International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com
© 2026 IJERST. All Rights Reserved
Peer Reviewed, Referred & Indexed Journal

Research Paper

TIME SERIES TRAFFIC PREDICTION WITH VEHICLE-TYPE SUGGESTIONST

PRIYA RANJAN RAJ [1], SIRI CHANDANA MUDHUGANTI [2], SESHAM UDAY KIRAN[3], BELLAMKONDA SUSHMA[4], GOLLAGOPU LOKESH [5]

[1]Assistant Professor, Dept. of CSE, Guru Nanak Institutions Technical Campus, Ibrahimpatnam, Telangana, India

[2, 3, 4, 5] B.Tech, Dept. of CSE, Guru Nanak Institutions Technical Campus, Ibrahimpatnam, Telangana, India

ABSTRACT— Urban traffic congestion is a major challenge in modern cities, leading to increased travel times, fuel consumption, and air pollution. To address this issue, Deep Traffic-VTS presents an intelligent hybrid system that integrates Long Short-Term Memory (LSTM) networks for time series forecasting with YOLO (You Only Look Once) for vehicle detection. The LSTM model analyzes historical traffic data—such as vehicle count, average speed, and congestion levels—to predict traffic conditions over upcoming time intervals. Simultaneously, YOLO processes live video feeds to detect and classify vehicle types on the road, including two-wheelers, cars, buses, and emergency vehicles. Based on both predicted and real-time traffic conditions, the system provides adaptive suggestions on the most suitable vehicle types for efficient navigation—for example, recommending two-wheelers in high-congestion zones due to their maneuverability, while advising larger vehicles to reroute or delay travel. This combined approach enables more effective traffic management, emergency response optimization, and smart urban mobility planning.

Based on both predicted and real-time traffic conditions, the system provides adaptive suggestions on the most suitable vehicle types for efficient navigation. Specifically, when congestion levels are high, the system recommends small vehicles such as two-wheelers due to their maneuverability; for medium congestion, it suggests medium-

sized vehicles like cars; and for low congestion, it supports the use of larger vehicles such as buses and trucks for efficient mass transportation. In addition, emergency vehicles like ambulances and fire trucks can be given priority-based navigation routes, reducing response times in critical situations.

Index Terms – Intelligent traffic management, traffic forecasting, Long Short-Term Memory (LSTM), YOLO, vehicle detection, congestion prediction, adaptive vehicle recommendation, smart transportation, urban mobility, emergency vehicle prioritization, computer vision, deep learning.

I. INTRODUCTION

Urban traffic congestion has become one of the most pressing challenges in modern cities, contributing to longer travel times, increased fuel consumption, environmental pollution, and reduced quality of life. Traditional traffic management systems often struggle to handle the dynamic and complex nature of urban traffic, as they typically rely on static rules and limited real-time data. To address these limitations, the integration of advanced machine learning techniques and computer vision offers a promising solution. Deep Traffic-VTS is a hybrid intelligent system designed to improve urban traffic efficiency by combining predictive and real-time analysis. It employs Long Short-Term Memory (LSTM) networks to forecast traffic conditions based on historical data such as vehicle counts, average speeds, and congestion trends. Simultaneously, the system uses YOLO (You Only Look Once) to detect and classify vehicles from live video feeds, including cars, buses, two-wheelers, and emergency vehicles. By merging these insights, Deep Traffic-VTS can provide adaptive recommendations for optimal vehicle movement, helping to alleviate congestion, optimize travel routes, support emergency responses, and enable smarter urban mobility planning. This approach demonstrates the potential of combining time series forecasting and real-time detection to create a proactive, data-driven traffic management system capable of enhancing the safety, efficiency, and sustainability of urban transportation networks. Based on both **predicted and real-time traffic conditions**, the system provides **adaptive suggestions** on the most suitable vehicle types for efficient navigation. Specifically, when congestion levels are **high**, the system recommends **small vehicles such as two-wheelers** due to their maneuverability; for **medium congestion**, it suggests **medium-sized**

vehicles like cars; and for **low congestion**, it supports the use of **larger vehicles such as buses and trucks** for efficient mass transportation. In addition, emergency vehicles like ambulances and fire trucks can be given **priority-based navigation routes**, reducing response times in critical situations.

II. RELATED WORK

A. Predicting multiple types of traffic accident severity with explanations: A multi-task deep learning framework

This paper proposes a multi-task deep learning framework for predicting different levels of traffic accident severity while also providing interpretable explanations. The model simultaneously predicts multiple severity categories by leveraging shared representations, enhancing efficiency and accuracy. By integrating explainable AI techniques, the study offers insights into the most influential factors affecting accident severity, aiding policymakers and traffic safety authorities in implementing targeted safety measures. The approach is validated using large-scale accident datasets, demonstrating significant performance improvements over traditional single-task models.

B. Factors affecting severity of motorcycle accidents on Thailand's arterial roads: Multiple correspondence analysis and ordered logistics regression approaches

This study investigates the key factors influencing the severity of motorcycle accidents on Thailand's arterial roads. Using multiple correspondence analysis and ordered logistic regression, the authors identify variables such as road conditions, rider behavior, and environmental factors that significantly impact crash outcomes. The findings highlight the role of infrastructure improvements, enforcement strategies, and public awareness campaigns in reducing accident severity, providing valuable guidance for policymakers and traffic safety planners.

C. Evaluation of contributing factors affecting number of vehicles involved in crashes using machine learning techniques in rural roads of Cosenza, Italy

This research applies machine learning methods to analyze factors influencing the number of vehicles involved in rural road crashes in Cosenza, Italy. The study uses datasets containing road geometry, traffic indicators, and crash data to identify patterns and relationships. The machine learning models outperform traditional statistical approaches in predictive accuracy, revealing

Deep Traffic-VTS integrates YOLOv8 and LSTM to provide an intelligent traffic management solution. YOLOv8 is used for real-time detection and classification of vehicles—such as two-wheelers, cars, buses, and emergency vehicles—from live video feeds, enabling accurate assessment of current traffic conditions. In parallel, LSTM processes historical traffic data to forecast future congestion patterns and traffic flow. By combining real-time detection with time series forecasting, the system offers adaptive vehicle-type recommendations for efficient navigation under both present and predicted traffic scenarios, supporting smarter mobility decisions and improved urban traffic planning.

critical factors such as curvature, speed limits, and traffic flow that contribute to crash severity. The results can be used to design targeted safety interventions.

D. Risk factors as causes of accidents: Criterion of causality, logical structure of relationship to accidents and completeness of explanations

This paper critically examines the concept of causality in traffic accident research, focusing on identifying and classifying risk factors that contribute to crashes. The study presents a logical framework for linking accident occurrence to specific causes and evaluates the completeness of current explanatory models. The work emphasizes the importance of comprehensive datasets and robust methodologies for accurately identifying causal factors, aiming to enhance road safety policies and prevention strategies.

III. PROPOSED METHODOLOGY

Complementing this, the LSTM model is employed to analyze historical traffic data—including vehicle count, congestion levels, and average speed—over time to forecast future traffic conditions. LSTM's ability to model long-term dependencies in sequential data makes it ideal for predicting short- and long-term congestion trends. By integrating insights from both real-time detection and time series forecasting, Deep Traffic-VTS dynamically suggests the most suitable vehicle types for efficient navigation under evolving traffic conditions.

For instance, in predicted high-congestion scenarios, the system may favor two-wheelers or emergency vehicles for their maneuverability, while recommending delays or alternate routes for larger vehicles. This hybrid approach enhances urban traffic monitoring, supports timely decision-making, and contributes to the development

of more adaptive and sustainable transportation.

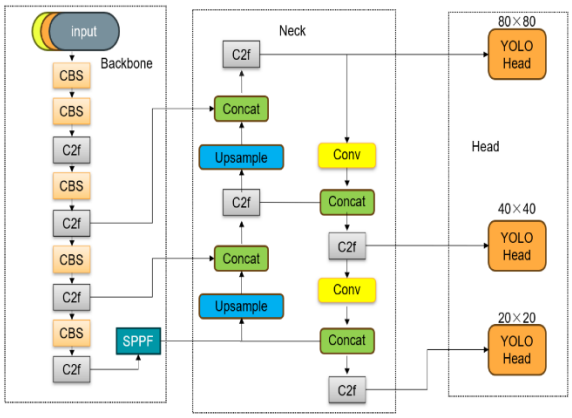


Fig. 1: System Overview

3.1 Data Collection

Historical traffic data such as vehicle counts, average speed, congestion levels, and time of day is collected from sensors, traffic cameras, or government traffic databases.

Live video feeds from urban roads are captured using CCTV cameras for real-time analysis.

3.2 Traffic Prediction using LSTM

Long Short-Term Memory (LSTM) networks are trained on historical traffic data to learn temporal patterns and trends. The model predicts future traffic conditions for upcoming time intervals, including potential congestion levels and traffic density.

3.3 Vehicle Detection using YOLO

YOLO (You Only Look Once) is applied to live video feeds to detect and classify vehicles in real time, such as two-wheelers, cars, buses, and emergency vehicles. The detection model provides information about vehicle types, count, and their location on the road network.

3.4 Integration and Analysis

Predictions from the LSTM model are combined with real-time data from YOLO to form a comprehensive view of traffic conditions. The system analyzes which vehicle types are suitable for specific routes and identifies congested zones requiring alternate routing.

3.5 Adaptive Recommendations

Based on integrated insights, the system suggests optimal navigation for different vehicles:

Two-wheelers for congested areas due to high maneuverability. Larger vehicles are advised to take alternate routes or delay travel. Emergency vehicles are prioritized with fastest and least congested paths.

3.6 System Evaluation

The performance of the system is evaluated based on metrics like prediction accuracy, vehicle detection accuracy, congestion

reduction, travel time optimization, and response efficiency for emergency vehicles.

IV. EXPERIMENTAL RESULTS AND ANALYSIS

The experimental results show that the proposed DeepTraffic-VTS system can accurately predict traffic conditions using LSTM and detect vehicle types in real time using YOLO. By combining historical traffic forecasting with live vehicle detection, the system provides adaptive vehicle-type suggestions based on congestion levels. It also supports priority movement for emergency vehicles. Overall, the model improves traffic management and smart urban mobility planning.

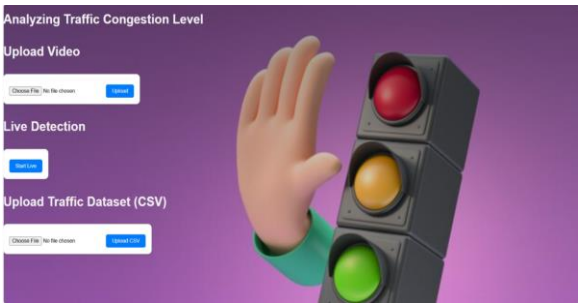


Fig. 2: Home Page

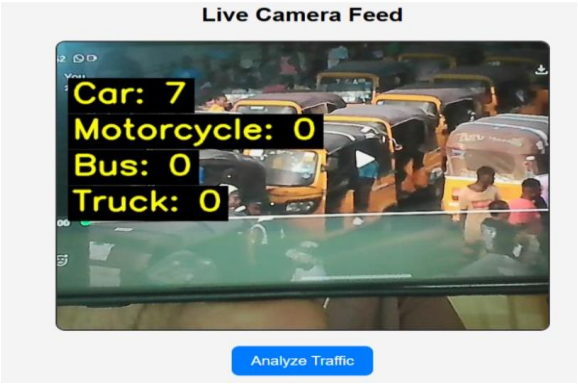


Fig. 3: Live Camera Feed



Fig. 4: Uploaded Video Detection

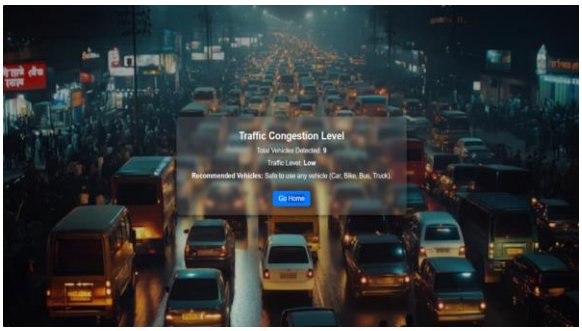


Fig. 5: Traffic Congestion Level

V. CONCLUSION

DeepTraffic-VTS showcases an innovative approach to tackling urban traffic congestion by leveraging the strengths of both predictive analytics and real-time computer vision. By employing LSTM networks for accurate

traffic forecasting and YOLO for live vehicle detection and classification, the system provides actionable insights that help optimize traffic flow and improve decision-making for commuters and traffic authorities alike. The integration of these two powerful techniques allows the system to dynamically adapt to changing traffic conditions, offering suitable vehicle routing suggestions, minimizing delays, and reducing fuel consumption. Moreover, the project demonstrates significant potential in enhancing emergency response, as it can prioritize routes for ambulances and fire trucks in real time. Beyond daily traffic management, the system offers valuable data for urban planners and policymakers, supporting evidence-based decisions for sustainable city development. With future enhancements such as IoT integration, multi-modal transport analysis, and AI-driven traffic signal optimization, DeepTraffic-VTS can evolve into a comprehensive solution for smart city infrastructure. Overall, this project emphasizes the importance of combining artificial intelligence, data analytics, and computer vision to create safer, more efficient, and environmentally friendly urban transportation networks, paving the way for smarter cities of the future and Based on both predicted and real-time traffic conditions, the system provides adaptive suggestions on the most suitable vehicle types for efficient navigation. Specifically, when congestion levels are high, the system recommends small vehicles such as two-wheelers due to their maneuverability; for medium congestion, it suggests medium-sized vehicles like cars; and for low congestion, it supports the use of larger vehicles such as buses and trucks for efficient mass transportation. In addition, emergency vehicles like ambulances and fire trucks can be given priority-based navigation routes, reducing response times in critical situations.

REFERENCES

[1] Z. Yang, W. Zhang, and J. Feng, ‘‘Predicting multiple types of traffic accident severity with explanations: A multi-task deep learning framework,’’ Saf. Sci., vol. 146, Feb. 2022, Art. no. 105522, doi: 10.1016/j.ssci.2021.105522.

[2] F. Zong, X. Chen, J. Tang, P. Yu, and T. Wu, ‘‘Analyzing traffic crash severity with combination of information entropy and Bayesian network,’’ IEEE Access, vol. 7, pp. 63288–63302, 2019, doi: 10.1109/ACCESS.2019.2916691.

[3] Global Status Report on Road Safety 2018, World Health Organization,

Geneva, Switzerland, 2018. [Online]. Available: https://apps.who.int/iris/handle/10665/276462

[4] J. Roland, P. D. Way, C. Firat, T.-N. Doan, and M. Sartipi, ‘‘Modeling and predicting vehicle accident occurrence in Chattanooga, Tennessee,’’ Accident Anal. Prevention, vol. 149, Jan. 2021, Art. no. 105860, doi: 10.1016/j.aap.2020.105860.

[5] R. Elvik, F. Sagberg, and P. A. Langeland, ‘‘An analysis of factors influencing accidents on road bridges in Norway,’’ Accident Anal. Prevention, vol. 129, pp. 1–6, Aug. 2019, doi: 10.1016/j.aap.2019.05.002.

[6] L. Eboli, C. Forciniti, and G. Mazzulla, ‘‘Factors influencing accident severity: An analysis by road accident type,’’ Transp. Res. Proc., vol. 47, pp. 449–456, Jan. 2020, doi: 10.1016/j.trpro.2020.03.120.

[7] R. L. Rodriguez, J. Tricia, B. Villamaria, and M. I. Noroña, ‘‘Analysis of factors affecting road traffic accidents in the city of makati Philippines,’’ Tech. Rep., 2021.

[8] I. Pugachev, Y. Kulikov, G. Markelov, and N. Sheshera, ‘‘Factor analysis of traffic organization and safety systems,’’ Transp. Res. Proc., vol. 20, pp. 529–535, Jan. 2017, doi: 10.1016/j.trpro.2017.01.086.

[9] B. Dadashova, B. A. Ramírez, J. M. McWilliams, and F. A. Izquierdo, ‘‘The identification of patterns of interurban road accident frequency and severity using road geometry and traffic indicators,’’ Transp. Res. Proc., vol. 14, pp. 4122–4129, Jan. 2016, doi: 10.1016/j.trpro.2016.05.383.

AUTHORS Profile



Mr. PRIYA RANJAN RAJ has received his B.Tech from MIT University Of Meghalaya in 2019, M.Tech degree in Computer science from Chandigarh University, Punjab in 2021 and Pursuing Ph.D degree in Computer Science from Chandigarh University, Punjab. He is dedicated to teaching field from the last 4 years. At present he is working as Assistant Professor in CSE Department at Guru Nanak Institutions Technical Campus, Ibrahimpatnam, Telangana, India.



Ms. SIRI CHANDANA MUDHUGANTI pursuing B.Tech degree in Computer Science and Engineering at Guru Nanak Institutions Technical Campus affiliated to JNTUH in 2022-2026.



Mr. SESHAM UDAY KIRAN pursuing B.Tech degree in Computer Science and Engineering at Guru Nanak Institutions Technical Campus affiliated to JNTUH in 2022-2026.



Ms. BELLAMKONDA SUSHMA pursuing B.Tech degree in Computer Science and Engineering at Guru Nanak Institutions Technical Campus affiliated to JNTUH in 2022-2026.



Mr. GOLLAGOPU LOKESH pursuing B.Tech degree in Computer Science and Engineering at Guru Nanak Institutions Technical Campus affiliated to JNTUH in 2022-2026.