AMRITA VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY

Mathematics for Intelligent Systems-2
Introduction to data structure and algorithms

Traffic Flow Prediction

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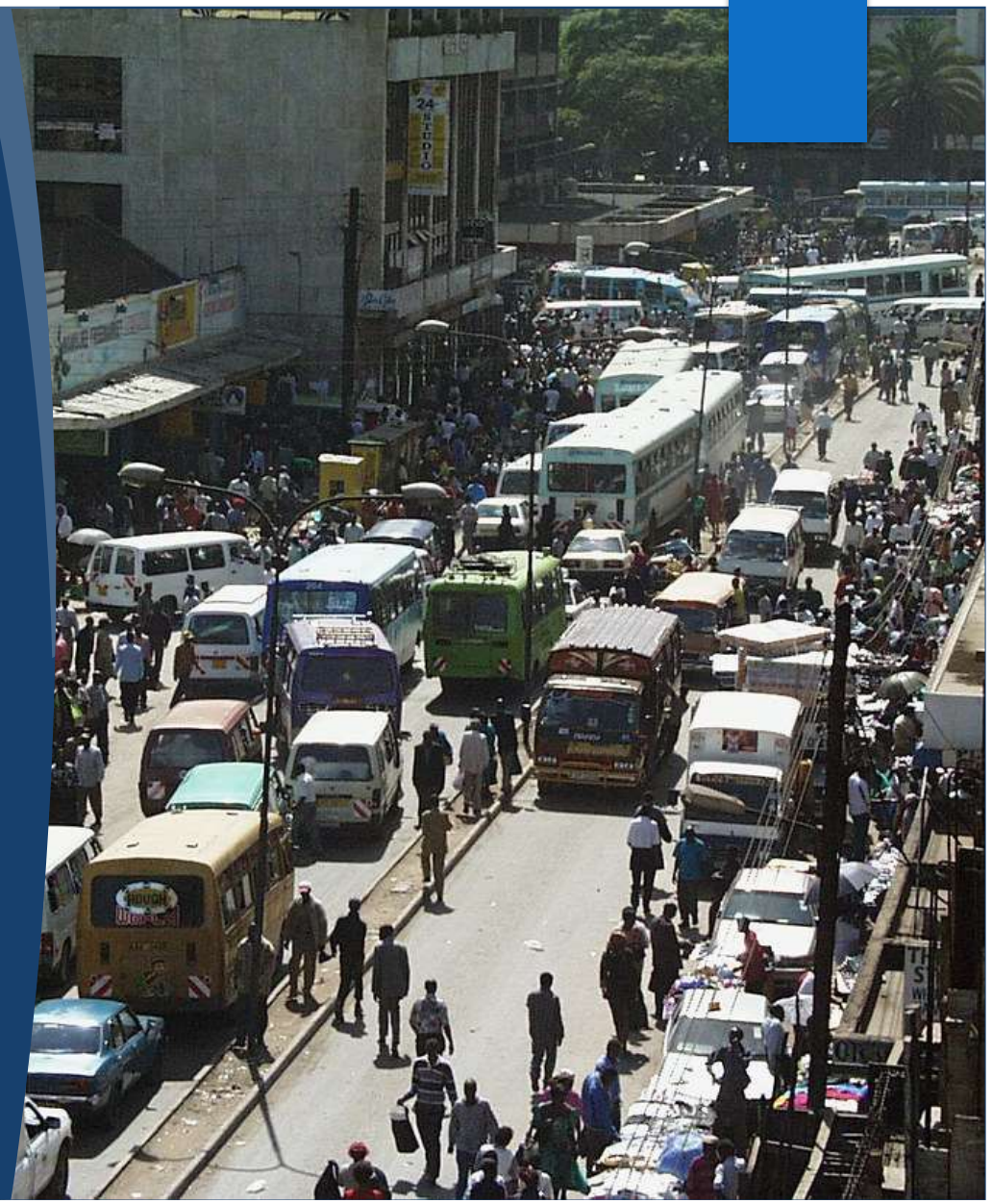
PROBLEM STATEMENT

Urban areas face severe traffic congestion, causing delays, fuel loss, and pollution. Traditional systems lack predictive intelligence. There is a need for a system that can predict vehicle flow and classify traffic levels using real-time data and ML.

OBJECTIVES

- Predict the number of vehicles using regression.
- Classify traffic congestion levels into Low, Normal, and High.
- Provide real-time insights through a Gradio-based web interface.
- Assist in smart city planning and intelligent traffic management.



Literature Review

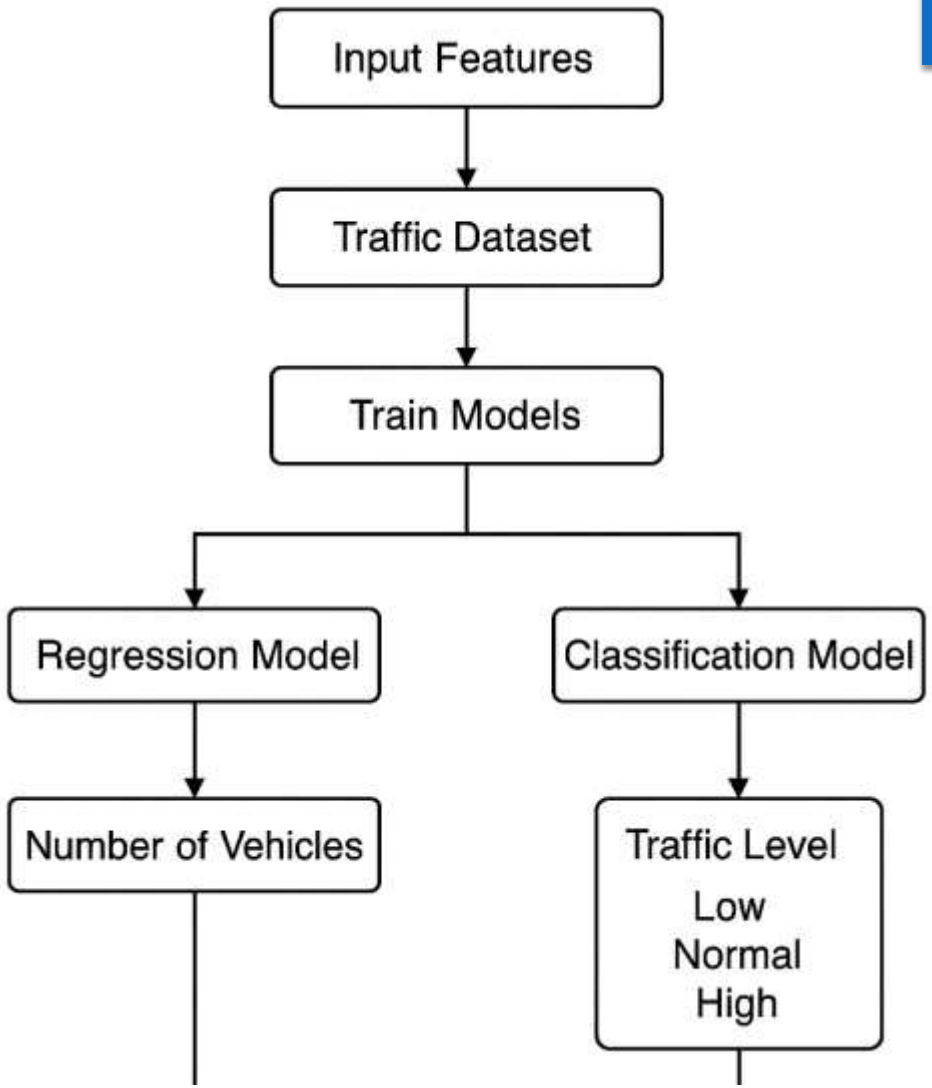
Paper Title	Authors	Year	Publication	Summary
Traffic Flow Prediction with Big Data: A Deep Learning Approach	Lv, Y., Duan, Y., Kang, W., Li, Z., & Wang, F. Y.	2015	IEEE Trans. on Intelligent Transportation Systems	Introduces a deep learning framework that leverages big data to forecast traffic flow, demonstrating significant improvements in prediction accuracy.
Urban Traffic Flow Prediction Based on Support Vector Machines	Zhang, Z., Liu, Y., Song, X., & Wang, L.	2016	Transportation Research Part C: Emerging Technologies	Explores the application of Support Vector Machines in predicting vehicle counts in urban settings, highlighting the potential of statistical learning methods in traffic management.
A Hybrid Machine Learning Approach for Traffic Flow Prediction	Sun, Y., Wang, X., & Xiao, F.	2019	IEEE Access	Proposes a hybrid model combining multiple machine learning techniques to capture non-linear dynamics in urban traffic, improving forecasting performance.

METHODOLOGY

Split into two branches:

- Regression Model: Predicts vehicle count.
- Classification Model: Labels traffic status.

Both models are trained on a labeled traffic dataset with features like time, weather, day, etc.



Dataset

- Source of dataset :Kaggle
- Key features:Timestamp, Weather, Day TypeVehicle Count (for regression)Traffic Status Labels (for classification)

Time	Date	Day of the week	CarCount	BikeCount	BusCount	TruckCount	Total	Traffic Situation
12:00:00 AM	10	Tuesday	31	0	4	4	39	low
12:15:00 AM	12	Tuesday	49	0	3	3	55	low
12:30:00 AM	11	Tuesday	46	0	3	6	55	low
12:45:00 AM	14	Tuesday	51	0	2	5	58	low
1:00:00 AM	15	Tuesday	57	6	15	16	94	normal
1:15:00 AM	16	Tuesday	44	0	5	4	53	low
1:30:00 AM	18	Tuesday	37	0	1	4	42	low
1:45:00 AM	10	Tuesday	42	4	4	5	55	low

Fig-1:Snapshot of dataset

Model Architecture

Regression: Random Forest Regressor

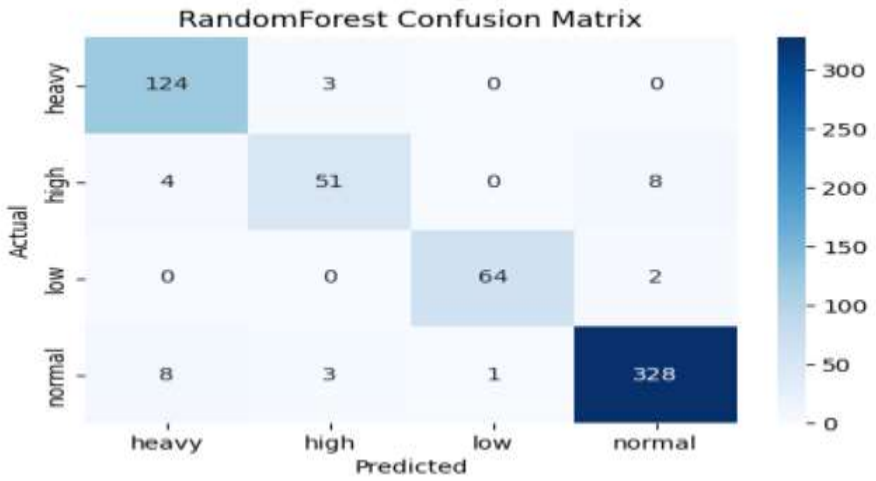
Classification: Random Forest Classifier

Evaluation Metrics: MAE, MSE, Accuracy, Confusion Matrix

Also trained 4 more models and found Random Forest as best one for both regression and classification

RandomForest model Report ---

	precision	recall	f1-score	support
heavy	0.91	0.98	0.94	127
high	0.89	0.81	0.85	63
low	0.98	0.97	0.98	66
normal	0.97	0.96	0.97	340
accuracy			0.95	596
macro avg	0.94	0.93	0.93	596
weighted avg	0.95	0.95	0.95	596

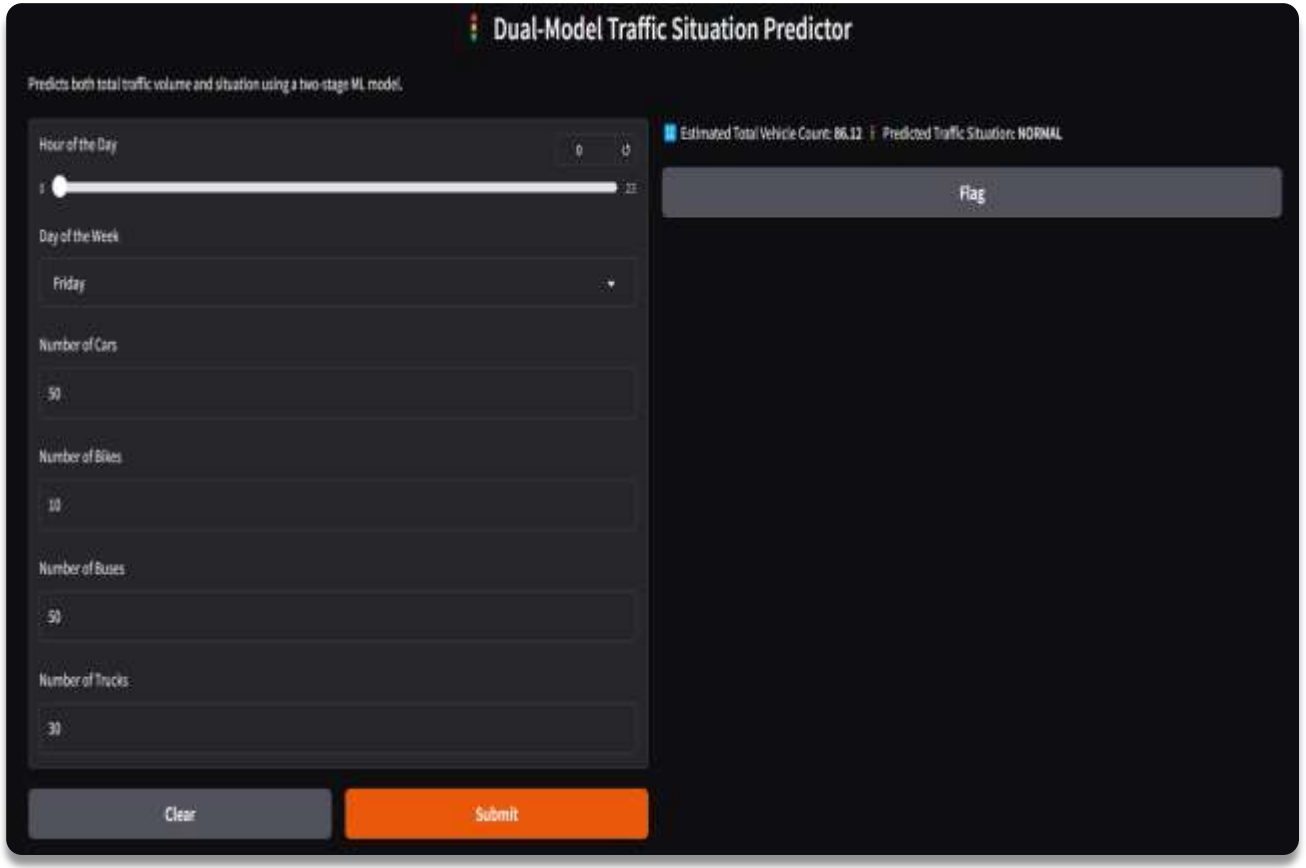


Interface

User inputs → Vehicle count prediction

Traffic level Output → Visual feedback

Saves output and whole input data in csv file



Applications

Smart City Traffic optimization Planning

Navigation Apps (future scope)

Emergency Vehicle Routing (Like Ambulance)

Logistics Route Optimization(For express delivery)

Future Enhancements

- Live API data integration
- Route suggestion system
- Map-based congestion visualization
- Mobile app version

References

1. Lv, Y., Duan, Y., Kang, W., Li, Z., & Wang, F. Y. (2015). Traffic Flow Prediction with Big Data: A Deep Learning Approach. IEEE Transactions on Intelligent Transportation Systems.
2. Zhang, Z., Liu, Y., Song, X., & Wang, L. (2016). Urban Traffic Flow Prediction Based on Support Vector Machines. Transportation Research Part C: Emerging Technologies.
3. Sun, Y., Wang, X., & Xiao, F. (2019). A Hybrid Machine Learning Approach for Traffic Flow Prediction. IEEE Access.
4. Zhang, J., Zheng, Y., & Qi, D. (2017). Deep Spatio-Temporal Residual Networks for Citywide Crowd Flows Prediction. AAAI Conference on Artificial Intelligence.
5. Chen, H., Chen, J., & Zhao, Y. (2020). Real-Time Traffic Flow Prediction Using Machine Learning: An Integrated Approach. IEEE International Conference on Intelligent Transportation Systems.