JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

A Proactive Accident Detection And Prevention System

[1]Shrikant Shinde, [2]Snehal Birajdar, [3]Vaishnavi Kshirsagar, [4]Vishal Patil, [5]Aarti Swami

[1]Assistant Professor, [2, 3,4,5]Student
[1,2,3,4,5]Department Of Computer Engineering,
[1,2,3,4,5]Sinhgad Institute of Technology And Science, Narhe, Pune, 411041, India.

Abstract : Deep learning is important for accident detection because it can analyze large amounts of data, such as images or sensor readings from cameras or other devices, to identify patterns indicative of accidents or potential hazards. In this paper, we present a critical analysis of various existing methodologies used for predicting and preventing road accidents, highlighting their strengths, limitations, and challenges that need to be addressed to ensure road safety and save valuable lives. A Convolutional Neural Network is a type of artificial intelligence model that's particularly good at processing and analyzing visual data, such as images and video. In the context of automatic accident detection systems, it can be used to analyze images or video footage from cameras installed on roads and vehicles. CNNs are often considered better than FPNs and RNNs for certain tasks due to their ability to efficiently capture spatial hierarchies in data like images. FPNs are designed to address scale variation in object detection tasks but may not capture spatial information as effectively as CNNs. RNNs, on the other hand, are better suited for sequential data like text or time-series data but may struggle with capturing spatial relationships in data like images. So, for tasks where spatial hierarchies are crucial, CNNs often outperform FPNs and RNNs.

Index Terms - Convolutional Neural Network, Feature extraction, FPN, RNN Accident detection, Road safety, Accident detection.

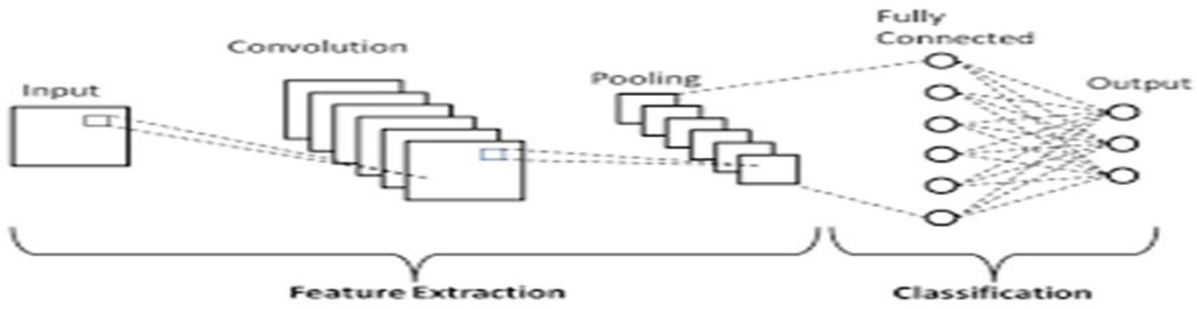
I. INTRODUCTION

Accident detection systems are advanced technological solutions designed to monitor and detect unexpected events in various environments. The goal of accident detection systems is to enhance safety for individuals property. Machine learning is used to implement the project. Image processing technique is used to detect the accident. The primary objective of Accident detection systems is to identify incidents as soon as they occur. The key job of these systems is to provide early warnings using technology and data analysis. This helps minimize mistakes made by people and enhances safety overall. In the context of traffic safety, for instance, these systems can reduce the severity of road accidents and save lives. We plan to build an application for the detection of accidents of people in public places in real time. Our application can be used in surveillance at places like malls, airports, railway stations, etc. where there is a risk of robbery or a shooting attack. We will be using deep learning and neural networks to train our system. And prevent this type of accident in the early stage. Due to the rapid growth of the world population, the demand for vehicles has increased tremendously, resulting in problems of traffic congestion and road accidents has also increased. The general population's life is at high risk, if any accident occurs there's a long reaction time which increments the number of deaths, therefore an automatic accident detection system must exist to overcome this situation. It improves road safety, reduces human error, enhances response times, and leverages technological advancements. These systems have the potential to save lives, reduce economic costs, and create safer and more efficient transportation networks. These systems have the power to transform how societies respond to and mitigate the impact of traffic accidents, making roads safer for everyone.

II. COMPUTATIONAL NEURAL NETWORK BASED VEHICLE ACCIDENT DETECTION

CNN is Convolutional Neural Network it is one of the type of Neural Network. It is mostly designed for tasks like Image recognition, Image Classification, object detection and well-suited for image and video analysis. CNN is best because it automatically learns patterns and features from raw pixel data.
It has mainly 3 layers:
Convolutional Layer: To scan input data using filters having patterns like textures, shapes.
Pooling Layer: It reduces size of images and makes it computationally efficient.

Fully-Connected Layer: It Acts like decision-maker. CNN have one /more these layers to make predictions from learned features. The convolutional layers are the key component of a CNN, where filters are applied to the input image to extract features such as edges, textures, and shapes. The output of the convolutional layers is then passed through pooling layers, which are used to down-sample the feature maps, reducing the spatial dimensions while retaining the most important information. The output of the pooling layers is then passed through one or more fully connected layers, which are used to make a prediction or classify the image.



III. RELATED WORK

This literature review, encompassing major studies, underpins our forthcoming survey paper on Exploring the Future of Finance: An In-depth Analysis and Review of Predictive Techniques in the Stock Market. The paper [1] introduces a superior hybrid module for stock price prediction but warrants deeper discussions on limitations and market risks. [9] innovatively deploys deep reinforcement learning, yet lacks comprehensive performance metrics and adaptability discussions. [8] creatively combines deep reinforcement learning with a multi-scale convolutional neural network but would benefit from more extensive system comparisons to enhance its contributions. [2] effectively utilizes ARIMA for precise predictions but predominantly relies on ARIMA without exploring alternatives or discussing model drawbacks.[4] surveys stock selection models, emphasizing validation with Random Forest, though overseas testing and enhanced feature selection are needed. [7] merges supervised and reinforcement learning, demonstrating the potential for broader financial applications. [6] delves into stock market trend prediction, emphasizing machine and deep learning models. [10] introduces SK-GCN, a novel stock classification model. [12] excels in outperforming the Nifty-100 index with seven metaheuristic algorithms, while requiring more details on neural network models and data sources. [5] innovatively enhances trend prediction, improving accuracy, though lacking some motif and dataset details. [11] combines candlestick charting and AI, emphasizing high accuracy but needing further insights into broader applicability and practical challenges. [3] uses deep learning to predict stock behaviour, outperforming traditional neural networks, but necessitates a more comprehensive discussion on limitations and generalizability. This synthesis of strengths and weaknesses provides a robust foundation for our survey paper.

IV. LITERATURE SURVEY TABLE

Sr.No	Paper	Author	Mechanism	Advantages	Disadvantages
1.	Accident Detection Using Deep Learning[2020]	Durgesh Kumar Yadav	Machine Learning CNN, RNN Every year around 1.35 million people are cut off due to numerous crashes in case of road traffic accident. As per the statistics 20 to 50 million people suffer as a result of its injuries.	High accuracy in detecting accidents, especially when trained on large and diverse datasets.	Require large amounts of labeled data for training.
2.	Real Time suspicious Detection &Localization in Crowded Scenes[2015]	Mohammad Sabokrou , Mahmood Fathy	Machine Learning CNN In this paper, we propose a method for real-time suspecious detection and localization in crowded scenes.	Identifying potential threats or criminal activities as they happen, enabling rapid response from security personnel.	Real-time surveillance raises concerns about privacy rights.
3.	A Deep Learning based Accident Detection System[2020]	Gokul Rajesh, Amitha Rossy Benny	Deep Learning CNN An indicator of survival rates after detecting accidents is the time between the occurrence of accidents and the advent of medical care to the victim	Achieve high accuracy in accident detection tasks	Require large amounts of labeled data for training.
4.	An application of a deep learning algorithm for automatic detection of unexpected accidents under bad CCTV monitoring conditions in tunnels.[2019]	Kyu Beom Lee, Hyu Soung Shin	Deep learning R-CNN Vehicles using this system can detect the vehicle ahead in real time when the driver is driving the vehicle, and calculate the safety distance of the vehicle ahead	Operate in real-time, enabling immediate detection of accidents as they occur.	Required to ensure its effectiveness.
5.	Application of Vehicle Detection Based On Deep Learning in Headlight Control[2020]	1st Zi-Han Huang, 2nd Chuin-Mu Wang	Deep Learning CNN This system makes it possible to track a moving object in time, which is not usual to be achieved in conventional object detection frameworks.	Enables adaptive headlight control, ensuring that headlights are focused on the road and surroundings	Requires large, diverse, and well-labeled datasets.
6.	Real-Time Traffic Sign Detection using Capsule Network[2019]	Neelavathy Pari S,Mohana T,Akshaya V	Machine Learning CNN RNN Automatic detection of traffic signs is also important for automated intelligent driving vehicle or driver assistance systems.	Capsule networks offer more interpretable feature representations compared to traditional convolutional neural networks .	Capsule networks can be computationally intensive, especially as the network architecture becomes deeper and more complex.
7.	Deep Spatio Temporal Repre-sentation for Detection of Road Accidents [2018]	Dinesh Singh , and Chalavadi Krishna Mohan	Deep Learning CNN In this paper, we propose a novel framework for automatic detection of road accidents in surveillance videos	Stacked autoencoders can automatically learn hierarchical and abstract features from spatio-temporal data, allowing for the creation of rich representations of road accident scenarios.	Training deep networks, especially stacked autoencoders, requires a large amount of labeled data and substantial computational resources.

Sr.No	Paper	Author	Mechanism	Advantages	Disadvantages
8.	A Detailed Study on Bangladeshi Road Sign Detection and Recognition[2019]	Sk. Md. Masudul Ahsan, Sunanda Das, Shanto Kumar	Machine Learning CNN RNN Automatic road sign detection and recognition is crucial for autonomous Driver Assistance Systems (DAS).	Accurate detection and recognition of road signs contribute significantly to road safety.	Road signs can vary significantly in design, color, and layout, making it challenging to create a one-size-fits-all recognition system.
9.	Pre-Activated 3D CNN and Feature Pyramid Network for Traffic Accident Detection[2020]	Hyunwoo Kim, Seokmok Park, and Joonki Paik	Machine Learning CNN The proposed method consists of pre-activation ResNet and feature pyramid network (FPN) structure.	3D cnns can process sequential frames as video volumes, capturing temporal patterns and motion cues. .	Implementing and fine-tuning pre-activated 3D cnns and fpns can be complex and may require significant expertise in deep learning and computer vision.
10.	Computer Vision-based Accident Detection in Traffic Surveillance [2019]	Dhananjai Chand, Savyasachi Gupta	Machine Learning CNN RNN The probability of an accident is determined based on speed and trajectory anomalies in a vehicle after an overlap with other vehicles.	Accidents in real-time, enabling swift response from emergency services, reducing response time, and potentially saving lives.	Setting up a robust computer vision system can be expensive, involving costs related to high-quality cameras, sensors, and advanced software development.
11.	A new approach to traffic accident anticipation With geometric features for better Generalizability[2023]	Farhan mahmood 1 , Daeheon Jeong 1 , and Jiha Ryu 1,2,	Machine learning CNN. Resnet and feature pyramid network structure.	Addressing visual biases. Proposal of an uncertainty-based method. Improved cross-dataset evaluation. Suggestions for future improvement.	Object detector dependency. Unclear information on dataset quality. Limited discussion on driver's attention. Lack of citations for existing methods.
12.	Development of an interpretable maritime Accident prediction system using machine Learning techniques[2022]	Gyeongho kim 1 and Sanghoon Lim	Machine learning CNN, RNN The probability of an accident is determined based on speed and trajectory anomalies in a vehicle after an overlap with other vehicles.	Utilizes diverse risk factors. Includes fishery information as a unique risk factor. Applicable to real-world scenarios, including autonomous vessels.	Expert-dependent risk factor identification. Challenges in data collection. Complexity of machine learning models. Scope limitation.

V. CONCLUSION

In this survey accident detection systems represent a crucial advancement in technology with the primary aim of improving safety across various environments, particularly in the context of traffic safety. By leveraging advanced technologies and data analysis, these systems work towards identifying incidents promptly, thereby reducing the severity of accidents and ultimately saving lives. The motivation behind these systems lies in the desire to enhance road safety, minimize human error, improve response times, and capitalize on technological advancements. The potential benefits extend beyond individual well-being to encompass economic savings and the creation of safer and more efficient transportation networks. As these systems continue to evolve, their role in fostering a safer and more secure environment for communities remains paramount, reinforcing the importance of ongoing innovation and implementation in the field of accident detection technology.

REFERENCES

[1] Renu, Durgesh Kumar Yadav, Iftisham Anjum, Ankita, "Accident Detection Using Deep Learning: A Brief Survey", International Journal of Electronics Communication and Computer Engineering (IJECCE), vol. 11, no.3, pp. 16-25, May 2020.

[2] Y. Zhang, R. Q. Hu, L. M. Bruce, N. Balraj, and S. Arora, "Development of real-time automated accident detection system at intersections," in 83rd Annu. Meeting Transportation Research Board, Washington, DC, 2004.

[3] E. S. Lee, W. Choi, D. Kum, "Bird's eye view localization of surrounding vehicles: Longitudinal and lateral distance estimation with partial appearance," Robotics and Autonomous Systems, 2019, vol. 112, pp. 178-189.

[4] Y Gao and H J Lee, "Vehicle Make Recognition Based on Convolutional Neural Network[C]", International Conference on Information Science and Security, pp. 1-4, 2015.

[5] Hee Seok Lee and Kang Kim, "Simultaneous Traffic Sign Detection and Boundary Estimation Using Convolutional Neural Network", IEEE Transactions on Intelligent Transportation Systems, Vol.19, No.5, May 2018, pp. 1652-1663.

[6] V. Kostakos, T. Ojala, and T. Juntunen, "Traffic in the smart city: Exploring city-wide sensing for traffic control center augmentation," IEEE Internet Computing, vol. 17, no. 6,
pp. 22–29, 2013.

[7] Tashmina Rahman, "Road Accidents in Bangladesh: An Alarming Issue", blogs.worldbank.org, Jan. 03, 2012. [Online].Available:https://blogs.worldbank.org/endpove rtyinsouthasia/roadaccidentsBangladesh-alarming-issue. [Accessed: Sep. 08, 2019].

[8] B. Maaloul, A. Taleb-Ahmed, S. Nair, N. Harb, and C. Valderrama, "Adaptive video-based algorithm for accident detection on highways," in 2017 12th IEEE International Symposium on Industrial Embedded Systems (SIES), pp. 1–6, IEEE, 2017.

[9] Y. Ki, J. Choi, H. Joun, G. Ahn, and K. Cho, "Real-time estimation of travel speed using urban traffic information system and CCTV," in Proc. of International Conference on Systems, Signals and Image Processing (IWSSIP), May 2017, pp.

[10] D. Selvathi, P. Pavithra, and T. Preethi, "Intelligent transportation system for accident prevention and detection," 2017 International Conference on Intelligent Computing and Control Systems (ICICCS), 2017. Forman, G. 2003.

[11] F. H. Chan, Y. T. Chen, Y. Xiang, and M. Sun, "Anticipating accidents in dashcam videos," in Proc. Asian Conf. Comput. Vis., 2016, pp. 136–153.

[12] F. U˘gurlu, S. Yıldız, M. Boran, O. U˘gurlu, and J. Wang, "Analysis of fishing vessel accidents with Bayesian network and chi-square methods," Ocean Eng., vol. 198, Feb. 2020, Art. no. 106956, doi: 10.1016/j.oceaneng.2020.106956.