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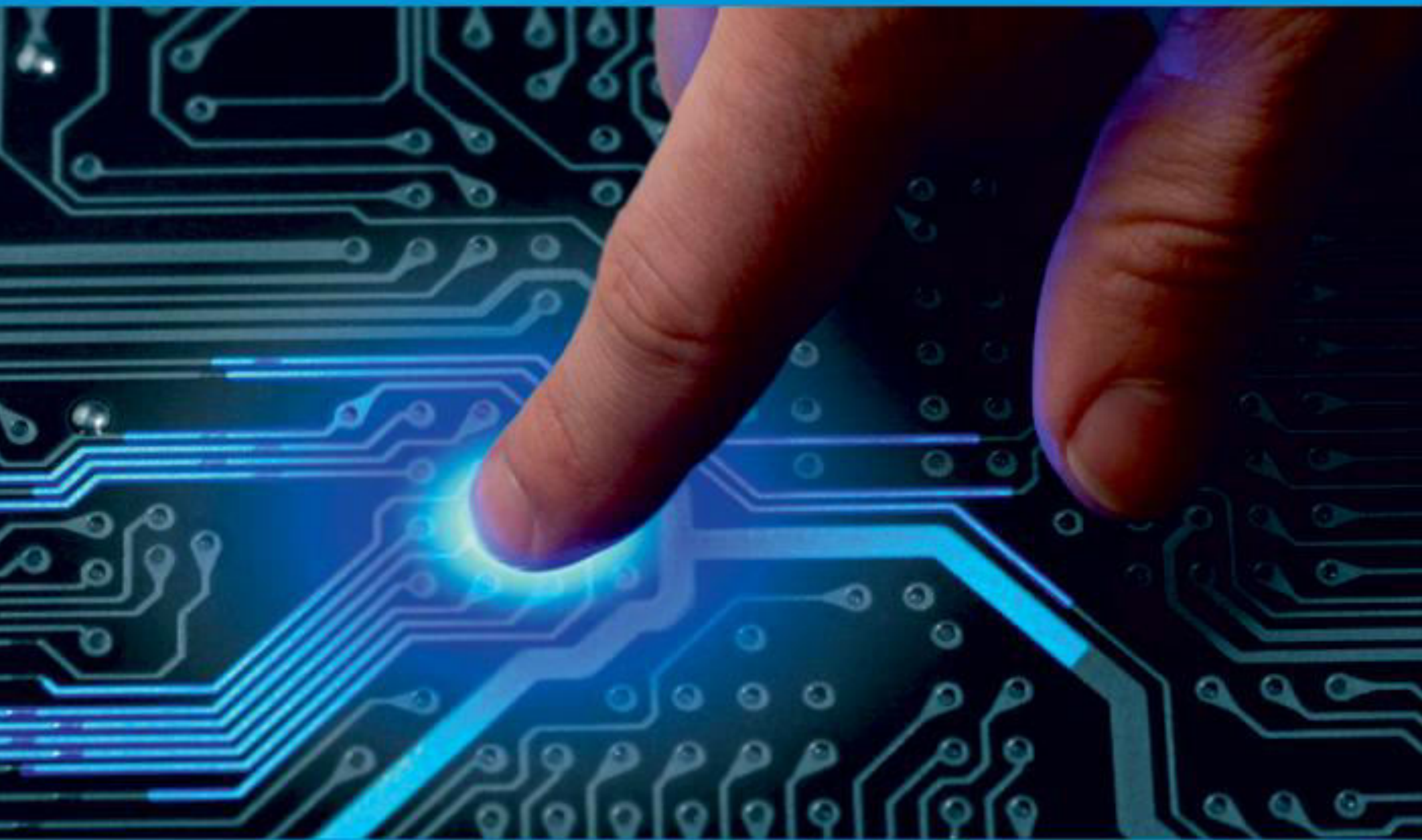

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Machine Learning in Transportation

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ABSTRACT: The number of vehicles and people on the planet is growing, and this has made traffic management more complex and requires accuracy and efficiency that go beyond human intervention. This work explores the use of machine learning (ML) algorithms in intelligent transportation systems, with a focus on traffic control. It looks at how ML might help with issues caused by increasing traffic, such as accidents and congestion. In an effort to lessen traffic-related problems, the suggested ML-based Traffic Management System (TMS) keeps an eye on cars, adjusts traffic lights, finds congestion, and provides other routes. In order to construct an intelligent transport system that uses machine learning (ML) algorithms, stimulate efficient traffic data management, and improve contemporary traffic management systems, the article outlines the principles of operation, obstacles encountered, and suggestions offered.

KEYWORDS: Traffic Management System, Machine learning, YOLO, Convolution Neural Networks, Artificial Intelligence, Rectangular Region of Interest, convolutional neural network, Intelligent Transportation System

I. INTRODUCTION

The issue of traffic congestion has become more urgent due to the fast urbanization and population growth, calling for creative solutions for effective traffic management. As a result, there is rising interest in transforming traffic control systems through the use of cutting-edge technology, especially machine learning (ML). As a subset of artificial intelligence (AI), machine learning (ML) has the potential to forecast patterns of traffic on roads and find pertinent information for efficient traffic management.

This review paper examines the connection between traffic management and machine learning, emphasizing the use of Deep Learning methods like the You Only Look Once (YOLO) algorithm. It seeks to investigate how these cutting-edge ML models might improve traffic prediction and control systems, reducing the negative impacts of traffic on public health, environmental sustainability, and economic productivity. It emphasizes how crucial it is to create cutting-edge technology solutions in order to maximize the efficient use of already available transportation resources.

The study also emphasizes how ML-driven traffic management systems have the power to transform urban mobility and open the door to more intelligent, environmentally friendly transportation systems. Through a comprehensive analysis of multiple studies and conversations, this review paper aims to offer a thorough grasp of how machine learning is changing traffic management systems. illuminating possible advantages, difficulties, and future directions. This presentation explores state-of-the-art research and practical applications to add to the continuing discussion on improving traffic management with advanced machine learning technologies.

II. LITERATURE STUDY

The field of transportation has seen a great deal of development with the use of big data, deep learning, and machine learning technology. Researchers have put forth a number of architectures and approaches in recent years to improve traffic management systems with cutting-edge tools and methods. The scalable architecture presented by Guerreiro et al. [1] can handle both historical and real-time traffic data. Using the DATEX-II data model, this design uses Spark on Hadoop and MongoDB to harmonies data from many sources, such as traffic management centers and service providers.

With MongoDB selected as the database option, the suggested Extract, Transform, Load (ETL) architecture, which is based on the Cross Industry Standard Process for Data Mining, effectively processes and saves both historical and

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real-time data. Significant processing time reduction was shown in the validation process using Spark standalone mode.

Tseng et al. [2] introduced another method that was centered on using streaming data for real- time traffic predictions. This process supports a real-time processing system by using Apache Storm bolts and spouts. The system allows for real-time monitoring and forecast of traffic situations by merging weather data from meteorological organizations with vehicle data from national motorway databases. MARE and MSE, or mean absolute relative error and mean squared error, were used in the experiments to demonstrate the model's forecast accuracy on both rainy and non-rainy days.

Deep Test is a system for automatically monitoring self-supporting Deep Neural Network (DNN) vehicles, which was proposed by Yuchi Tian et al. [3]. DeepTest is a tool that enhances the evaluation capabilities of DNNs by using artificial test images created by applying different changes to a seed frame. DeepTest finds examples of improper DNN behavior without requiring full domain- specific metamorphic correlations. Deep Test's adaptability makes it easy to integrate extra transformations or metamorphic interactions for the evaluation of various DNN structures.

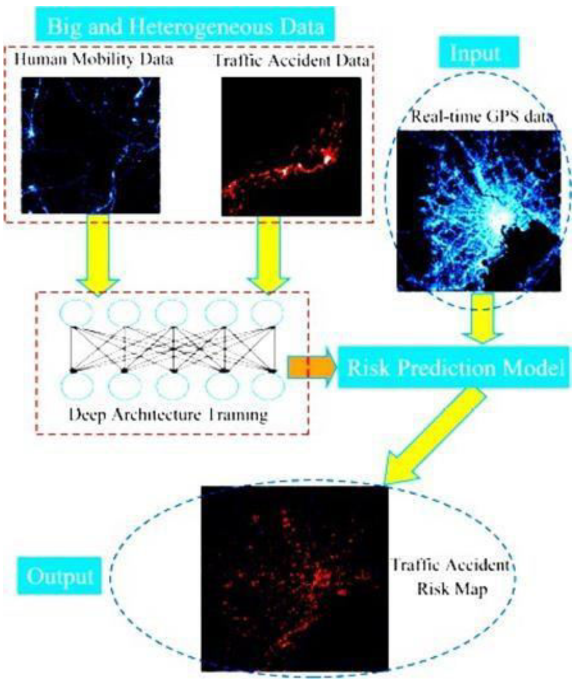

Fig.1.Using data from traffic events and deep learning on human movement, traffic accident risk maps are predicted [4]

Hoang Nguyen et al. [4] provide a thorough analysis of the latest advancements in the use of deep learning algorithms in the transportation sector in their paper. They point out how deep learning methods are widely used for a variety of transportation-related problems, especially traffic data analysis, where successful results have been seen. The authors point out that there haven't been many noteworthy theoretical developments despite the abundance of experiments. While efforts have been made to use deep learning techniques to combine temporal and geographical linkages within transportation channels, the scope of these studies is still restricted.

The authors also highlight the paucity of novel research, particularly in the areas of event effect forecasting and quantifying the spatiotemporal impact of incidents on road networks. This analysis emphasises that in order to overcome these obstacles and broaden the field's research area, more investigation and creativity in deep learning applications within the transportation industry are required One of the more successful uses of artificial intelligence (AI) is machine learning, which allows computers to learn from their past experiences .

The benefit of using a machine learning algorithm is that it can enhance the training process. One of the best real-time object identification algorithms is YOLO (You Only Look Once), which is used to detect objects .It has been noted

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that one of the most crucial requirements or procedures to be applied in autonomous car technology is object detection. YOLO uses an ingenious convolutional neural network (CNN) to perform efficient object detection [6].
The approach is used for the entire image and has shown useful when used with a single neural network. After that, the image is separated into different areas, and each region's bounding box and probability are predicted [9]. The bounding boxes are waited for using the predicted probabilities. One benefit of using YOLO is that it allows for real-time operation with a high level of accuracy. The item is only viewed once by the algorithm, which then uses the single forward propagation to feel the image. It generates predictions after going through the neural network [6]. It has been noted that a single CNN can simultaneously predict multiple bounding boxes and train on full images by YOLO. It directly aids in improving the performance of detection. This example illustrates the suggested system, which obtains the input video sequences, applies a convolutional neural network, and then implements ROI. In the following stage, the YOLO algorithm is executed and aids in the vehicle count [6].
After the photos are used to train the algorithm, the object is tracked and detected. An alert message is sent to manage traffic when an image of a car travelling the wrong way is taken. This has been seen to avoid traffic jams, which leads to efficient traffic management .

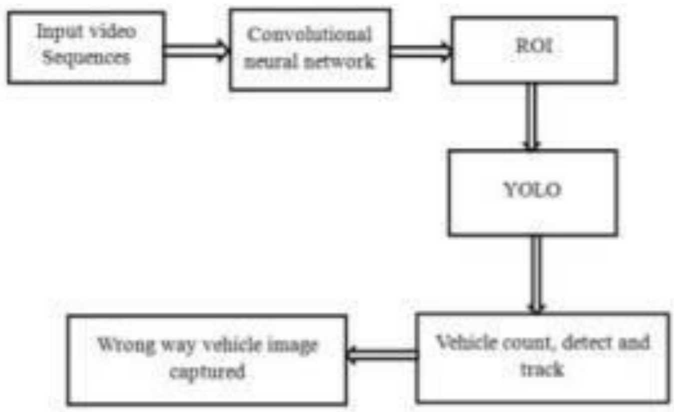

Fig 2 A suggested ML -based traffic management system [6]

III. ADVANTAGES AND DISADVANTAGES

Model	Advantages	Disadvantages
DNN (Deep Neural Network)	=> Once trained, the predictions are relatively fast.	=>Computationally ,training with Standard CPUs are very expensive, time-consuming, and demanding.
CNN (Convolution Neural network)	=> high dependability when it comes to image recognition.	=> need a substantial amount of training data in order to reach ideal performance. =>extremely intricate approach to object detection.

IV. RESULT AND DISCUSSIONS

The review paper delves deeply into the use of Deep Learning (DL) techniques for predicting traffic flow, especially in the context of autonomous cars. Several significant conclusions from this investigation are revealed, providing insight into several facets of DL's impact: In order to demonstrate how current DL techniques can be used to optimise

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vehicle behavior in autonomous driving scenarios, the study first explores how they are used to estimate traffic flow for driverless vehicles. Second, DL strategies and traditional Machine Learning techniques are critically compared for traffic flow analysis, with an emphasis on the possible improvements in accuracy and efficiency that can be achieved with DL approaches. In addition, the study thoroughly analyses the body of research on traffic flow modelling, with an emphasis on DL approaches. This analysis sheds light on important questions and points of view in the field and offers insightful information on current research projects .In addition, the research highlights the main goal of improving traffic flow forecast accuracy by utilizing DL techniques, demonstrating their capacity to examine intricate traffic patterns and produce more accurate predictions in comparison to conventional approaches.

Furthermore, the possibility of using DL to enhance the effectiveness of autonomous car traffic flow prediction systems is discussed, opening the door to more effective vehicle routing and improved response to shifting traffic conditions. Lastly, the work highlights topics for additional research and suggests methodologies to optimize DL techniques in prediction tasks, highlighting potential and obstacles for future study in DL-based traffic flow estimation.

All things considered, the result and discussion section provide a thorough summary of the state of the art in DL-based traffic flow prediction research, highlighting both its advantages and disadvantages in relation to self-driving cars.

V. CONCLUSION

In conclusion, the field of traffic management and prediction has seen a substantial transformation due to the quick development of particularly in the fields of deep learning (DL) and machine learning (ML) for autonomous vehicle .Although conventional techniques have been used in self-driving automobiles, end-to-end learning systems that translate sensory data into steering orders have been made possible by the advent of deep learning technologies. Widespread adoption is still hampered by issues like demonstrating the practical safety of autonomous AI cars and the system's strong reliance on large training datasets and computing technology.

Notwithstanding these obstacles, ML-driven traffic management systems present encouraging ways to raise the efficacy and efficiency of transportation networks. These systems seek to improve operational performance and capability by utilising advanced technology and sensors, which will ultimately help to ease traffic flow and lessen congestion on road networks.

There is a lot of promise for managing non-linear data and increasing accuracy over conventional methods when ML techniques are integrated into traffic prediction models. The results also highlight the need of using large datasets for effective system implementation and the drawbacks of conventional prediction models in order to highlight the noteworthy contribution of machine learning (ML)-driven traffic management

We have implemented an automatic text detection technique from an image for Inpainting. Our algorithm successfully detects the text region from the image which consists of mixed text-picture-graphic regions. We have applied our algorithm on many images and found that it successfully detect the text region.

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