

# A Literature Review on the Intelligent Transportation System using Deep Learning and Machine Learning Techniques

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**Abstract :** Road traffic accidents are very common. An estimated 1.2 million deaths and 50 million injuries happen all over the world every year. In this emerging world, the road accidents are among the principal reason of fatality and injury. The concern of traffic safety has heaved immense alarms across the manageable enhancement of contemporary traffic and transportation. The analysis on road traffic accident grounds can detect the major aspects quickly, professionally and afford instructional techniques to the prevention of traffic accidents and reduction of road traffic accidents, which might significantly decrease personal victims by means of road traffic accidents. The current research represents that the Machine Learning techniques and Big Data Analytics that are employed in the field of transport have been investigated. Through this comprehensive investigation, the techniques of Machine Learning and Big Data Analytics in the traffic study can enhance the administration level of road traffic safety productively.

**IndexTerms - Transportation, Machine Learning, Big Data Analytics, Road Traffic, Accidents, Road Safety.**

## I. INTRODUCTION

India has the second biggest road network in the world. Therefore, road accidents occur rather recurrently and moreover, they assert several lives every year. It is essential to detect the origin for road accidents with the aim of evading them. In the recent years, the compilation of data on traffic amount has turned out to be a huge part of the work of road forecasting programs by both value and workforce. The Traffic data is apportioned into various rules by categorizing the breakpoints for traffic factors in the data. In two-regime traffic methods, decisive possession is employed to divide free flow and crammed flow conditions. Traffic clogging roots incredible failure in terms of both time and power worn out. The forecast of Traffic flow is an essential detective subject in an Intelligent Transportation System (ITS) [1], and it can be utilized as a vital measurement to sort the predicament of traffic congestion. Traffic clogging is rooted while the traffic stipulates methods or surpasses the obtainable facility of the traffic network. Fortunately, as a result of systematic sensor instrumentations of road networks in main metropolis in addition to the vast accessibility of supplementary commodity sensors from which traffic data can be copied (e.g., CCTV cameras, GPS devices), a huge amount of instantaneous and chronological traffic data at very high spatial and sequential decisions has grown to be obtainable.

## II. EFFECT OF TRAFFIC

The concern of affording the travel safety on the road network in the urban and suburban areas is one of the primary ethics which leads the engineering, traffic and transportation development. Approximately 3,500 people die by the road accidents all over the world every day. Tens of millions of people are wounded or disabled each year. Pedestrians, children, cyclists, bike, car users and the aged are amongst the most susceptible of road users. WHO functions with partners - governmental and nongovernmental - around the globe to elevate the report of the inevitability of road traffic injuries and support high-quality trainings associated to helmet and seat-belt wearing, drunk and drive, rash riding and being noticeable in traffic [2]. On the other hand, the accident is predictable, specified the definition, “an incident is distinct as the rapid accidental release of or the spotlight to a dangerous substance that marks in or might logically have brought about the injuries, deaths, considerable possessions or ecological harm, evacuation or sheltering in place [3]”. The expense of these accidents can be serious trouble to the government. Therefore, the road accidents are a severe threat to public transportation. In particular, the colossal economic toll of road accidents on human societies inflict, recuperating road safety needs awareness to three effective features: human, the road and the vehicle [4]. The bureaucrats of the transport system also require stabling the road safety wants through inadequate resources to lessen the accidents and augment the road conditions. In fact, the primary objective is as conceivable in reducing accidents that can be loomed to this target by managing the traffic engineering, driver training and implementation.

## III. MACHINE LEARNING AND BIG DATA ANALYTICS

Machine learning is an assortment of techniques that allow computers to systematize data-driven method building and programming over a methodical detection of statistically substantial patterns in the existing data. Machine learning techniques can be categorized through the type of “learning.” There occur numerous elementary forms of learning techniques, such as:

1. **Supervised learning** where formerlycategorized data is employed to assist the learning process; (ex. Classification, Regression)
2. **Unsupervised learning**, where only unlabelled data is deployed; (ex. Clustering, Association)
3. **Semi-supervised learning**, which customs both labelled and unlabelled data
4. **Reinforcement learning**, where the learning process is directed by a sequence of response / reward cycles.

The enhancement of big data and the Internet of things (IoT) is quickly advancing and moving all fields of technologies and industries by swelling the profits for administrations and individuals. The evolution of data formed via IoT has performed a pivotal role on the field of big data. IoT provides a point for radars and devices to communicate flawlessly in a keen setting and empowers data distribution across all platforms in an appropriate way. IoT has perceived its fresh implementation in smart cities with attention

in emerging smart systems, like smart retail, smart office, smart water, smart agriculture, smart healthcare, smart transportation, and smart energy.



Figure 1: Data Sources in Internet of Things

Big data analytics comprises the developments of probing a database, mining, and examining data devoted to advance business act. Big data analytics need technologies and devices that can transmute a huge quantity of designed, un-designed, and semi-designed data into a more comprehensible data and metadata set-up for diagnostic developments.

#### IV. LITERATURE REVIEW

Sarkar, Sobhan, et al [5] explained the foremost objective of this study is to construct a method which could forecast the professional incidents (i.e., injury, property damage, and near-miss) with support vector machine (SVM) by employing a database containing nearly 5000 occupational accidents reports from an united steel plant consistent to the period of years 2010 to 2012. Parameter optimization of the SVM is achieved by grid search (GS), genetic algorithm (GA), and BAT algorithm to attain the healthier exactness of the classifier.

Bommess, Michael, et al [6] proposed the Video based detection systems, being a crucial part of intelligent traffic systems (ITS), display enormous possibilities as they do not only provide a stretchy way of data procurement but are also being established at a massive pace owing to current developments in hardware and software technology. With the intention to offer a healthier understanding on the approaches and possibilities of this technology, a structured review is offered which not only comprises current applications but similarly displays forthcoming use cases by examining the procedures of image processing and generalizing their outcomes to the forthcoming necessities of traffic engineering.

Wan, Nianfeng, Ardalan Vahidi, and Andre Luckow [7] introduced a Speed Advisory System (SAS) for pre-timed traffic signals is planned and the fuel minimal driving strategy is attained as a systematic solution to a fuel consumption minimization problem. The authors exhibited that the slight fuel driving strategy may go against intuition of some people; in that it substitutes between periods of maximum acceleration, engine shut down, and sometimes constant speed, known in optimal control as bang-singular-bang control. This paper assesses the impact of vehicles with SAS on the complete arterial traffic in micro-simulations.

Janušová, Lucia, and Silvia Čičmancová [8] pacts with status of dangerous transportation infrastructure and habits to guard it. Smart transportation classifications are innovative tools to advance and aid safety of dangerous infrastructure elements. The chief purpose is to describe smart transportation systems which could be employed to defend elements of critical road and rail transportation infrastructure.

Althoff, Matthias, and Robert Lösch [9] explained a frequently elevated dispute in contradiction of safely driving automated vehicles is that they would not blend well with traffic flow whimsically large progressions would request other traffic participants to cut in and thus put passengers of subsequent automated vehicles at risk. So as to test this hypothesis, we practice real data of thousands of vehicles documented in the United States as part of the Next Generation Simulation (NGSIM) program. To examine the hypothesis, we invented each human-driven vehicle is mechanized: These automated vehicles drive precisely as the documented human drivers, then they have a much smaller reaction time and therefore can still drive safely in circumstances that are insecure for human drivers.

Castro, Yuri, and Young Jin Kim [10] deployed three data mining classification methods to identify factors with the highest impact on car accidents. By comprehending the conditions in which the drivers and passengers are more probable to be killed or brutally injured in an automobile crash is of specific apprehension in traffic safety.

Al Najada, Hamzah, and Imad Mahgoub [11] designed a real-time Big Data system that obtains online streamed data from vehicles on the road along with real-time average speed data from vehicles detectors on the road side to (1) Deliver accurate Estimated Time of Arrival (ETA) by means of a Linear Regression (LR) model (2) Forecast accidents and blockings before they occur by Naive Bayes (NB) and Distributed Random Forest (DRF) classifiers (3) Update ETA if an accident or a congestion takes place by forecasting exact clearance time.

Park, Hyoshin, and Ali Haghani [12] described a modification of the boxplot is functional to capture segments at the extremity of the queue and at the head of the queue where subordinate occurrences might occur. The subsequent contour plot delivers temporal-spatial area under congestion to identify secondary incidents. The probability of categorized secondary incidents are chronologically forecasted from the point of incident response to the road clearance. The forecast recital of the ethical Bayesian learning method to neural networks outstrips the logistic method.

Walraven, Erwin, Matthijs TJ Spaan, and Bram Bakker [13] recommended an innovative technique to augment the traffic flow, built on fortification learning. The authors express that a traffic flow optimization problem can be articulated as a Markov Decision method. The author exploited Q-Learning to acquire strategies uttering the extreme driving speed that is acceptable on a highway, such that traffic congestion is condensed.

Vishnu, VC Maha, M. Rajalakshmi, and R. Nedunchezian [14] explained over the traffic videos, the traffic video surveillance inevitably keyed out the vehicles like ambulance and trucks, which in turn supported us in guiding the vehicles at the time of emergency. Hybrid median filter has been exploited at the starting for pre-processing of traffic videos, and to eliminate the noise.

Hybrid support vector machine (SVM with protracted Kalman filter) has been applied to hunt the vehicles. Next, the histogram of movement gradient structures is drew-out to categorize the vehicles.

García - Ródenas, Ricardo, María L. López - García, and María Teresa Sánchez - Rico [15] investigated about a prototype of an urban traffic control system created on a prediction-after classification approach. In an off-line stage, a source of traffic control approaches for a set of (dynamic) traffic patterns is created. The main objective is the k-means algorithm for everyday traffic pattern detection. The clustering method customs the speed, input attributes flow, and possession and it changes the dynamic traffic data at system level in a pseudo-covariance matrix, which accumulates the lively associations between the road links.

Yu, Bing, Haoteng Yin, and Zhanxing Zhu [16] projected a different deep learning technique, Spatio-Temporal Graph Convolutional Networks (STGCN), to challenge the time series prediction problem in traffic domain. As an alternative of spread on consistent convolutional and persistent units, we frame the problem on graphs and create the method with comprehensive convolutional structures, which permit much quicker training speed with less constraints.

Yang, Senyan, et al [17] proposed the Short-term traffic prediction is vibrant for smart traffic systems and inclined by neighbouring traffic condition. Gradient boosting decision trees (GBDT), a collaborative learning technique, is planned to brand short-term traffic prediction grounded on the traffic volume data composed by loop sensors on the freeway.

Aslani, Mohammad, Mohammad Saadi Mesgari, and Marco Wiering [18] explained Reinforcement learning (RL) is an operative method in machine learning that has been pragmatic for scheming adaptive traffic signal controllers. One of the most competent and strong type of RL algorithms are incessant state actor-critic algorithms that have the benefit of fast learning and the skill to simplify the new and unseen traffic circumstances. These algorithms are employed in this research to enterprise adaptive traffic signal controllers named actor-critic adaptive traffic signal controllers (A-CATs controllers).

Yin, Jinghai, Jianfeng Hu, and Zhendong Mu [19] explained the primary objective of the authors are principally three: (i) A middleware architecture, illustrated as process unit (PU), which can connect with personal electroencephalography (EEG) node (PEN) and cloud server (CS). The PU receives EEG signals from PEN, identifies the exhaustion state of the driver, and transfer this data to CS. The CS refers the report messages to the immediate vehicles. (ii) An android application for fatigue detection is assembled. The application can be employed for the driver to sense the state of his/her fatigue based on EEG signals, and warn neighbourhood vehicles. (iii) The detection algorithm for driver fatigue is functional based on fuzzy entropy.

Iranitalab, Amirfarrokh, and Aemal Khattak [20] elucidated the multiple objectives like assessment of the performance of four statistical and machine learning methods including Nearest Neighbor Classification (NNC), Multinomial Logit (MNL), Random Forests (RF), and Support Vector Machines (SVM), in forecasting traffic accident severity; emerging a crash costs-based method for evaluation of crash severity prediction methods; and examining the effects of data collecting approaches encompassing K-means Clustering (KC) and Latent Class Clustering (LCC), on the recital of crash severity prediction approaches.

Navarro, Pedro, et al [21] proposed a mechanized sensor-based system to identify pedestrians in an independent vehicle application. Even though the vehicle is fortified with a comprehensive set of sensors, the paper highlights the processing of the data produced by a Velodyne HDL-64E LIDAR sensor. The effort narrates a comprehensive investigation of the concert of three dissimilar machine learning algorithms: k-Nearest Neighbours (kNN), Support Vector Machine (SVM), and Naïve Bayes classifier (NBC).

Yao, Baozhen, et al [22] studied about a support vector machine model (single-step prediction model) composed of spatial and temporal constraints is projected. Moreover, a short-term traffic speed prediction method is enhanced by the single-step prediction technique.

Djuric, Nemanja, et al [23] initiated a deep learning-based method that takes into explanation of present state of the world and creates rasterized representations of each actor's vicinity. The raster pictures are formerly employed by deep convolutional models to deduce future drive of actors while accounting for intrinsic vagueness of the forecast task.

Liu, Xiao-Yang, et al [24] discovered the probable for Deep Q-Networks (DQN) to enhance traffic light control policies. As a preliminary benchmark, the researchers created that the DQN algorithms yield the "thresholding" policy in a single-intersection.

Bagloee, Saeed Asadi, et al [25] established a hybrid technique based on machine-learning and optimization. The hybrid method renovates the unique problem to an integer linear programming problem grounded on a controlled learning method and a docile nonlinear problem.

Hafezi, Mohammad Hesam, Hugh Millward, and Lei Liu [26] exhibited a complete outline of fresh and constant computational-based activity forecast representations. For contrast, a brief account of combined trip-generation methods to travel demand is also offered. The enhancements of activity-based travel demand modelling, and a debate of how such modelling may be functional in practice, are offered.

Mfenjou, Martin Luther, et al [27] presented the major objective of the research is, initially the complications of the operation of smart transport systems in emerging countries like sub-Saharan Africa. Furthermore, the researchers display a review of a road traffic method and an urban transport network model. To conclude, we suggest solutions, which deliver procedures for the exhibiting of a structure and detect traffic on inter-urban road transport networks in emerging countries.

Stilgoe, Jack [28] explained the Self-driving cars, a characteristically 'smart' technology, are not instinctive smart. The processes that regulate their actions are learning as the technology arises. Self-driving cars characterize a high-stakes test of the supremacies of machine learning, in addition to a test case for social learning in skill domination. Society is learning about the technology while the technology acquires about society.

Yang, Chen, Shulin Lan, and Ming-Lang Tseng [29] recognized the persuading characteristics of synchronized expansion between metropolitan economy and logistics, and objects to disclose the reasonable associations among the numerous effect characteristics based on the decision-making trial and evaluation laboratory (DEMATEL) method. DEMATEL-Bayesian network model is employed to acquire the crucial effect attributes and driving path of the synchronized development.

Zou, Xin, Wen Long Yue, and Hai Le Vu [30] planned the method based on the envisaged investigation of MKD can be used to create a reference data and research basis for the application and growth of approaches in the field of road safety investigations. In specific, our outcomes display that the knowledge bases (classical documents) of road safety studies in the last two periods have engrossed on five major ranges of "Crash Frequency Data Analysis", "Driver Behavior Questionnaire", "Safety in Numbers for Walkers and Bicyclists", "Road Traffic Injury and Prevention", and "Driving Speed and Road Crashes". Among the investigation topics, the five leading clusters are "Causation and Injury Severity Analysis of Road Accidents", "Epidemiologic Study and Prevention of Road Traffic Injury", driving behavior and psychology "Intelligent Transportation System and Active Safety", "Young

drivers’, and “Older drivers’ psychological and physiological characteristics”. Finally, the burst keywords in investigation trends comprise Transportation Systems, Cycling, Intelligent and Distraction.

#### IV. RESEARCH DIRECTION

The future research trend by this literature survey characterized as intention of the study area:

- To ease the number of accidents by investigating into the chronology of the accidents using Data Mining techniques.
- To limit the traffic congestion by using Machine Learning algorithms.
- To enhance shipment movements with optimization algorithms.
- To guarantee the road safety

#### V. CONCLUSION

Through this survey paper, the paper pooled different researcher opinions on the accident, road traffic analysis using Machine Learning, Deep Learning and Big Data analytics techniques. This present investigation depicts the numerous methods that were employed for examining the accident, road traffic congestion. It distributes a lot in perceptive the conditions and source of the accident. This current survey is an intelligent traffic data mining is established to be precious in a large quantity of traffic information. Data driven technique is employed to evaluate the traffic situations.

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