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Autonomous Vehicles: Live Face Detection

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Abstract:-Researchers are interested in the topic of autonomous automation, and this paper provides a thorough chronicle of the achievements made there. The developments in self-driving techno for the future can be understood with the aid of this essay. We observe a significant shift in autonomous

Since the 1920s, when the first radio-controlled cars were created, vehicles have advanced significantly. In the ensuing decades, we'll witness electric vehicles that are largely autonomous and are fuelled by embedded roadside circuits.

Autonomous vehicles with comparable electronic guidance systems first appeared in the 1960s. Vision-guided autonomous vehicles were a significant technological advance in the 1980s, and we continue to use variants of these technologies today. the introduction of several semi-autonomous characteristics.

Modern automobiles are designed to be automated to allow human drivers to travel more leisurely. the subject of numerous factors that go into making an automated vehicle has been taken into account. The largest network, Google, began working on self-driving cars in 2010 and is still coming up with fresh innovations to take automated vehicles to a whole new level. In this essay, we mainly focus on drowsiness detection which is introduced due to accidents caused by the drowsiness of drivers while driving.

1. INTRODUCTION

Automated vehicles are an advancement in automotive technology. Even while automated vehicles are designed to make life easier for people.

Customers all across the world are excited about the introduction of autonomous vehicles for public use. An autonomous vehicle is one that can run unsupervised and without human interference.

Modern autonomous vehicles, according to Campbell et al., can assess their immediate surroundings, classify various items they come across, and interpret sensory data to choose the best routes to take while adhering to traffic laws.

Significant progress has been achieved in providing a suitable response to unexpected events where either a bounceback in the vehicle systems could happen or some part in the external environment might not respond as predicted by internal prototypes**.**

Combining a range of technology from several fields, including computer science, mechanical engineering, electronics engineering, electrical engineering, and control engineering, is crucial for performing successful autonomous navigation in such circumstances (Deshpande, 2014). The first radio-controlled car, known as the "Linriccan Wonder," marks the beginning of the autonomous vehicle era in 1926. Since the introduction of the vision-guided Mercedes-Benz robotic van in 1980, when the main emphasis has been on vision-guided systems using LIDAR, radar, GPS, and computer vision, significant advancements in autonomous vehicle technology have been made. This evolved into the autonomous features seen in modern vehicles, such as steer assist, adaptive cruise control, and lane parking.

Moreover, in the future, According to official predictions made by numerous automakers, we will live in a time when fully autonomous automobiles are a reality.

One of the leading causes of death worldwide is traffic accidents. By implementing newer, inventive techniques and making improvements in road safety at all levels—from the local to the global—this world could avert **5 million human fatalities** and **50 million serious injuries by 2020**. The **Commission for Global Road Safety** thinks it's vital to stop this horrific and needless surge in traffic accidents and start year-over-year reductions (Campbell, 2010). Nearly 3000 people per day die as a result of traffic accidents, according to Deshpande et al.

In this paper we mainly focus on one of the characteristics of automated cars which is drowsiness detection as it is.

Very much needed. Driving when fatigued is one of the leading causes of accidents on the road today. Long-distance drivers often fall asleep behind the wheel, which is to be expected. In this post, we'll show you how to create a drowsiness monitoring system that will let you know the moment the driver nods off.

Using vision-based approaches like eyes detection, yawning, and nodding, drowsiness can be detected. Some people have the ability to fall asleep without yawning or nodding.

2. Related Work

The only factor identified as the single cause of serious traffic accidents in recent years is sleepy driving, which can result in serious injuries and mass deaths as well as financial misfortune.

An accurate framework for **detecting driver fatigue** that could warn the driver before an accident happens was emphasised by many studies.

Experimentalists have proposed various methods and theories to identify fatigue. They attempted to comprehend driver fatigue concentrating on specifics such as vehicle-based, physiological, and behavioural measures, among others.

This section provides a detailed review that will give a knowledge of the frameworks in use today and some of the problems associated with them, and the enhancement that should be made to create a better framework.

A method for detecting drowsiness based on vehicle movement was proposed. This method was primarily concerned with the location and modifications of the steering wheel, which is a critical factor in maintaining the car stays in its lane without veering. Calculations were performed to link micro-modifications in steering and sleepiness, **yielding an 86% efficiency in detecting drowsiness.**

In another case By measuring the distance between the car's position and lane lines using a camera mounted in the front part of the rear-view mirror, users' driving habits in the system were compared under alert and sleepy conditions. Next, the path deflection was looked at.

The next group of approaches is figuring out the users' biological makeup. It makes use of bioelectrical sensors such as the electrocardiogram, electroencephalogram, and electrooculogram. Theta, alpha, and delta frequencies are the primary signals used in to estimate human drowsiness.

Drowsiness is identified using EEG waves. in the electrical activity in the brain is controlled by them. In addition to computing the instantaneous frequency and signal abnormalities, the **zero-crossing** and **energy spread** are also calculated. Spectrogram images acquired by EEG are used to create **deep CNN architectures** for feature extraction.

The task described in [10] concentrates on incorporating automated driver fatigue as well as an alarming system using electrooculography signals. For signal acquisition, a circuit for an embedded system a system's embedded circuit on Arduino was prepared. In order to account for the classification, supervised learning K-nearest neighbour was used These techniques all offer the highest level of accuracy (more than 90%). The intrusiveness of all of these frameworks, meanwhile, is a serious drawback because it diverts drivers' attention from the connection of too many sensors. It is possible to estimate bio-signals without interference, although these methods are less accurate.

Similarly, you can utilise speech recognition technologies in your car to spot lethargic or sleepy voices. The idea is to analyse a person's voice to gauge how worn out they are. The results are simultaneously approved using estimates based **on electroencephalography (EEG).**

People participated in a study where they had to recite sentences at various levels. The responses were recorded so that limits could be set for things like reaction time, unvoiced length, and duration. The quiet of both voiced and unvoiced forms is also understood by employing **Mel Frequency Cepstral Coefficients** (MFCC), which are used to separate these components using a **Gaussian Mixture Model (GMM).**
The problem of these approaches is their intricacy. Furthermore, a building was built that.

The analysis and dissemination of research findings from the study on the brain-computer interface driven by fNIRS and deep learning for sleepiness identification.

The method of science for producing meaningful neuroimaging is called functional near-infrared spectroscopy. Both the dorsolateral prefrontal and prefrontal cortices engaged in fNIRS. For the purpose of separating awake from asleep states, deep networks were used. The experiment made use of convolutional neural networks. Images of colour maps were discovered to be the most logically sound method for observing brain activity.

Theoretically, a number of unique, **state-of-the-art deep-learning techniques** based on convolutional neural networks and facial characteristics can be used to evaluate a person's gaze
where they are used to build a deep learning technique that uses several GPUs to sort the gaze from a particular face recognition image. This methodology, however, falls short given the need for a substantial amount of data to set up a network that can coordinate and function correctly with an indisputable degree of precision.

To determine drowsiness or sleepiness, researchers just looked at the iris' condition. They did not take into account yawning recognition or head movements like lowering, which produce a framework with substantially better accuracy. Based on both head and ocular signals, they created a technique for analysing gaze.
Additionally presented was a framework for a monocular camera and an active eye cue system. They recognised ocular characteristics that could be utilised to record information about the driver's stare.
seen as another fascinating strategy that emphasises the significance of drivers' quick reactions. It emphasises detecting drowsiness in advance, giving users enough time to respond. A sequence of blink events was achieved using the sliding window mechanism. The

Hidden Markov Long Short-Term Memory model receives these qualities. It has been taught to comprehend the dynamic hierarchical structure used to analyse blinks with different lengths. In this process, flickering features were taken into account By adding additional features, it may be made even better.

Built on actions like doze length and eye gesture, as well as face component extraction by computer vision, the idea in [18] is based. To recognise yawns and detect eye closures, mouth feature calculations and the eye aspect ratio are both important criteria.

The recognition process employs **a HAAR-based classifier.** Outputs are produced by recurrent eye flickers and the intuition that the number of yawns increases as a person tired. Drowsiness is also influenced by the overall number of hours spent driving. As a result, [19] incorporated a novel function that allowed for the adjustment of the threshold of the mouth and eye frames.

The **EM-CNN model** is used in a different manner to analyse the condition of the lips and eyes. The detection relies on a multitasking cascaded convolutional neural network. Both the amount of lips closure time and the amount of eye closure are the study's parameters. Other convolutional neural network techniques can't compare to its performance.
The community will approve the design and implementation of an effective passive sleepiness detection technique that can function in real-time due to the significance of drowsiness detection. Based on this, we created and put into practise a brand-new sleepiness detection system.

3. Proposed schema

1. This section discusses the suggested method for detecting sleepiness. A behaviourally based technique is used to analyse the driver's frontal traits. This method includes recognising head, face, and eye movements. MATLAB software is used to carry it out. The first step in the procedure is to record the live feed from the camera.
2. This is the scheme's starting point. In addition, a frame from the live broadcast is recorded and a face detection process is applied to it. Face detection is accomplished using the "**Haar cascade classifier**". Face and eye detection methods are invoked using built-in MATLAB routines.
3. The "**Haar cascade classifier** identifies frontal faces by using the frames that have undergone the transformation from colourful to grayscale images**.** A study algorithm has been developed to recognise faces. A grid-like pattern separates the image into different halves. Rectangles that display haar-like traits in the grid are found and assessed using detection windows. by adding the terms of rectangular subregions essential images are formed.
4. A cascade system is then used to perform additional processing. The best features are evaluated in the first stage by the sub-regions, and if they are favourable, the other features are considered in the subsequent stages. If every classifier agrees that the image is a human face, the region is labelled as such and the observation is shown
5.The live recording continues till the person stop using the system. This is done because drowsiness can strike the driver at any time, necessitating continuous detection.
6. A loop operation is used to accomplish this. Any arbitrary frame is first reviewed. Continuous snapshots are taken, and a rectangular boundary is created by detecting faces and eyes.
7.The collected frame must be converted into a grayscale image before detecting both the left and right eyes. If numerous faces are discovered, considered are the first or first row. In the second stage, box coordinates for both eyes are calculated.
8.The estimated outcome is then used to crop the frame. The next step is to check to determine if there are more elements than zero that are used to store bounding box values. The values are changed if it is; else, the initial box coordinates are used. Then, both eyes are boosted and cropped.
9.An SVM classifier is loaded and used to analyse the eye movement. It uses supervised machine learning to address classification issues.
[9.1] SVM can be used to identify the candidate's eye region and classify them according to their eye condition. In order to distinguish between two or more classes, it uses hyperplanes.
A decision border with the greatest feasible distance between the two classes is what SVM aims to achieve. Furthermore, because SVM can prevent false recognition, we can perform accurate and quick eye detection procedures.

It is possible to generate an audio signal that prompts the person to open their eyes if they are neither closed nor blinking by studying this string aloud with a voice recognition for text synthesiser. Additionally, changing the sensor box's colour to red makes this clear.
[9.2] To detect head motion, the **Euclidean distance** between the frames is constantly computed and evaluated against a **threshold value**. The threshold value of 5 in this proposed method is the result of ongoing experimental research. If the Euclidean distance exceeds this value of 5, indicating movement. The frame is added to the video player while the box coordinates are modified.

4. Experiment and Result Analysis

Analysis of an experimental study's findings
Live video footage captured by our laptops' webcams is used for the experimental investigation and outcome analysis. A webcam video's uint8 RGB frames are present.

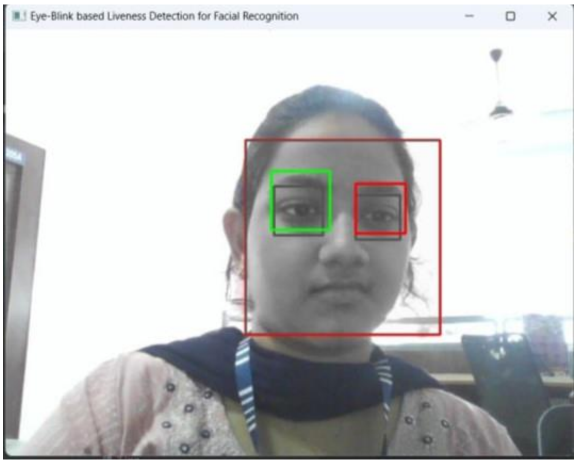

Image 1. The HOG characteristics of eyes and their states

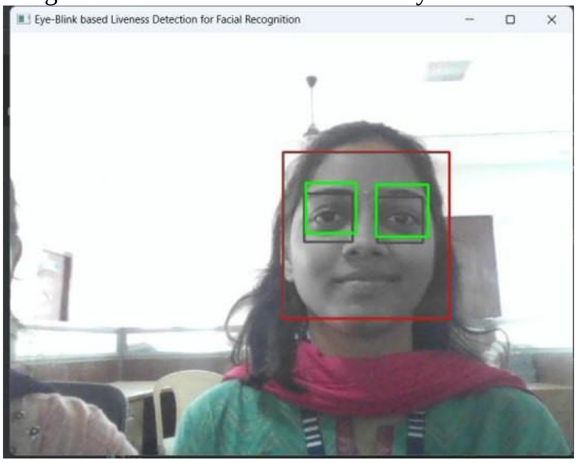

Image 2. HOG feature plot in 640x360 resolution.

We used the MATLAB R2020b programme to write the code, and we recorded the final video in.avi format. We captured an active webcam image, identified motion of a face, and determined whether two eyes were open or closed. A rectangle in yellow is added close to the face and eyes when they are found. If the face moves, a message is displayed across the rectangle that surrounds it. Furthermore, the driver receives an auditory warning to return to the stationary state. The condition of two eyes is shown as added text in the upper left corner of the frame. If two eyes are identified by system audio alert as closed it is played to wake the driver from anticipated drowsiness. A timestamp is added. into each frame confirm the video's continuity. Each frame is added at the end of a video displayer. Each cycle concludes with a 0.5-second wait to allow the processing to complete without interruption and to avoid the need to constantly review the video. All video frame rates are slowed for the same reason.
Several factors are used. The face, the eyes, face's lateral and axial mobility, the left and right eyes, the distance between the left and right eyes, and the presence or absence of sleep were all correctly identified. Face movement was visible in both bright and low-lighting shots.
If the eyes are partially hidden in the frame, eye detection won't work, as is true of spectacles with small frames. Drowsiness is successfully recognised, and the driver receives an audio indication.
We flag it as sleepiness Because a false positive is bearable but a false negative is fatal, it is impossible to precisely identify the eyes or face. Because it contains real driving examples rather than static simulations or camera recordings, This dataset is perfect for testing algorithms that identify driver fatigue. Our method had 90% accuracy, 84% precision, and 98% recall. We wish to emphasise that a high recall rate indicates a low False Negative classification.
When the face or eyes in the frame cannot be seen clearly owing to anomalous obstructions, lighting issues, or misalignment.

Our behavioural analysis approach's main advantage is that it requires very little hardware and enables the inclusion of any features via soft computing.

5.Algorithm:

Input: recording live through cam
Output: voice alert based upon drivers drowsiness
1.) launch the photographic equipment wc, monitoring device md, viola-jones biometric identifier bi and eye moment identifier em
2.)Take one frame and save its detailed properties like size, resolution and use bi to get confined box cfb[m ,n ,width, height] constraints of initial face moment
3.) State a global assembly for voice alert and illustrate object ds for dialogue synthesis and swap to high volume
4.)while !(device is shutdown) do
5.)Get Frame from wc
6.)Analyse face in frame considering viola-jones algorithm and store face moments confined values in cfb2[m ,n ,width ,height]
7.)if((cfb(2)-cfb2(2))^2 +(cfb(1)-cfb2(1))^2)^0.5>5:
    1) exhibit face is moving
    2)give less volume sound alert
8) modernize cfb = cfb2

9) collect face from frame. now calculate ROI for
anticipated eye moment according to standard face ratios
10.) gather each eye from frame and store in left and right

11) Execute precomputed viola-jones algorithm for eye detection in ROI to get perfect eye positions in frame. Crop these and save in same variables
12.) The SVM classifier will produce a binary result for each eye in Lsol, Rsol after receiving HOG features extracted from each eye picture. (where 0 denotes closed and 1 means the door is open)
13) define left message Lef, right message Ryt, and drowsiness status Ds as "left eye: closed", "right eye: closed"and "Flickering". Set box colour to yellow.
14)If Lsol=1or Rsol=1: set Ds="awake"
15) Else: Give HIGH volume sound alert "Please open your eyes" and shift box color to red.
16)If Lsol=1: set L="left eye: open"
17) If Rsol=1: set R="right eye: open"
18) Put rectangle over face, eyes in Frame and add timestamp, messages L, R, Dat top left of Frame.
19) Add Frame to the monitoring device.
20) End of while in step 4.

6. Conclusion:

A sleepiness detection technique based on behavioural data and image processing has been developed. It records all head movements, detects them, and categorises eyes as open or closed. Using the "Haar cascade classifier" for face recognition, we estimated separation between the face's location and another in successive frames; if this seperation exceeds a threshold value, Face movement is implied. We used an SVM classifier model that had previously been trained a cropped image's classification of an eye as closed or open for eye monitoring. The live frame inserts and shows the position of both eyes, as well as a checksum. A loud auditory alert is played if there is any head movement to warn the driver if both eyes are found to be closed. We conducted our experiment using real driving subjects from a dataset and live camera video, and we built our algorithm in MATLAB software. Our calculated accuracy is 90%, with an 84% precision and a high 98% recall.

Limitation: Our study of the data showed that, while our system recognises facial movement in all cases, it is unable to recognise eye proximity if the eyes are partially obscured in the video.

Future Work: To get around this problem, we'll use point tracking analysis along with Max Bidirectional Error in our upcoming work.

7. Reference:

[1] M. Omidyeganeh, A. Javadtalab, and S. Shirmohammadi, "Intelli- gent driver drowsiness detection through fusion of yawning and eye closure," in 2011 IEEE International Conference on Virtual Envi- ronments, Human-Computer Interfaces and Measurement Systems Proceedings. IEEE, 2011, pp. 1–6.

[2] P. Kolpe, P. Kadam, and U. Mashayak, "Drowsiness detection and warning system using python," Available at SSRN 3645864, 2020.

[3] A. Picot, S. Charbonnier, and A. Caplier, "Drowsiness detection based on visual signs: blinking analysis based on high frame rate video," in 2010 IEEE Instrumentation & Measurement Technology Conference Proceedings. IEEE, 2010, pp. 801–804.

[4] Y. Suryawanshi and S. Agrawal, "Driver drowsiness detection sys- tem based on lbp and haar algorithm," in 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC). IEEE, 2020, pp. 778–783.

[5] P. R. B. Agustin, R. C. Lazaro, M. D. L. Mazo, A. C. P. Vidal, E. Q. Raguindin, and M. A. C. Purio, "Matlab based drowsiness detection system using an array of sensors and fuzzy logic," in TENCON 2014-2014 IEEE Region 10 Conference. IEEE, 2014, pp. 1–6.

[6] T. Vesselenyi, S. Moca, A. Rus, T. Mitran, and B. Ta˘taru, "Driver drowsiness detection using ann image processing," in IOP confer- ence series: materials science and engineering, vol. 252, no. 1. IOP Publishing, 2017, p. 012097.B. Reddy, Y.-H. Kim, S. Yun, C. Seo, and J. Jang, "Real-time driver drowsiness detection for embedded system using model compression of deep neural networks," in Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops, 2017, pp. 121–128.

[7] U. Budak, V. Bajaj, Y. Akbulut, O. Atila, and A. Sengur, "An effective hybrid model for eeg-based drowsiness detection," IEEE sensors journal, vol. 19, no. 17, pp. 7624–7631, 2019.

[8] Y. Ma, B. Chen, R. Li, C. Wang, J. Wang, Q. She, Z. Luo, and Y. Zhang, "Driving fatigue detection from eeg using a modified pcanet method," Computational intelligence and neuroscience, vol. 2019, 2019.

[9] A. A. Hayawi and J. Waleed, "Driver's drowsiness monitoring and alarming auto-system based on eog signals," in

2019 2nd Interna- tional Conference on Engineering Technology and its Applications (IICETA). IEEE, 2019, pp. 214–218.

[10] L. S. Dhupati, S. Kar, A. Rajaguru, and A. Routray, "A novel drowsiness detection scheme based on speech analysis with valida- tion using simultaneous eeg recordings," in 2010 IEEE international conference on automation science and engineering. IEEE, 2010, pp. 917–921.

[11] S. Tateno, X. Guan, R. Cao, and Z. Qu, "Development of drowsiness detection system based on respiration changes using heart rate monitoring," in 2018 57th Annual Conference of the Society of Instrument and Control Engineers of Japan (SICE). IEEE, 2018, pp. 1664–1669.

[12] F. Guede-Fernandez, M. Fernandez-Chimeno, J. Ramos-Castro, and M. A. Garcia-Gonzalez, "Driver drowsiness detection based on respiratory signal analysis," IEEE access, vol. 7, pp. 81 826–81 838, 2019.

[13] M. A. Tanveer, M. J. Khan, M. J. Qureshi, N. Naseer, and K.-S. Hong, "Enhanced drowsiness detection using deep learning: an fnirs study," IEEE access, vol. 7, pp. 137 920–137 929, 2019.

[14] I.-H. Choi, S. K. Hong, and Y.-G. Kim, "Real-time categorization of driver's gaze zone using the deep learning techniques," in 2016 International conference on big data and smart computing (BigComp). IEEE, 2016, pp. 143–148.

[15] A. Tawari, K. H. Chen, and M. M. Trivedi, "Where is the driver looking: Analysis of head, eye and iris for robust gaze zone estimation," in 17th International IEEE Conference on Intelligent Transportation Systems (ITSC). IEEE, 2014, pp. 988–994.