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A Review of Vehicle Accident Detection and Notification Systems Based on Machine Learning Techniques

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Abstract

The rabid growth of the vehicles accidents on our roads are increasing as well as the number of human lives lost and the costs of repairing damages due to these accidents in order to reduce the dangers associated with accidents. A lot of researchers and specialists turn to electronic systems based on machine learning, deep learning techniques algorithms or any other artificial intelligence methods to detect and generate an emergency signal can reduce the time gap between the accident happening and the arrival of medical help. The main purpose of this review article was to identify and collect all the studies that have been done previously to detect roads traffics based on using machine learning techniques particularly deep learning. This paper will present all the methods that have been used and the experimental results of these studies and the research gabs they contain. We are following a systematic search plan passed on selected the papers that have the most similar keyword to make sure that all paper are exactly matching this paper subject so we apply this plan by using Springer, Elsevier, Electrical and Electronics Engineers (IEEE) xplore ,Google scholar, Arxiv, Sciencedirect and Researchgate datasets. From the all previous mentioned datasets we found 37 papers only 26 of these papers are corresponded with the review subject.

Keywords: Vehicles Accidents, Machine learning, Object detection, Surveillance camera, Convolutional Neural Network (CNN), Region-based (RCNN).

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مراجعة لانظمة الكشف عن حوادث المركبات في الطرق والاخبار عنها بالاعتماد على تقنيات التعلم الالي

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الخلاصة

مع النمو السريع لحوادث المركبات في طرقنا وتزايد الخسائر البشرية وكلف اصلاح الاضرار الناجمة عن تلك الحوادث لتقليل المخاطر المرافقة للحوادث.الكثير من الباحثين والمختصين اتجهوا لايجاد نظام الكتروني قائم على استخدام تقنيات وخوارزميات التعلم الالي والتعلم العميق او اي من طرق الذكاء الاصطناعي لكشف الحوادث وتوليد اشارة طارئة لتقليل الفجوة الزمنية بين زمن وقوع الحادث ووصول المساعدة الطبية.الغرض الرئيسي لهذه المراجعة هو لجمع كل الدراسات التي اجريت سابقا للكشف عن الحوادث المرورية بالاعتماد على طرق التعلم الالي و على وجه الخصوص طرق التعلم العميق.هذه الورقة البحثية قامت باستعراض كل الطرق المستخدمة في تلك الدراسات والنتائج المتحصلة منها والفجوات البحثية التي تحتويها.لقد اتبعنا خطة بحث ممنهجة تعتمد على تحديد الدراسات ذات الكلمات المفتاحية الاكثر تشابها لضمان ان كل الدراسات تتطابق مع موضوع المراجعة.قمنا بتطبيق هذه الخطة بتحميل الدراسات المعنية من المنصات التالية Springer, Elsevier, Electrical and Electronics Engineers (IEEE) xplore ,Google scholar, Arxiv,) (Sciencedirect and Researchgate ومن كل المنصات المذكورة سابقا قمنا بتحديد 35 ورقة بحثية فقط 26 منها تتوافق مع موضوع المراجعة.

الكلمات المفتاحية: حوادث المركبات, تعليم الالي, اكتشاف الاشياء, كاميرة المراقبة المحيطية, خوارزمية الشبكة العصبية الالتفافية, خوارزمية الشبكة العصبية الالتفافية المعتمدة على تحديد المنطقة.

Introduction

Every year, according to the numbers, more than a million people die on the world's roads because of vehicle accident and the costs to overcome the consequences of these Accidents runs into billions [1]. Mobility is the main simplest requirements for people who live in towns or townships. There are numerous methods to mobile from one region to another by airplanes, ships and roads by diverse categories of motor vehicles, e.g., cars, bikes, vans, and buses. Roads are the main source for linking towns and villages. Because of the flexibility in traveling by

road, vehicles have become the chief way to mobile. The probabilities of vehicular accidents (Vas) have increased with the growing amount of vehicles on the roads. Throughout any trip, there is a chance for accident happening at any moments [2]. Manual control of traffic, by traffic officers or using predefined timers has been confirmed that it's not an real solution to all the earlier cited problems caused by traffic accidents [3]. So we need to design better traffic management system can detect the accident and decreased the severity of injures after an accident by reducing the period gap between the accident happening and the therapeutic response. Advanced artificial intelligence (AI) and machine learning (ML) methods are employed, particularly deep learning (DL), that are used for decision making [4]. Once objects on the road have been recognized a decision must be taking by the module is there an actual accident or there is a probability for its happening and passed on that decision the notification signal will be generated. Figure-1 show that systems mechanism that have been proposed in the reviewed papers are to generate the notification signal automatically at the accident location by the surveillance camera which record the accidents footage and passing the signal to the nearest medical station

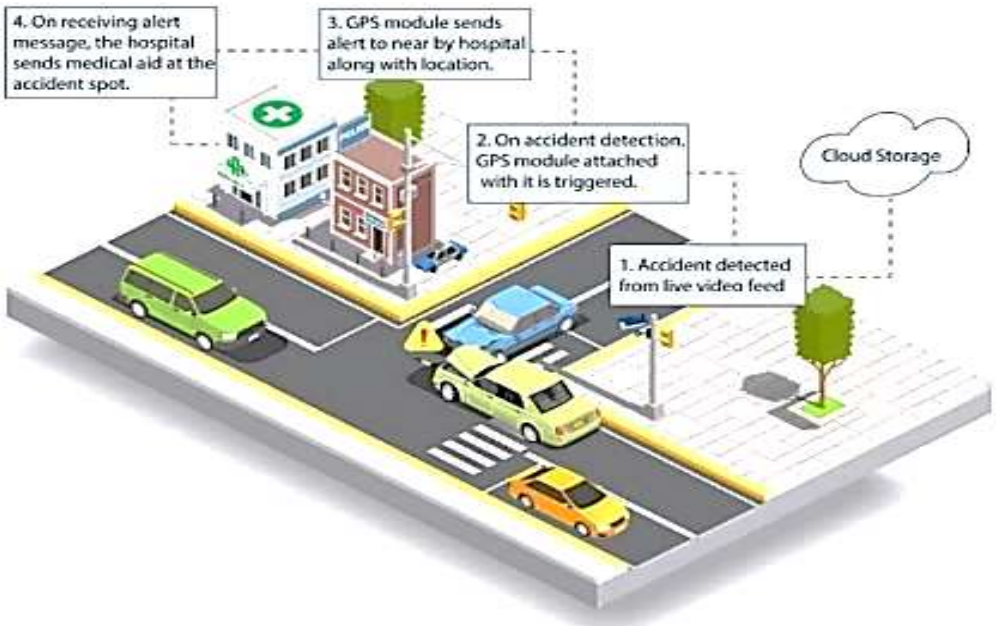

Figure1: Vehicles accidents system mechanism [36].

Artificial intelligence is the science and engineering of building intelligent machines, specifically intelligent computer programs and applications. It is related to the similar task of using computers to understand human intelligence, but AI does not have to limit itself to approaches that are biologically noticeable [5]. It's maybe the oldest field of computer science, and it's very wide-ranging, dealing with all aspects of simulating intellectual functions for real-world problem solving and the construction of systems that learn and think like people. Therefore, it is often called "machine intelligence" to contrast it with human intelligence. The field turned around with the joining of intellectual science and computer science, for example, Siri voice assistant and Alex [6].

Machine Learning is the ability of computers to learn by themselves from data and experiences, or subsections of techniques using arithmetical methods to allow machines to learn by themselves. Its greatest complex use uses Deep learning, for example, predictive analytics in autonomous vehicles face detection of persons with judicial positions, among others. With the rise of the intelligent computing era, many researchers search to incorporate human processes such as learning and communication with the purpose of copying them into machines. For many years, this technology has been outstanding at different challenges, accomplishing quick computation times (real-time) and data processing as a human. Today we are talking about a new technology that is coming into a great success, which is Deep Learning, based on sequences of neural networks that look a lot like the human brain. It contains a set of unsupervised algorithms that form layers of artificial neurons to control hidden features in a data set [7].

Deep learning is a subfield of machine learning that allows computers to learn from experience and understand the world in terms of a hierarchy of concepts. Because the computer collects knowledge from experience, there is no need for a human computer operator to officially identify all of the knowledge needed by the computer. The hierarchy of concepts allows the computer to learn complicated concepts by building them out of simpler ones a graph of these hierarchies would be many layers deep [8].

Lately, ML has become very common in research and has been incorporated in a diversity of applications, including text mining, spam detection, video recommendation, image classification, and multimedia concept retrieval. Among the different ML algorithms, DL is very commonly used in these applications. Another name for DL is representational learning (RL). The continuing studies in the fields of deep and distributed learning are due to both the irregular growth in the ability to gain data and the wonderful progress made in the hardware technologies [9].

This review presents the research strategies, methods, and the final results of a vehicle accident detection and notification system using road surveillance camera data as input. The involved studies were examined with respect to the size and type of datasets used for training and testing the models, the implemented version of the model, and the final results. The review also discusses the heterogeneity of the studies that have been conducted so far and points out the potential, challenges, and gaps of such classifiers that should be addressed in the future.

The rest of this paper is organized as follows: Section 2 presents an overview of related work. Section 3 described briefly CNN algorithms architecture and Objects Detection and Classification by CNN. Section 4 shows the challenges and limitations that we have faced. Section 5 holds the discussion, and finally, Section 6 reports the final conclusions, research gaps, and suggestions for future works.

Research Questions

To conduct a review paper be more useful for beginner's authors who hope to conduct research on the same title, we are doing our best to evaluate all the previous researches and show the gaps in this research. To fulfill all these factors, we form general questions and answer them in this paper.

Q1: What are the latest studies that have been done in this field?

Q2: How many deep learning techniques have been employed in these studies?

Q3: How perfectly the final result was fulfilled by these studies?

Q4: What are the research goals in these studies?

Related work

For vehicle accident detection and notification many systems have been proposed the main purpose of its to accomplish this goal lots of methods, techniques, and algorithms are used to apply these systems and presented to the world as articles to evaluate and show the problems that these articles may contain a lot of researches turned to make evaluation studies presented as articles called the review or survey articles and below some of these articles.

In 2018, Abdallah Moujahid, et al. [10], this paper, which investigated ADAS and ML independently and then related which ML technique is appropriate for what ADAS component and why. The paper gave a good grasp of the current state of the art. Sample works in supervised, unsupervised, deep, and reinforcement learning are offered; their assets and rooms for improvements are also discussed. This forms part of the essentials for understanding autonomous vehicle. This work is a contribution to the continuing research in ML intended for reducing road traffic accidents and losses of life, and the request for safe driving.

In 2020, Renu et al. [52], this paper offers a short-term review on the methods used in direction to save people affected by the road accidents over automatic road accident detection system. Moreover, technique based on low cost ultrasonic sensors is also offered

In 2022, Victor Adewopo, et al. [11], presented a serious review focusing on action recognition in accident detection and autonomous Tran partition systems for a smart city. In this paper, they focused on AR systems that used various sources of traffic video capturing, such as static surveillance cameras on traffic connections, highway monitoring cameras, drone cameras, and dash-cams. Through this review, they recognized the main techniques, taxonomies, and algorithms used in AR for autonomous transportation and accident detection. They also studied the data sets used in the AR tasks, classifying the main sources of the datasets and their features. This paper provided potential research directions to develop and mix accident detection systems for autonomous cars and public traffic safety systems by warning emergency personnel and law

enforcement in the event of road accidents to minimize human error in accident reporting and provide a spontaneous response to victims.

In 2022, Mohsin Naseer, and Javeria Naz, [12], reviewed accident and accidental vehicle analysis over automated approaches. The areas of applications are underlined beside the recent trends and perform discussed in this article.

In 2022, Samuel Olugbade et al. [13], explored in this article the overview of artificial intelligence and machine learning in enabling automatic incident detector systems to reduce road accidents. The study surveys the critical problems and possible medicines for reducing road traffic accidents and the application of artificial intelligence and machine learning in road transportation systems.

In 2022, Reuben George Mathew, et al. [14], analyzed the existing approaches and methodologies of the detection systems, along with their strengths and weaknesses, to understand how this problem can be tackled efficiently.

Convolutional neural network (CNN) algorithm

The Convolutional Neural Network (CNN) is a special type of multilayer neural network or deep learning architecture inspired by the visual system of living beings. CNN is very appropriate for different fields of computer vision and natural language processing. CNN, also called ConvNet, is a form of Artificial Neural Network (ANN), which has deep feed-forward architecture and wonderful simplifying abilities as compared to other networks with FC layers, It can learn very abstract features of objects, particularly spatial data. Furthermore, It categorize them more efficiently. A deep CNN model involves of a determinate set processing layers that can learn different features of input data (e.g., images) with multiple levels of abstraction. The initiatory layers learn and extract the high-level features (with lower abstraction), and the deeper layers learn and extract the low-level features (with higher abstraction) as shown in the figure-2 below [15].

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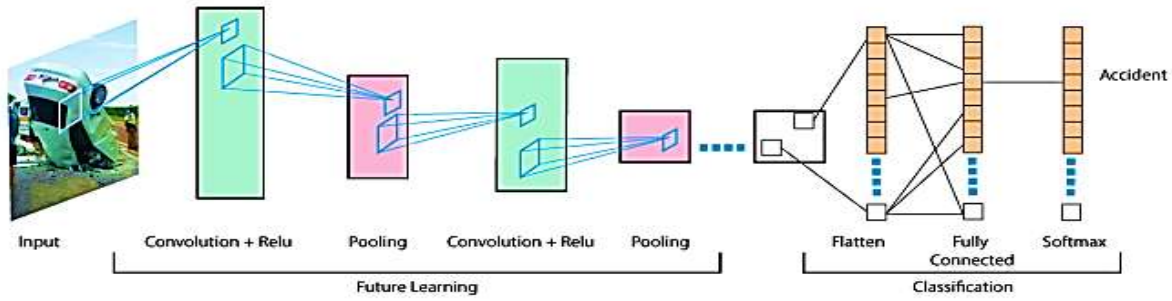

Figure 2: The standard architecture of Convolutional neural network (CNN) [47].

Convolutional Neural Networks (CNNs) have been showcasing their capable performance on various real-world applications. It has been known that performing of CNNs is highly based on their architectures, such as how many building-block layers (e.g., the convolutional and pooling layers) are used, how the used building-block layers are collected, and how the parameters related to the used building-block layers are identified [16]. The most famous versions of CNN algorithm are: LeNet (1998), AlexNet (2012), ZFNet (2013), VGGnet (2014), GoogLeNet (2014), ResNet (2016), DenseNet (2017), and many others CNN.

The CNN architecture involves a number of layers (or so-called multi-building blocks). Each layer in the CNN architecture contains its own function, starting with the Layer, whose main operation to extract features and produce a feature map from the input image [17]. Second, pooling layer the main benefit of using pooling technique is that it ordinarily decreases the number of trainable parameters and presents translation invariance [18]. Thirdly, a fully connected layer, within this layer every value acquires an election for determining the image classification. Fully connected layers are often stacked together, with each intermediary layer elective on phantom “hidden” categories. In effect, each additional layer lets the network learn even more sophisticated mixtures of features on the way to better decision-making [19]. In addition to these layers, there are three commonly used activation functions: sigmoid, tanh, ReLU, and Softmax function, which is a smooth ReLU function. The function outputs for sigmoid and tanh converge in single constant such as 0, 1, or −1, resulting in ‘disappearing gradients’ if the absolute values of initial weights are too large as illustrated in Table-1[20].

Table1: CNN activation functions

FUNCTION	EQUATION
Sigmoid	$f(x) = \frac{1}{1 + \exp(-x)}$
ReLU	$f(x) = \max(0, x)$
tanh	$f(x) = \frac{e^{x} - e^{-x}}{e^{x} + e^{-x}}$
Softmax	$\sigma(z_j) = \frac{e^{z_j}}{\sum_{j}^{j} = 1^{e^{z_j}}}$

We can summarize the general structure over all of Deep Convolution Neural Network (DCNN) in the figure-3 below.

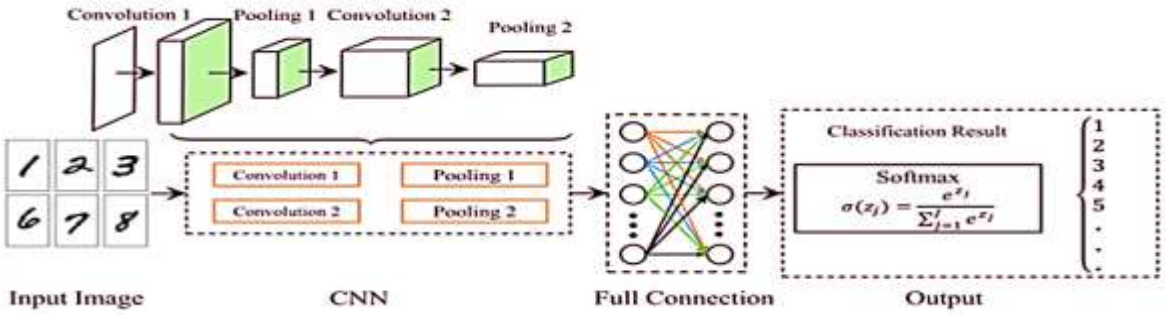

Figure 3: CNN model structure[51]

CNN Objects Detection and Classifications

Object detection is an important issue in computer vision. The core purpose of object detection is to discover objects of interest in images or videos and detect their location and size concurrently [21]. Object detection is an image segmentation based on the geometric and statistical features of the object, and it combines the segmentation and recognition of the object. The accuracy and real-time performance of the whole system are important abilities for object detection. Particularly in complex scenes, automatic object extraction and recognition are important when several objects need to be handled in real-time. In the latest years, object detection has been broadly used in artificial intelligence, face recognition, unmanned driving, and other fields. The current object detection algorithms contain both traditional detection

algorithms and detection algorithms based on deep learning. Traditional object detection algorithms are mostly based on sliding window frames or matching based on feature points. Though this method has accomplished good results, the absence of relevance when using sliding windows for region selection leads to high time complexity and window redundancy [22].

With the growth of machine learning techniques, particularly deep learning, object detection algorithms have swapped from traditional methods based on manually selected features to detection methods based on deep neural networks. Detection methods based on deep neural networks and CNN, such as R-CNN. The object detection method based on CNN has become the typical algorithm in modern object detection[23] . R-CNNs have been used in recent years as the finest object localization CNNs. Fast R-CNN projected a single-stage training method that learns to detect and classify object schemes, providing their bounding boxes .The last improves speed and accuracy compared to the previous by sharing the computation of the convolutional layers between different schemes and swapping the order of producing region schemes. Consequently, Faster R-CNN was presented to combat the complex training pipeline of both R-CNN and Fast R-CNN. This system added a region proposal network (RPN) for learning to expect regions that have objects. It reduced the complexity of the training process compared to Fast R-CNN [24].

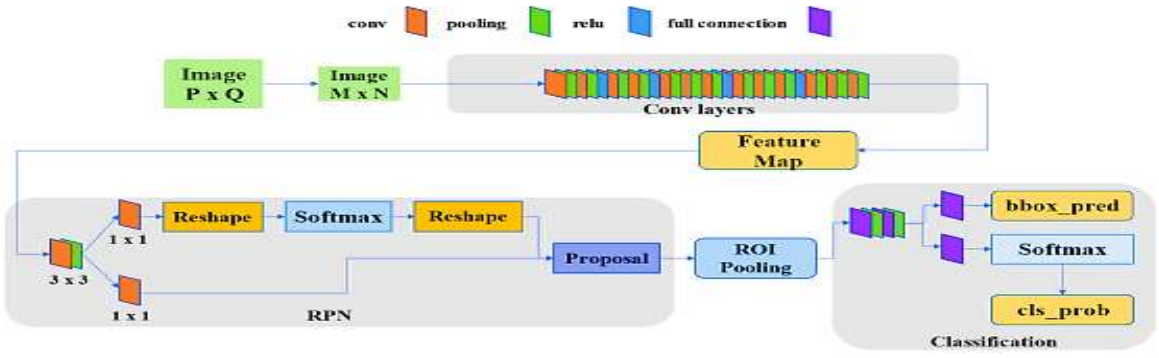

Figure 4: Faster-CNN structure [22].

Based on these techniques, a capable traffic monitoring system can be accomplished in order to detect the main objects found in a driving location in any urban or motorway environment. For this purpose, we chose to use a state-of-the-art CNN network to detect the objects within

driving environments: cars, motorbikes, people, traffic lights, buses, bicycles, and traffic signs, as shown in the figure-5 below.

Figure 5: Roads objects detection [24].

Challenges and limitations

After selecting the articles and reviewing them deeply, we have faced some challenges we mention below:

1. The difficulty in comparing these articles is because they did not follow the same approach and didn't use the same model and datasets.
2. Some of these articles didn't explain their approach by using figures, flowcharts, plots, and so on, but they explain it by text only, and that makes it boring and time-consuming to review.
3. Many of these articles have a problem with their abstract. It is too short that you can't understand the whole article by reading it only.
4. Some articles didn't use common datasets and also didn't descriptor briefly the data they have used so we can't evaluate their result because we ignore the inputted data

Discussion

With the greater increase in population in our societies and, with that, the number of vehicles on our roads, that has been increasing as well. All the specialists around the world have proven that early detection of vehicle accidents and quick medical response are important in increasing the opportunities of injured people surviving. So many specialists turn to find an electronic system by employing computer-based techniques like machine learning techniques, algorithms, or any other artificial intelligence method. Table 2 is presented analyses and comparing of the studies that have been reviewed in this study

Table 2: Analysis and comparing of the studies that have been reviewed in this study

REF	AUTHORS & YEAR	OBJECTIVE	METHODS & MODELS	DATA	RESULTS
[25]	Amir Bahador Parsa, et al, 2020	1.Test the performance of —Support Vector Machine (SVM) and Probabilistic Neural Network (PNN) 2.Determining the optimal number of minutes between 1 to 7 and detect accident	SVM PNN	Illinois Department of Transportation (IDOT)	Accuracy (ACC) SVM = 99% PNN = 98%
[26]	Jae Gyeong Choi,et al, 2021	As They can use the proposed car crash detection system as part of an emergency road call service that recognizes traffic accidents automatically and allows immediate rescue after transmission to emergency recovery agencies.	CNN Gated recurrent unit(GRU)	Dashboard cameras video and audio	AUC video = 98.6% Audio = 89.8%
[27]	Mamoudou Sangare,et al 2021	They combine the descriptive strength of the Gaussian Mixture Model (GMM) with the high-performance classification capabilities of the Support Vector Classifier	GMM SVM	The road traffic accident database from gov.uk	ACC = 85.5%
[28]	Karishma Pawar & Vahida Attar, 2022	Detecting and localizing road accidents as a special case of anomaly detection by using a deep learning approach	DL approach LSTM autoencoder	Detection of Traffic Anomaly (DoTA)	AUC = 84.7%

[29]	Neha Prakash, et al, 2020	suggesting an automated, lightweight speed detection system for real-time video surveillance using image processing that can be used by law enforcement	Haar Cascade Algorithm ROI	1500 positive images	ACC = 92%
[30]	Hydar Hasan&Majed Ali,2021	They detect objects in front of the car in our road environment and the risk factor for it according to the estimate of its distance from the vehicle	YOLO	MS COCO dataset	ACC = 83% recognition rate = 61%
[31]	Zhenhua Zhang, et al 2018	Detecting the traffic accident from social media data	LSTM SVM	Tweet data from twitter API	ACC = 85%
[32]	A.Al Mamun, et al , 2021	They proposed a simple encode-decode deep learning model to detect lane markings under the distinct environmental conditions with lower computational complexity	SegNet architecture	SDCND advanced lane lines video	ACC = 96.38%
[33]	Mohamed Essam,et al,2022	To detect road traffic crashes (RCTs) by using the installed surveillance/CCTV camera and report them to the emergency in real-time with the exact location and time of occurrence of the accident	YOLOv3 MOSSE violent flow descriptor (ViF), SVM GPS, GSM	CCTV cameras videos	Recall = 94% ACC = 93%
[34]	V. Machaca Arceda & E. Laura Riveros 2018	To detect car crashes in video	YOLO ViF SVM	114 CCTV videos	ACC = 89%
[35]	Zhenbo Lu, et al, 2020	Traffic crash detection and achieving a balance between detection speed and accuracy with limited computing resources.	ResNet Conv-LSTM	Data from local traffic police	ACC = 87.78%
[36]	Vedika Sadavarte,et al,2022	It aspires to deliver a self-operating accident detection system with alert generation to provide timely aid in crucial ways.	CNN TensorFlow object detection API	150 CCTV cameras videos	Error mean < 20%

[37]	Rutik Desai, et al, 2022	Detecting accidents from CCTV footage and alerting rescue systems	YOLOv-3	CCTV footage	ACC = 92.3%.
[38]	DAXIN TIAN, et al, 2019	Proposing a car accident detection method based on Cooperative Vehicle Infrastructure Systems (CVIS) and machine vision	YOLO-CA MSFF	CAD-CVIS	Average Precision = 90.02%
[39]	Sergio Robles-Serrano, et al, 2021	Describing traffic accident events by visual features occurring in a temporal way	Faster RCNN	Data from YouTube platform	ACC = 98%
[40]	Daniel Santos, et al, 2021	Developing models that can select a set of influential factors that may be used to classify the severity of an accident, support an analysis of the accident data	DT,RF ,LR NB,C5.0	28,102 traffic accident	ACC LR = 73% RF = 73% DT = 65%
[41]	WAN-JUNG CHANG,et al 2019	A deep learning-based Internet of Vehicles (IoV) system named DeepCrash is proposed to detect high-speed head-on and single-vehicle accidents and provide an emergency alert mechanism.	IoV, in-vehicle infotainment (IVI), GPS,DL	Cars sensor data	ACC = 96%
[42]	Pawan Kumar & Pawan Kumar, 2022	Detecting vehicle injuries primarily based totally absolutely totally on cooperative vehicle infrastructure systems (CVIS) and pc imaginative and prescient	YOLOCA	CAD-CVIS dataset	ACC = 90%
[43]	Kashish Bansal, et al, 2020	Machine learning-based pothole detection system called DeepBus for real-time identification of surface irregularities on roads using the Internet of Things (IoT).	SVM, KNN, DT, RF , LR NB	Potholes Sensors data	ACC = 86.8%
[44]	Rohith G, et al, 2020	To capture live video from CCTV and processes it to detect accidents in real time	YOLOV3	Traffic videos	detecting accidents & alerting the authorities

[45]	Lin Zhu, et al, 2019	A deep learning based method has been calibrated using part of the collected traffic variables and the pre-assigned traffic incidents and then tested against the rest of the dataset	CNN	SUMO based microscic traffic simulation	Detection Rate = 95.97%
[46]	Hawzhin Hozhabr Pour, et al, 2022	ML framework for automated car accident detection based on multimodal in-car sensors. Our work is a unique and innovative study on detecting real-world driving accidents by applying state-of-the-art feature extraction methods using basic sensors in cars	CNN SVM	(NDS) crash dataset	ACC CNN = 85.72% SVM = 84.9%
[47]	Sardar Waqar Khan, et al, 2022	Proposes a methodology for detecting accidents automatically through surveillance videos	CNN	vehicle accident image dataset (VAID)	ACC = 82%
[48]	Nikhlesh Pathik, et al, 2022	Proposed an intelligent accident detection and rescue system which mimics the cognitive functions of the human mind using the Internet of Things (IoTs) and the Artificial Intelligence system (AI)	ResNet InceptionResnetV2	accident-related information	ACC = 98%
[49]	JongBae Kim.2020	Proposes a real-time detection method for a car driving ahead in real time on a tunnel road	YOLO v2	Road images	ACC = 94%
[50]	Yeoh Keng Yik et al,2021	Deep learning detection with the YOLOv3 algorithm is proposed apart from researches ranging from accelerometer detection, image processing or machine learning- based detection as it is easier to develop and provide more accurate results	YOLOv3 GPU	pothole images	AP = 65.65 precision rate = 90% recall rate = 45%

In addition to the information's of each paper in Table-2 the weakness and strength points of each paper are mentioned in Table-3 below.

Table 3: The weakness and strength points of the reviewed papers

PAPER NUMBER	REF	WEAKNESS POINT	STRENGTH POINT
1	[25]	The dataset details like type, size and source that used in this study is unknown	The study applied two AIs algorithms which are SVM and PNN and achieved high detection rate in both
2	[26]	The theoretical background of the model and its main mathematical equations is not clearly described	The study used an ensemble deep learning model (CNN & GRU) based on multimodal data(video & audio) and proved that its significantly better than signal classifier
3	[27]	The abstract is too short and not present the details of the paper approach	Presented a new approach is that used the mean vectors acquired from the GMM model as input to the SVC
4	[28]	The dataset didn't described and also the preprocessing process before applying the model	Applied spatio-temporal autoencoder and sequence-to-sequence long short-term memory autoencoder for modeling spatial and temporal representations in the video
5	[29]	The theoretical background of the model and its main mathematical equations is not clearly described and the results are unwell presented	The proposed system automatically detect the speed of each car and recorded any license numbers from the video stream in cases of over speeding
6	[30]	Less information's presented about theoretical background and dataset	The experimental results presentation has been backup by images
7	[31]	Used the Social Media Data as dataset that's make the results of this paper unreliable because the most of these data are not trustworthy	The theoretical and mathematical backgrounds of the algorithms used are illustrated briefly and can be used as reference for another papers
8	[32]	The study didn't mentions the used dataset	Achieved good results and also provide good presentation to the theoretical background of the algorithms and the results
9	[33]	Less information about the dataset and the preprocessing process	The study achieves higher accuracy with fewer false alarms
10	[34]	The abstract is too short and didn't presented more details about the whole paper	provide good presentation to the theoretical background of the algorithms and the results
11	[35]	Less information about the dataset preprocessing process	provide good presentation to the theoretical background of the algorithms and the results
12	[36]	less information's presented about theoretical background and dataset	provide good presentation to the experimental results
13	[37]	The experimental results is not clearly results described	Used Computer vision and AI techniques to detect Accidents and alert it through Android Application
14	[38]	Less information about the dataset preprocessing process	Perfect describing for theoretical background, approach details and experimental results

15	[39]	The model has errors in detecting accident sections with low lighting or low resolution and obstruction	Achieved the detection of accidents in public traffic accident datasets and show a high ability in detection autonomous of the road construction.
16	[40]	Less information's presented about theoretical background and dataset	This work achieved an excellent False Positive Rate (FPR)when compared to other works
17	[41]	The proposed DeepCrash IoV system is applied to detect high-speed head-on and single-vehicle collisions only	The average response time for emergencyrelated announcements is approximately 7s
18	[42]	Less information's presented about theoretical background and dataset and experimental results	The proposed techniques can come across car screw of destiny in 0.046 seconds with ninety accuracy
19	[43]	The study approach is unclear and need for more details to be more understandable	This study compared various machine learning models based on different performance parameters
20	[44]	Only major accidents are handled	The proposed system captures the video and applied object detection algorithms to identify the different objects like vehicles and people
21	[45]	Less details about the dataset	The proposed method is compared to other benchmarks usually used in accident detection, like detection rate, false positive rate, f-measurement and detection time
22	[46]	The approach need for more illustration objects like flowcharts, figures and so on because its described by text only	It's a unique and advanced study on detecting real-world driving accidents by applying state-of-the-art feature extraction methods using basic sensors in cars
23	[47]	The study didn't compare the results of CNN with other AIs models results to prove its efficiency	The study has perfect organization and the approach are described briefly
24	[48]	Less details about the dataset	The proposed method is validated by a comparative analysis of ResNet and InceptionResnetV2
25	[49]	Less information's presented about theoretical background and dataset	The study proved that YOLO v2 model is the optimal performance compared to the performances of other deep learning algorithms
26	[50]	Less information's presented about theoretical background and dataset and experimental results	The study proved that the limitation of YOLOv3 algorithm detection can be improve further using GPU with higher specification performances and can sample 1000 to 10,000 datasets

Conclusion

Vehicle accidents are still a great danger threaten the general health of populations, and undermined the general safety of our roads worldwide. Since these accidents have occurred

continuously, early detection is critical in the direction of improving the survival chance of injured people. So many specialists turn to finding electronic systems by employing computer-based techniques like machine learning techniques and algorithms, which have been employed in many studies with different datasets. In this review articles we have found 37 papers selected from different datasets, but only 26 papers totally match our review subject. Each one depends on different approaches models, and datasets, and fined different results. Regardless of all the perfect results that have been fulfilled by these articles and the promising methods and techniques that have been employed to conduct these researches but by reviewing these researches we have found a common gaps in these articles that may have affected the reliability of the final results now or in the future this paper derived the attention to these gaps and suggested it as a future work in the same time below.

1. All the reviewed papers didn't describe the preprocessing methods on the input data and the impact of these methods on the final results, so we suggest that since most of the inputted data are images. We are listing the preprocessing methods and showing which has the greatest impact on the result.
2. Most of the reviewed papers focused only on cars vehicles accidents despite the roads containing several types of vehicles and other road objects. Hence, the studies that will be conducted should be general and take into inconsideration traffic accidents of all kinds.

References

1. C. C. Prevention, S. K. Leem, F. Khan, S. H. Cho, Vital Sign Monitoring and Mobile Phone Usage Detection Using IR-UWB Radar for Intended Use in,(2017)
2. A. Mateen, M. Z. Hanif, N. Khatri, S. Lee, S. Y. Nam, Smart Roads for Autonomous Accident Detection and Warnings, Sensors, 22(6), (2022)
3. A. Yadav, V. More, N. Shinde, M. Nerurkar, N. Sakhare, Adaptive Traffic Management System Using IoT and Machine Learning, Int. J. Sci. Res. Sci. Eng. Technol., 216–229(2019)

4. B. T. Morris, S. Member, M. M. Trivedi, S. Member, Learning , Modeling , and Classification of Vehicle Track Patterns from Live Video, 9(3),425–437(2008)
5. J. McCarthy, What Is Artificial Intelligence Anyway, Am. Sci., 73(3),258(1985)
6. A. Holzinger, G. Langs, H. Denk, K. Zatloukal, H. Müller, Causability and explainability of artificial intelligence in medicine, Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 9(4), 1–13(2019)
7. S. A. Sanchez, H. J. Romero, A. D. Morales, A review: Comparison of performance metrics of pretrained models for object detection using the TensorFlow framework, in IOP Conference Series: Materials Science and Engineering, 844(1), (2020)
8. K. G. Kim, Book review: Deep learning. Healthcare informatics research, 22(4), 351-354(2016)
9. L. Alzubaidi, Review of deep learning: concepts, CNN architectures, challenges, applications, future directions, J. Big Data, 8(1), (2021)
10. A. Moujahid, Machine Learning Techniques in ADAS: A Review, In: Proceedings on 2018 International Conference on Advances in Computing and Communication Engineering, ICACCE 2018, 2018, 235–242
11. V. Adewopo, N. Elsayed, Z. ElSayed, M. Ozer, A. Abdelgawad, M. Bayoumi, Review on Action Recognition for Accident Detection in Smart City Transportation Systems, (2022)
12. M. Naseer, J. Naz, Automated Accidents on Road Analysis: An Overview of State of the Insights Mohsin, Azerbaijan J. High Perform. Comput., 4(2), 242–262(2021)
13. S. Olugbade, S. Ojo, A. L. Imoize, J. Isabona, M. O. Alaba, A Review of Artificial Intelligence and Machine Learning for Incident Detectors in Road Transport Systems, Math. Comput. Appl., 27(5), 77(2022).
14. R. Mathew, J. Paul, R. Jamadagni, R. Shruthii, V. Malagi, A Comprehensive Study on Hardware and Software Based Accident Detection Systems, SSRN Electron. J., 2015
15. M. A. Albahar, Skin Lesion Classification Using Convolutional Neural Network with Novel Regularizer, IEEE Access, 7, 38306–38313(2019)
16. A. Aima, A. K. Sharma, Predictive Approach for Melanoma Skin Cancer Detection

using CNN, SSRN Electron. J., 546–552(2019)

17. H. Nahata, S. P. Singh, Deep Learning Solutions for Skin Cancer Detection and Diagnosis, 159–182(2020)

18. M. S. Junayed, N. Anjum, A. N. M. Sakib, M. B. Islam, A Deep CNN Model for Skin Cancer Detection and Classification, in Computer Science Research Notes, 3101(Dvd), 71–80(2021)

19. W. Salma, A. S. Eltrass, Automated deep learning approach for classification of malignant melanoma and benign skin lesions, Multimed. Tools Appl., 81(22), 32643–32660(2022)

20. S. Sakib, N. Ahmed, A. J. Kabir, H. Ahmed, An Overview of Convolutional Neural Network: Its Architecture and Applications, Prepr. 2018, no. February, (2018)

21. R. Zhao, X. Niu, Y. Wu, W. Luk, Q. Liu, Optimizing CNN-based object detection algorithms on embedded FPGA platforms, in Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 10216 LNCS (1), 255–267(2017)

22. W. Li, Analysis of Object Detection Performance Based on Faster R-CNN, in Journal of Physics: Conference Series, 1827(1), (2021)

23. C. Cao, An Improved Faster R-CNN for Small Object Detection, IEEE Access, 7, 106838–106846(2019)

24. A. Dominguez-sanchez, M. Cazorla, S. Orts-escolano, A New Dataset and Performance Evaluation of a Region-Based CNN for Urban Object Detection, (2018)

25. A. Parsa, H. Taghipour, S. Derrible, A. Mohammadian, Real-Time Accident Detection: Coping with Imbalanced Data, 312, 1–18(2019)

26. J. G. Choi, C. W. Kong, G. Kim, and S. Lim, Car crash detection using ensemble deep learning and multimodal data from dashboard cameras, Expert Syst. Appl., 183, 115400(2021)

27. M. Sangare, S. Gupta, S. Bouzefrane, S. Banerjee, P. Muhlethaler, Exploring the forecasting approach for road accidents: Analytical measures with hybrid machine learning, Expert Syst. Appl., 167, (2021)

28. K. Pawar, V. Attar, Deep learning based detection and localization of road accidents from traffic surveillance videos, ICT Express, 8(3), 379–387(2022)

29. N. Prakash, C. Uday Kamath, G. H. S, Detection of Traffic Violations using Moving Object and Speed Detection, Wutan Huatan Jisuan Jishu, XVI(61), 61–72(2020)

30. H. G. Hasn, M. Ali, Collision Avoidance by Identifying Risks for Detected Objects in Autonomous Vehicles, Embed. Selforganising Syst., 7(1), 4–9(2021)

31. Z. Zhang, Q. He, J. Gao, M. Ni, A deep learning approach for detecting traffic accidents from social media data, Transp. Res. Part C Emerg. Technol., 86, 580–596, (2018)

32. A. Al Mamun, P. P. Em, J. Hossen, Lane marking detection using simple encode decode deep learning technique : SegNet, 11(4), 3032–3039(2021)

33. M. Essam, N. M. Ghanem, M. A. Ismail, Detection of Road Traffic Crashes based on Collision Estimation, 169–179(2022)

34. V. E. Machaca Arceda, E. Laura Riveros, Fast car crash detection in video, In: Proceedings - 2018 44th Latin American Computing Conference, CLEI 2018, 632–637(2018)

35. Z. Lu, W. Zhou, S. Zhang, C. Wang, A New Video-Based Crash Detection Method: Balancing Speed and Accuracy Using a Feature Fusion Deep Learning Framework, J. Adv. Transp., (2020)

36. P. U. Ghorpade, A. Nema, Accident Detection and Alert Generation Using Raspberry Pi, SSRN Electron. J., 24(4), 288–297(2022)

37. R. Desai, A. Jadhav, S. Sawant, N. Thakur, Accident Detection Using ML and AI Techniques, (2022)

38. D. Tian, C. Zhang, X. Duan, X. Wang, An Automatic Car Accident Detection Method Based on Cooperative Vehicle Infrastructure Systems, IEEE Access, 7, 127453–127463(2019)

39. D. L. Techniques, Automatic Detection of Traffic Accidents from Video Using Deep Learning Techniques, 1–17(2021)

40. D. Santos, J. Saias, P. Quaresma, Machine Learning Approaches to Traffic Accident Analysis and Hotspot Prediction, (2021)

41. W. Chang, L. Chen, S. Member, DeepCrash : A Deep Learning-Based Internet of Vehicles System for Head-On and Single-Vehicle Accident Detection With Emergency Notification, 148163–148175(2019)

42. P. Kumar, Car Crash Detection And Reporting In Signals Using Deep Learning Approach, 04, 1003–1010(2022)

43. K. Bansal, K. Mittal, G. Ahuja, A. Singh, S. S. Gill, DeepBus : Machine learning based real time pothole detection system for smart transportation using IoT, Internet Technol. Lett., 3(3), (2020)

44. R. G, T. Roy, V. N. V, S. Shaju, A. R. Paul, Semantic Video Mining for Accident Detection, Int. J. Innov. Sci. Res. Technol., 5(6), 670–678(2020)

45. L. Zhu, R. Krishnan, A. Sivakumar, F. Guo, J. W. Polak, Traffic Monitoring and Anomaly Detection based on Simulation of Luxembourg Road Network, In: 2019 IEEE Intelligent Transportation Systems Conference, ITSC 2019, 382–387(2019)

46. H. H. Pour, A Machine Learning Framework for Automated Accident Detection Based on Multimodal Sensors in Cars, Sensors, 22(10), 1–21(2022)

47. S. W. Khan, Anomaly Detection in Traffic Surveillance Videos Using Deep Learning, Sensors, 22(17), (2022)

48. N. Pathik, R. K. Gupta, Y. Sahu, A. Sharma, M. Masud, AI Enabled Accident Detection and Alert System Using IoT and Deep Learning for Smart Cities, (2022)

49. K. Gajjar, T. Van Niekerk, A Real-time Pothole Detection Based on Deep Learning Approach A Real-time Pothole Detection Based on Deep Learning Approach, (2021)

50. J. Kim, SS symmetry Tunnel Road Environments, (2020)

51. K. Gajjar, T. Van Niekerk, A Real-time Pothole Detection Based on Deep Learning Approach A Real-time Pothole Detection Based on Deep Learning Approach, (2021)

52. D. K. Yadav, Renu, Ankita, I. Anjum, Accident Detection Using Deep Learning, Proc. - IEEE 2020 2nd Int. Conf. Adv. Comput. Commun. Control Networking, ICACCCN 2020, 11(3), 232–235(2020)