to cover the common area required for both cameras' views to perform as a stereo camera. We propose a passive marker-based approach to track the motion of the object. We use a unique method to restore the 3D positions by developing a relationship between the pixel dimensions and distances in an image and real world coordinates. In this paper, occlusion detection is considered because, in the marker-based capturing of articulated human kinematics, the occlusion of a marker is one of the major challenges. The proposed 3D positioning and tracking system is tested in different situations to validate its applicability as a stereo camera rig as well as its performance for motion capture.

2.9.Driver drowsiness detection using Behavioral measures and machine learning techniques[9]

This paper presents a literature review of driver drowsiness detection based on behavioral measures using machine learning techniques. Faces contain information that can be used to interpret levels of drowsiness. There are many facial features that can be extracted from the face to infer the level of drowsiness. These include eye blinks, head movements and yawning. However, the development of a drowsiness detection system that yields reliable and accurate results is a challenging task as it requires accurate and robust algorithms. A wide range of techniques has been examined to detect driver drowsiness in the past. The recent rise of deep learning requires that these algorithms be revisited to evaluate their accuracy in detection of drowsiness. The analysis reveals that support vector machine technique is the most commonly used technique to detect drowsiness, but convolutional neural networks performed better than the other two techniques. Finally, this paper lists publicly available datasets that can be used as benchmarks for drowsiness detection.

2.10. The Devil of Face Recognition is in the Noise[10]

The growing scale of face recognition datasets empowers us to train strong convolutional networks for face recognition. While a variety of architectures and loss functions have been devised, we still have a limited understanding of the source and consequence of label noise inherent in existing datasets. We make the following contributions:

1) We contribute cleaned subsets of popular face databases, i.e., MegaFace and MS-Celeb-1M datasets, and build a new large-scale noise-controlled IMDb-Face dataset.
2) With the original datasets and cleaned subsets, we profile and analyze label noise properties of Mega Face and MS-Celeb1M. We show that a few orders more samples are needed to achieve the same accuracy yielded by a clean subset.
3) We study the association between different types of noise, i.e., label flips and outliers, with the accuracy of face recognition models.
4) We investigate ways to improve data cleanliness, including a comprehensive user study on the influence of data labeling strategies to annotation accuracy.

2.11. A Dataset and Benchmark for Large-scale Multi-modal Face Anti-spoofing[11]

Face anti-spoofing is essential to prevent face recognition systems from a security breach. Much of the progresses have been made by the availability of face ant spoofing benchmark datasets in recent years.

However, existing face anti-spoofing benchmarks have limited number of subjects (≤ 170) and modalities (≤ 2), which hinder the further development of the academic community. To facilitate face anti-spoofing research, we introduce a large-scale multi-modal dataset, namely CASIASURF, which is the largest publicly available dataset for face anti-spoofing in terms of both subjects and visual modalities. Specifically, it consists of 1, 000 subjects with 21, 000 videos and each sample has 3 modalities. We also provide a measurement set, evaluation protocol and training/validation/testing subsets, developing a new benchmark for face anti-spoofing. Moreover, we present a new multi-modal fusion method as baseline, which performs feature re-weighting to select the more informative channel features while suppressing the less useful ones for each modal. Extensive experiments have been conducted on the proposed dataset to verify its significance and generalization capability.

2.12. Survey on Lie Group Machine Learning[12]

Lie group machine learning is recognized as the theoretical basis of brain intelligence, brain learning, higher machine learning, and higher artificial intelligence. Sample sets of Lie group matrices are widely available in practical applications. Lie group learning is a vibrant field of increasing importance and extraordinary potential and thus needs to be developed further. This study aims to provide a comprehensive survey on recent advances in Lie group machine learning. In addition, we introduce the special application of Lie group machine learning in image processing. Overall, this survey aims to provide an insightful overview of state-of-the-art development in the field of Lie group machine learning. It will enable researchers to comprehensively understand the state of the field, identify the most appropriate tools for particular applications, and identify directions for future research.

2.13. A Real-time Driving Drowsiness Detection Algorithm With Individual Differences Consideration[13]

The research work about driving drowsiness detection algorithm has great significance to improve traffic safety. Presently, there are many fruits and literature about driving drowsiness detection method. This paper proposes a real-time driving drowsiness detection algorithm that considers the individual differences of driver. According to the eyes landmarks, a new parameter, called Eyes Aspect Ratio, is introduced to evaluate the drowsiness of driver in the current frame. Taking into account differences in size of driver's eyes, the proposed algorithm consists of two modules: offline training and online monitoring. In the first module, a unique fatigue state classifier, based on Support Vector Machines, was trained which taking the Eyes Aspect Ratio as input. Then, in the second module, the trained classifier is application to monitor the state of driver online. In simulated driving applications, the proposed algorithm detects the drowsy state of driver quickly from 640 * 480 resolution images at over 20fps and 94.80% accuracy. The research result can serve intelligent transportation system, ensure driver safety and reduce the losses caused by drowsy driving.

2.14. A Survey of Calibration Methods for Optical See-Through Head-Mounted Displays[14]

Unlike Virtual Reality headsets, OST HMDs inherently support the addition of computer-generated graphics directly into the light path between a user's eyes and their view of the physical world. As with most Augmented and Virtual Reality systems, the physical position of an OST HMD is typically determined by an external or embedded 6-Degree-of-Freedom tracking system. However, in order to properly render virtual objects, which are perceived as spatially aligned with the physical environment, it is also necessary to accurately measure the position of the user's eyes within the tracking system's coordinate frame. For over 20 years, researchers have proposed various calibration methods to determine this needed eye position. However, to date, there has not been a comprehensive overview of these procedures and their requirements. Hence, this paper surveys the field of calibration methods for OST HMDs. Specifically, it provides insights into the fundamentals of calibration techniques, and presents an overview of both manual and automatic approaches, as well as evaluation methods and metrics. Finally, it also identifies opportunities for future research.

2.15. <u>The new Era of Full- Stack-Development[15]</u>

This is a concise study of the evolution of the full stack development due to advancement of technology and the introduction of cloud. It helps give you a better understanding of what full stack development was and how full stack development evolved, it shows a take on the fact that full stack development is not dead and has just evolved to better accommodate the user's needs. By incorporating all the parts, we can interpret what full stack was, how it has evolved and why has it evolved. The efficiency of workers can also be calculated and the approximations of time taken to complete a project, and finally people either see Full Sack Development to be dead or overrun. However, it can be seen from the pretext that it has been evolved and has been drastically optimized to meet the user’s needs.

CHAPTER 3: PROPOSED METHODOLOGY

3.1 FLOWCHART:

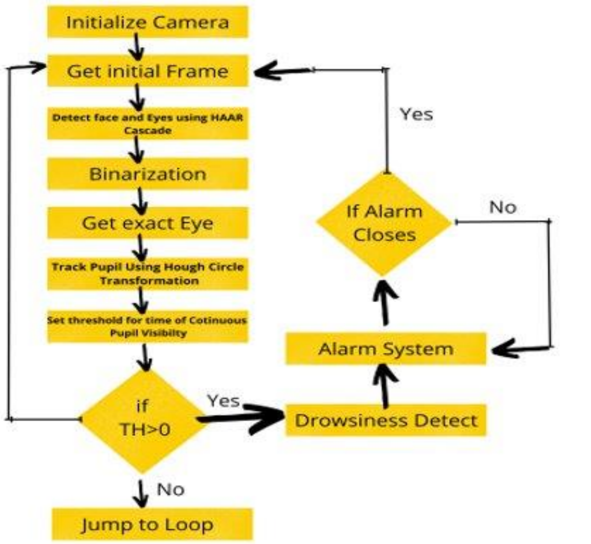

Figure 3.1 Drowsiness detection Algorithm

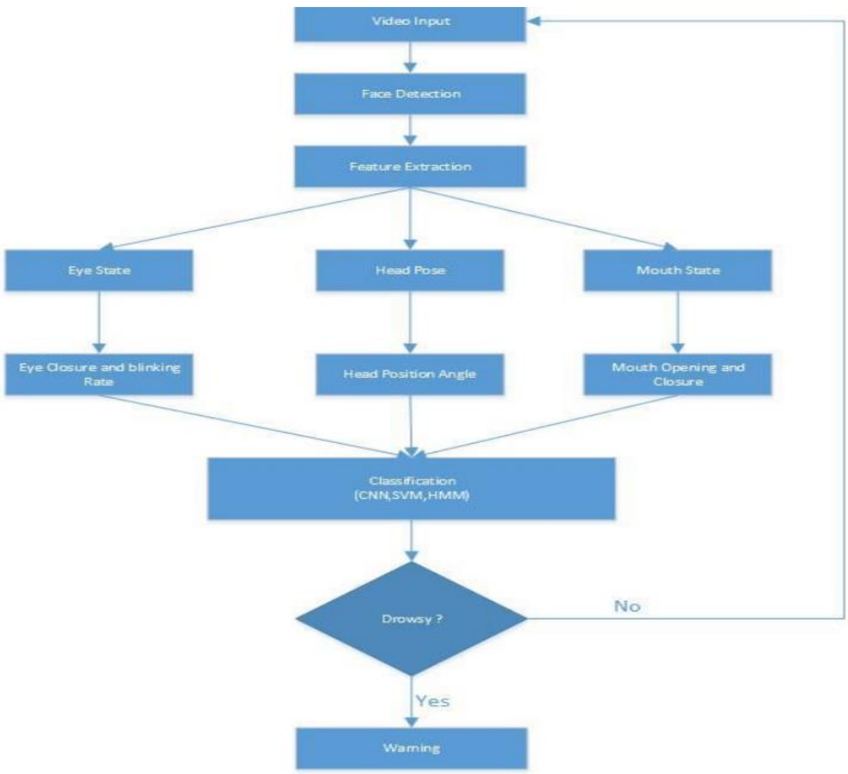

Figure 3.2 Process of Detection

3.2 ALGORITHM

ALGORITHM 1:

DROWSINESS DETECTION ALGORITHM

The general flow of our drowsiness detection algorithm is straightforward.

1. First, a camera is setup that monitors a stream for faces.

2. If a face is found, facial landmark detection is applied to extract the eye regions.

3. The eye regions are used to compute the eye aspect ratio to determine if the eyes are closed.

4. If the eye aspect ratio indicates that the eyes have been closed for a sufficiently long enough amount of time, sound an alarm is used to wake up the driver and the indicators will be on to indicate the pillion drivers.

ALGORITHM 2:

PROCESS OF DETECTION

1. First, a camera is setup that monitors a stream for faces.

2. If a face is found, facial landmark detection is applied to extract the eye regions.

3. Various other factors are checked using several ML algorithm Like HAAR and ADA boost like Eye state, head state and the Mouth State

4. If the factors do not match the Normal state of the Certain conditions respectively, based on the classification then the drowsiness will be detected.

CHAPTER 4: DIAGRAMS

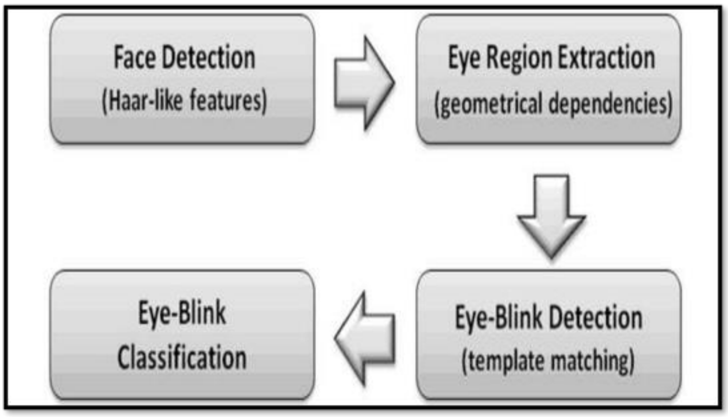

Figure 4.1: Scheme of the proposed algorithm for eye-blink detection

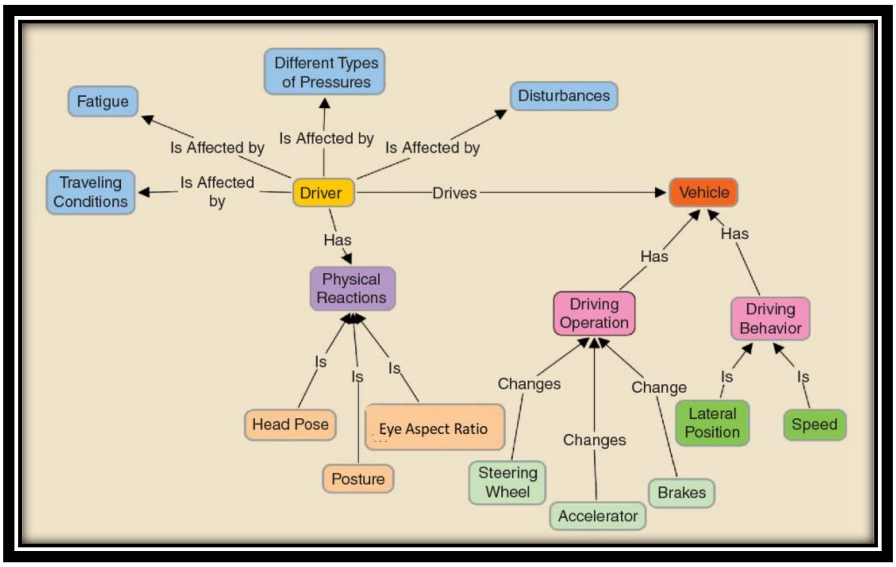

Figure 4.2 ER on Driver Drowsiness Detection

CHAPTER 5: CONCLUSION

There are many techniques that are based on behavioral methods and machine learning that can be utilized for the purpose of driver drowsiness detection. This paper presented a survey of approaches to driver drowsiness detection using machine learning techniques and discussed the range of features and measures used for classification. The main goal of these systems is to detect a slight change in a driver's facial expression that contains drowsiness information. Although there are different methods that can be used to measure the level of drowsiness (vehicle-based, physiological, and behavioral methods), this review has focused on behavioral methods because they are non-invasive, work in various light conditions and do not necessarily require vehicle modifications. Machine learning techniques such as SVM, CNN,HAAR Algorithm and HMM are reviewed in this paper. Unfortunately, it is extremely difficult to compare these approaches, as there is a limited number of standardized datasets that currently exist to do so. To remedy this, a meta-analysis was performed. This analysis highlighted the performance of CNNs, which outperformed other approaches, but also showed that there is a need for larger datasets and standard benchmarking measures for drowsiness detection. Future work will focus on the creation of a suitable dataset that covers a wide range of different races for making more reliable drowsiness comparisons.

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