

# Driver Monitoring System Using Machine Learning

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**Abstract**—As technology improves and becomes more novel, means of transportation are becoming more sophisticated. There are some rules that all motorists must follow, regardless of social status. The proposed system aims to reduce the number of accidents caused by driver drowsiness and fatigue and increase transport safety. This has become a common cause of accidents in recent years. Multiple facial and body gestures, such as tired eyes and yawning, are considered signs of driver drowsiness and fatigue. EAR (Eye Aspect Ratio) calculates the ratio of distance between horizontal and vertical eye marks required to detect drowsiness. It uses machine learning algorithms to identify facial features and alerts the driver with a buzzer when drowsiness is detected. We used Convolutional Neural Networks, a class in OpenCV and deep learning. We also use image processing, which uses computer algorithms to perform image processing on digital images. It is a camera-based technology that monitors driver attention. A convolutional neural network (CNN) is used to classify the state of the eyes and mouth. In machine vision- based driver fatigue detection, blink frequency and yawning are key indicators for evaluating driver fatigue. This project was undertaken to provide data and a different perspective on current issues.

**Keywords**—Image Processing, OpenCV, Machine Learning , CNN, E.A.R

## I. LITERATURE REVIEW

### PROBLEM STATEMENT

To develop a driver monitoring system with the objective of building a Machine learning algorithm for tracking of drivers behavioral attributes.

## II. INTRODUCTION

Cars have become an indispensable means of transportation for most people. According to statista global car statistics, 95 million cars sold from 2017 to 2019. Sales in 2018 were 1 billion. According to the World Health Organization (WHO), about 1.35 million people die in road accidents worldwide. About 20 percent to 30 percent of these accidents are caused by drowsy driving. The most dangerous cause of traffic accidents is fatigue while driving. Humans have always created tools and developed ways to make life easier and safer, from mundane tasks like commuting to work to intriguing tasks like flying. As technology evolved, so did transportation, and our reliance on transportation began to grow exponentially, which has a profound impact on our lives today. The algorithmic pipeline examines each frame of the video stream to determine if the driver is drowsy. Since the non-contact method is cheaper

than the contact method, it is the basis of the proposed system. By giving a warning signal to the driver after detection, the driver can take appropriate measures. Here, convolutional neural networks are used in combination with Deep His learning techniques.

| Ref. No. | Methodology                                      | Advantages  | Gaps Identified   |
|----------|--|---|---|
| [1]      | Computer Vision-based and SVM                    | Tested for different cases and genders.                               | Black tinted Spectacles   |
| [2]      | Eye Aspect Ratio (EAR), yawn rate and head pose. | 97% accuracy on eye blink detection                                   | Vulnerable to extreme lighting conditions                               |
| [3]      | Non-linear Support Vector Machine (SVM)          | High vision cameras   | detection rate decreases with increase in frame rate                    |
| [4]      | Convolutional Neural Network                     | Used a public driver drowsiness recognition dataset.                  | Does not work well on images such as faces when globally sharing weight |
| [5]      | Viola Jones, DLib, Yolo V3.                      | System works even when wearing spectacles                             | System could not work during the night-time.                            |
| [6]      | Image enhancement using Histogram Equalization.  | OpenCV algorithm Proves helpful to normalize human faces              | Low accuracy with very dark skin complexion.                            |
| [7]      | EAR Eye Aspect Ratio, SVM                        | Negligible extra cost of eye opening                                  | Require complex device setup  |
| [8]      | Mouth Aspect Ratio (MAR)                         | Single Shot MultiBox Detector (SSD)                                   | Large visual variations of faces in real-world applications             |
| [9]      | Haar algorithm                                   | Works with variable lighting conditions                               | Cannot detect face on Foggy Mornings.                                   |
| [10]     | Convolutional Neural Network                     | Tolerates greater error from the output predictions of the SEN model. | Center of the eye is greatly displaced from the real center,            |

### III. SYSTEM ARCHITECTURE

High vision cameras are embedded to monitor and capture to extract frames one by one and generate the alerts accordingly. Each extracted frame is analyzed at time to study the pattern of facial features; Eye Aspect Ratio(EAR) and Mouth Aspect Ratio(MAR) for each frame . E.A.R and M.A.R values exceed their respective threshold values, a blink and a yawn is considered respectively. The system alerts the driver by playing an alarm if eye blinking rate and yawns are suspected for a certain number of consecutive frames. The alarm is activated to grab the drivers attention and keep on ringing until driver wakes up.

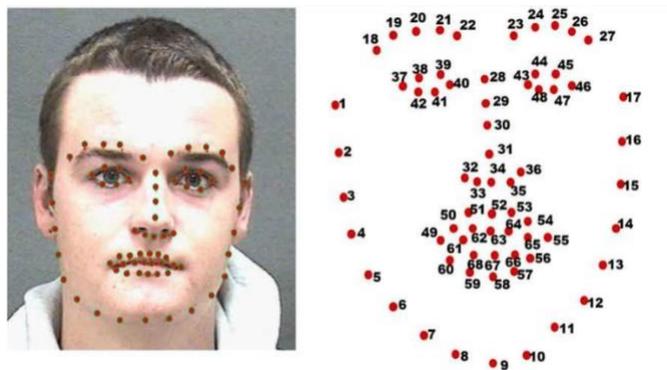


Figure : The 68 points mark-up used for our annotations.

#### A. Measuring EAR

### IV. METHADODOLOGY

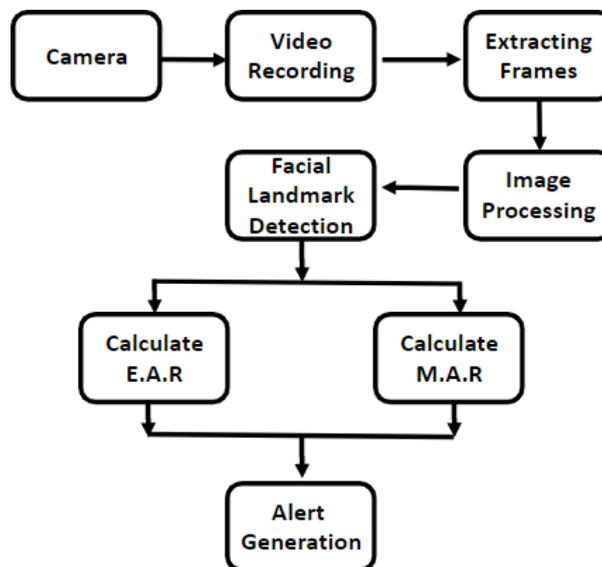
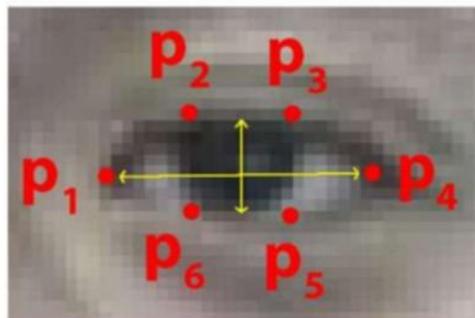


Fig.1 System Architecture

### V. DATASET USED

The 300-W is a face dataset that consists of 300 Indoor and 300 Outdoor in-the-wild images. It Covers a large variation of identity, expression, illumination conditions, pose, occlusion and facesize.Compared to the rest of in-the-wild datasets,the 300-W database

contains a larger percentage of partially- occluded images and covers more expressions than the com- mon “neutral” or “smile”, such as “surprise” or “scream”. Images were annotated with the 68-point mark-up using a semi-automatic methodology. Many images of the database contain more than one annotated face (293 images with 1 face, 53 images with 2 faces and 53 images with [3, 7] faces). Finally, there is a large variety of face sizes. Specifically, 49.3% of the faces have size in the range [48.6k, 2.0M] and the overall mean size is 85k (about  $292 \times 292$ ) pixels. Eye aspect ratio (EAR) is used for blink detection. This is the ratio of the vertical distance between the lower and upper eyelids to the horizontal length of the eye. During blinking, the vertical distance between the lower and up- per eyelids decreases, similar to when the eyes are open. After blinking, the distance between the eyelids tends to increase. Therefore, the EAR increases at the same time as it decreases (approaching zero) and is captured by a high resolution camera with night mode for different conditions and different people. The proposed algorithm is implemented in an OpenCV environment with the aim of detecting driver drowsiness and fatigue levels in real time using blink rate and yawning. Drowsiness is detected by analyzing the blink rate and yawning (mouth opening/closing rate) when the threshold state is stable for 25 consecutive frames or more.



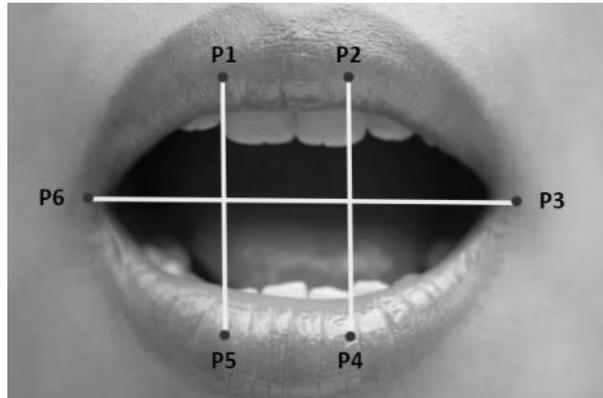
$$EAR = \frac{\|p_2 - p_6\| + \|p_3 - p_5\|}{2\|p_1 - p_4\|}$$

1

### B. Measuring MAR

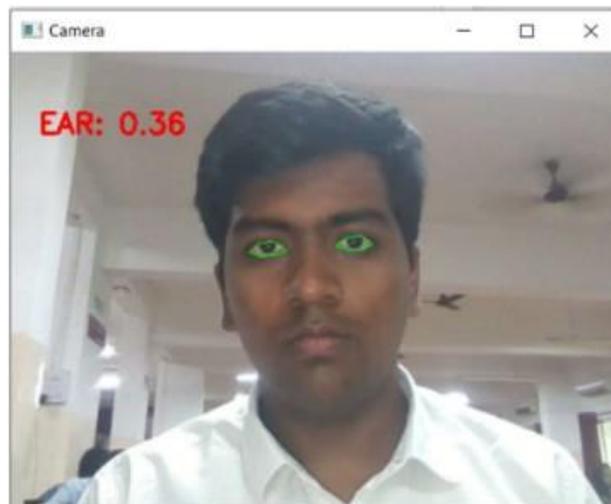
The mouth is represented by eight coordinates in the dlib landmark prediction function. Landmarks are marked clockwise from the left corner of the mouth as shown. It has been observed that horizontal and vertical coordinates have

some relation to each other. To determine MAR, calculate the ratio of the vertical distance between the lower and upper lips to the horizontal distance between the lip angles. When a person opens their mouth to yawn, the distance between their lower and upper lips increases. Unlike EAR, the yawn count increases when the increase in MAR exceeds the threshold.



$$MAR = \frac{[||P1 - P5|| + ||P2 - P4||]}{2||P6 - P3||}$$

## VI. SAMPLE OUTPUT



a) Eyes Open



b) Eyes Closed

## VII. RESULTS

| Sr. No. | Parameter         | Result      |
|---------|-------------------|-------------|
| 1.      | $E.A.R < 0.25$    | Eyes Closed |
| 2.      | $E.A.R \geq 0.25$ | Eyes Open   |

## VIII. CONCLUSION

A driver monitoring system is implemented to detect driver drowsiness and fatigue in real time from captured images. This work is based on behavioral analysis, installation of high-performance cameras, and conventional algorithms for detecting possible coordinates for identifying eyes and mouths. Based on real-time data collection and analysis, blink and yawn detection are considered key parameters for detecting drowsiness and device fatigue and triggering corresponding alarms.

## IX. FUTURE SCOPE

In the future, it is necessary to propose wearable devices that identify other parameters such as blood pressure, pulse rate, detect driver drowsiness and fatigue more accurately and efficiently, and minimize the number of traffic accidents. I have. The system is vulnerable to extreme lighting conditions. If the light is too bright or too weak, the system cannot recognize your face. For greater accuracy, infrared video cameras can be used in the future to identify eyes at night or in low-light environments where drivers are wearing sunglasses.

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## REFERENCES

- [1] V. Chaudhary, Z. Dalwai and V. Kulkarni, "Intelligent Distraction and Drowsiness Detection System for Automobiles," 2021 International Conference on Intelligent Technologies (CONIT), 2021.
- [2] A. Pondit, A. Dey and A. Das, "Real-time Driver Monitoring System Based on Visual Cues," 2020 6th International Conference on Interactive Digital Media (ICIDM), 2020.
- [3] H. Garg, "Drowsiness Detection of a Driver using Conventional Computer Vision Application," 2020 International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), 2020.
- [4] Agrawal, S. A., Umbarkar, A. M., Sherie, N. P., Dharme, A. M., & Dhabliya, D. (2021). Statistical study of mechanical properties for corn fiber with reinforced of polypropylene fiber matrix composite. *Materials Today: Proceedings*, doi:10.1016/j.matpr.2020.12.1072
- [5] A. Sinha, R. P. Aneesh and S. K. Gopal, "Drowsiness Detection System Using Deep Learning," 2021 Seventh International conference on Bio Signals, Images, and Instrumentation (ICBSII), 2021.
- [6] Jain, Mahek. (2021). Real-Time Driver Drowsiness Detection using Computer Vision. *International Journal of Engineering and Advanced Technology*.
- [7] Prof. Swati Gade, Kshitija Kamble, Aishwarya Sheth, Sakshi Patil, Siddhi Potdar. *Driver Drowsiness Detection Using Machine Learning*.
- [8] Aditya Ranjan, Karan Vyas, Sujay Ghadge, Siddharth Patel, Suvarna Sanjay Pawar. *Driver Drowsiness Detection System Using Computer Vision*.
- [9] Anupong, W., Azhagumurugan, R., Sahay, K. B., Dhabliya, D., Kumar, R., & Vijendra Babu, D. (2022). Towards a high precision in AMI-based smart meters and new technologies in the smart grid. *Sustainable Computing: Informatics and Systems*, 35 doi:10.1016/j.suscom.2022.100690
- [10] Li, Xiaofeng & Xia, Jiahao & Cao, Libo & Zhang, Guanjun & Feng, Xiexing. (2021). Driver fatigue detection based on convolutional neural network and face alignment foredge computing devices. *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering*.
- [11] Baiasu, Ana-Maria & Dumitrescu, Catalin. (2021). Contributions to Driver Fatigue Detection Based on Eye-tracking. *International Journal of Circuits, Systems and Signal Processing*.
- [12] Arsic, Aleksa & Ilic, Velibor & Pavkovic, Bogdan & Samardzija, Dragan. (2021). System for detecting drivers drowsiness, fatigue and inattention.