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Driver Drowsiness Detection System

COURSE CODE	ITE3999
COURSE NAME	TECHNICAL ANSWERS TO REAL WORLD PROBLEMS
SLOT	TE1
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Literature Survey/Review

No	Name	Journal	Author	Methodology	Research Gap
1	Drowsiness Detection of a Driver using Conventional Computer Vision Application Link	2020 International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC)	Garg, Hitendra	In this paper, in order to detect a driver's yawning, her nose tip is first identified in the depth image of the face and then the lower area of the face is separated. In the resulting image, the approximate area of the mouth is found and using depth information and the active contour model, an open mouth is identified.	The algorithm's performance is decreased as the driver's head is rotated widely such that the nose tip is not the lowest depth point anymore.
2	Real Time Driver Fatigue Detection System Based on Multi-Task ConNN Link	IEEE Access Volume 8	Burcu Kir Savaş, Yasar Becerikli	Multi-task ConNN models used to detect driver fatigue in real time. Dlib algorithm used to accurately identify the driver's eye and mouth information. Finally, depending on fatigue parameters, fatigue is evaluated as ''very tired, less tired and not tired''.	Does not take head position and condition into account which is as important as eyes and mouth.
3	Real-Time Driver-Drowsiness Detection System Using Facial Features Link	IEEE Access Volume 7	Wanghua Deng, Ruoxue Wu	Used MC-KCF algorithm to track the driver's face using CNN and MTCNN to improve the original KCF algorithm. Defined the facial regions of detection based on facial key points. Introduced a new evaluation method for drowsiness based on the states of the eyes and mouth.	Fails to properly detect alertness level if driver is wearing glasses especially dark sunglasses
4	A Fatigue Driving Detection Algorithm Based on Facial Multi-Feature Fusion Link	IEEE Access Volume 8	Kening Li, Yunbo Gong, Ziliang Ren	Used YOLOv3-tiny convolutional neural network, and trained the network with the open-source dataset WIDER FACE. Designed the eye and mouth SVM classifier that takes driver characteristics into account.	Falters if the driver is wearing glasses. Difficult to detect mouth shape since people wear masks due to COVID.
5	Detecting Human Driver Inattentive and Aggressive Driving Behavior Using Deep Learning: Recent Advances, Requirements	IEEE Access Volume 8	Monagi H. Alkinani, Wazir Zada Khan, Quratulain Arshad	The detection of human driver aggressive driving behavior (HADB) was classified according to the aggressive driving styles adopted by aggressive drivers. Solutions for human driver Inattentive and Aggressive Driving Behavior (HIADB) detection	Expensive & high performance can be achieved by utilizing deep learning models and strategies like deep reinforcement learning and Q-learning.

	and Open Challenges Link			were reviewed, highlighting their detection accuracies.	
6	Vision-Based Instant Measurement System for Driver Fatigue Monitoring Link	IEEE Access Volume 8	Yin-Cheng Tsai, Peng-Wen Lai, Po-Wei Huang, Tzu-Min Lin, Bing-Fei Wu	Remote photoplethysmography (rPPG) signal measured by camera to evaluate fatigue. System measures both the motional and physiological information by using one image sensor.	This system alone is not enough. Should be combined with other methods to create a hybrid system.
7	An Investigation of Early Detection of Driver Drowsiness Using Ensemble Machine Learning Based on Hybrid Sensing Link	2018 IEEE International Conference on Intelligent Transportation Systems	Jongseong Gwak, Akinari Hirao, Motoki Shino	Measured drowsiness level, driving performance, physiological signals (from EEG), and behavioral indices of a driver using a driving simulator and driver monitoring system. Driver alert and drowsy states were identified by ML algorithms. Hybrid system made for early drowsiness detection.	Effects of age and gender on driving performance during drowsy driving not included. Vibration and changes in gravity, sound, in a driving simulator are different from real vehicles. Further investigation is needed.
8	Applying deep neural networks for multi-level classification of driver drowsiness using Vehicle-based measures Link	Expert Systems With Applications, Elsevier	Sadegh Arefnezhad, Sajjad Samiee, Arno Eichberger, Matthias Frühwirth, Clemens Kaufmann, Emma Klotz	This study presented a new method for multi-level detection of drivers' drowsiness using deep neural networks based on vehicle-based measures. Three levels for drowsiness were considered: awake, moderately drowsy, and extremely drowsy. Three different neural networks using convolution layers and their combinations with two different recurrent layers consisting of LSTM and GRU were employed.	It is difficult in cases where the drivers scarcely show movements or mimics at all. Also, the input measures of the presented neural networks rely on active steering and will not work when driving without, like an active lane-keeping assist
9	Tensor-Based EEG Network Formation and Feature Extraction for Cross-Session Driving Drowsiness Detection Link	2020 International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC)	Mu Shen, Bing Zou, Xinhang Li, Yubo Zheng, and Lin Zhang	Tensor network formation and feature extraction is applied in driving drowsiness detection and overcomes variability across different sessions and subjects. These features reflect more intrinsic and underlying patterns of drowsiness.	Accuracy of the model is still less when compared to other models. More careful network structure design and feature extraction algorithms will be needed to further improve the accuracy and robustness
10	Real-time classification for autonomous	Expert Systems With	Caio Bezerra Souto Maior, Márcio José	The proposed method uses face landmarks to estimate Eyes Aspect Ratio(EAR), and	People often try to compensate for the effects of fatigue so that

	drowsiness detection using eye aspect ratio Link	Applications, Elsevier	das Chagas Moura, João Mateus Marques Santana, Isis Didier Lins	then applies the ML model to classify the user state with low-cost processing and in real-time. This was an efficient and reliable method only using an ordinary web camera.	the performance appears to be normal (e.g., keeping the eyes wide open). This is a limitation of the model because it uses only images as evidence for drowsiness.
11	Evaluation of driver drowsiness using respiration analysis by thermal imaging on a driving simulator Link	Multimedia Tools & Applications; Jul2020, Vol. 79 Issue 25/26, Springer	Kishari, Serajeddin Ebrahimian Hadi Nahvi, Ali Bakhoda, Hamidreza Homayounfard, Amirhossein Tashakori, Masoumeh	In this paper, a new drowsiness detection system was introduced based on analyzing driver respiration features using thermal imaging. Based on the data obtained from 30 participants, the SVM classifier resulted in the best performance in detecting drowsiness using the fusion of all respiration features with the accuracy of 90%	Due to driver's head and body movements, the respiration region may be blocked or go out of the thermal camera viewing window. Since it relies on respiration features, the model may not give accurate results for people having some respiratory problem.
12	Real-time monitoring of driver drowsiness on mobile platforms using 3D neural networks Link	Neural Computing & Applications; Jul2020, Vol. 32 Issue 13, Springer	Jasper S. Wijnands, Jason Thompson, Kerry A. Nice, Gideon D. P. A. Aschwanden, Mark Stevenson	This research proposed real-time video monitoring with a 3D convolutional neural network, providing early warning signals to a drowsy driver. This method implicitly decides which features are important for drowsiness detection, applies separation of blinking versus micro-sleep, talking versus yawning and the identification of important face movements.	Since this method uses a deep learning model for prediction, it needs a huge amount of dataset for high accuracy. Also, it may be slower than other models as deep learning models require more time for computation.
13	EDDD: Event-Based Drowsiness Driving Detection Through Facial Motion Analysis With Neuromorphic Vision Sensor Link	IEEE Sensors Journal, VOL. 20, No. 11, June 1, 2020	Guang Chen, Lin Hong, Jinhu Dong, Peigen Liu, Jörg Conradt, Alois Knoll	By using a novel neuromorphic vision sensor, the proposed work simplifies the traditional vision-based detection process as the new sensor is a natural motion detector for the drowsiness driving related motions. The proposed method can get robust and high-accuracy performance in corner-case scenarios such as driving with sunglasses or driving at night, which is very challenging for traditional frame-based vision sensors.	This model is still in the processing stage and isn't completely developed for real-time detection of the driver's head from other sensing modalities such as RGB images.
14	Driver Alertness System using Deep Learning, MQ3	International Conference on	Aashreen Raorane, Hitanshu	Real-time analysis is performed on both the driver as well as the road to detect any important aspect that	The model is trained to detect lanes and alert the driver if the vehicle does not obey lane for a

	and Computer Vision Link	Intelligent Computing and Control Systems, IEEE	Rami, Pratik Kanani	cannot be missed. This model is useful whenever it is the driver's fault, like, when the driver is distracted, angry, misses a sign or is drunk, as well as it proves to be helpful to guide the driver when it is not his fault, the cases wherein a car or a person is close or lane crossing.	longer period or if it crosses the lanes many times in a few seconds. However, it fails to detect if the road ahead has a curvature which may result in false prediction.
15	A Fuzzy Based Method for Driver Drowsiness Detection Link	2017 IEEE ACS 14th International Conference on Computer Systems and Applications (AICCSA)	Omar Rigane, Karim Abbes, Chokri Abdelmoula and Mohamed Masmoudi	This paper proposed a novel approach for an intelligent driver drowsiness detection system using visual behavior of the driver. The estimation of driver's vigilance was successfully made by combining facial and eye symptoms using fuzzy logic controller. Three parameters were extracted, two symptoms related to eye behavior after the classification of the eye state and one symptom related to face behavior. Experimental result using fuzzy-logic simulation in Matlab showed the performance of the developed approach to be quite accurate in various conditions.	This model needs to integrate measures to increase the performance of the system. Further, real time constraints need to be taken into account while developing the model.

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