

Project Laboratory : Traffic Prediction

Optimizing Transport Systems Using Sensor Data

Intelligent
Transportation Systems

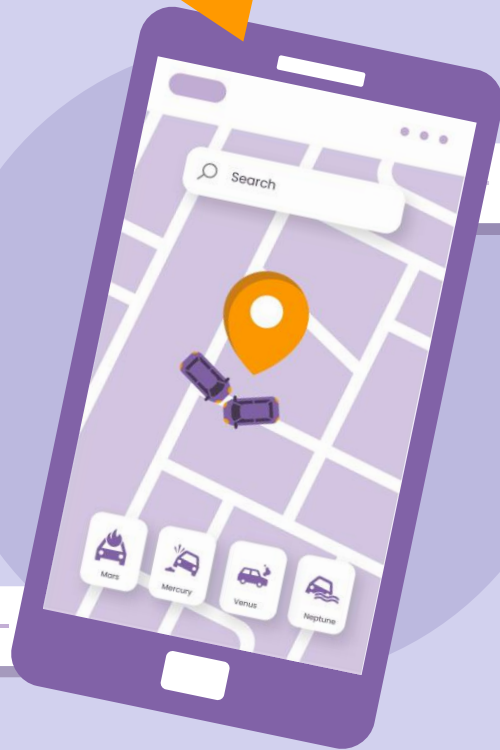


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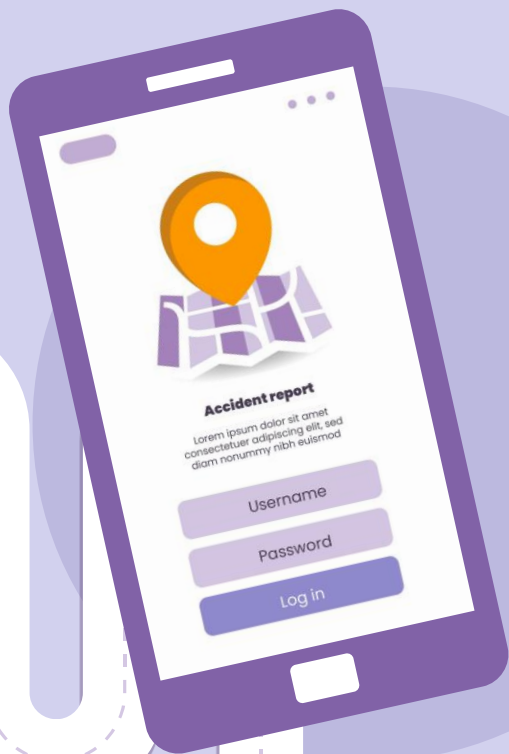
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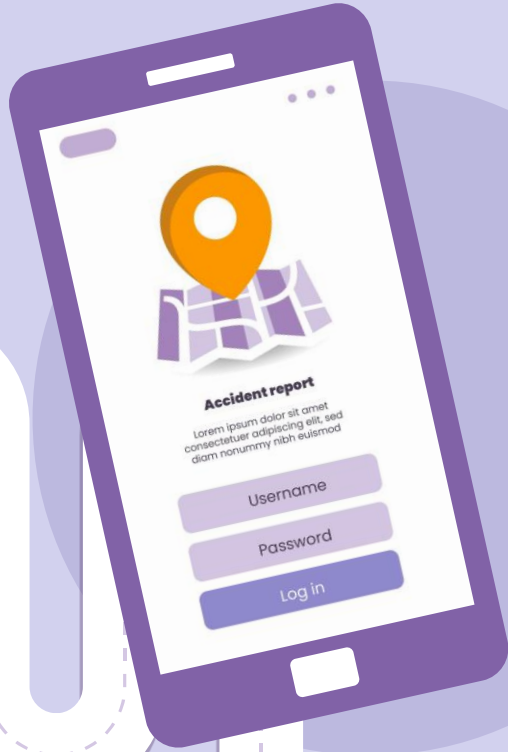


01

Overview

Predicting the state of traffic is a fundamental and challenging task.





02

Data Collection



getTraf_data

getTraf_data, Version 1.0 (released, July-13-2021)

Get MnDOT RTMC Traffic Data (Volume, Occupancy, Speed)



Begin Date: dimanche 28 mai 2023

Ending Date: dimanche 28 mai 2023

Detector IDs (separated by comma)

6908,6909,6910

Destination Folder

C:\temp\traffic\processed\test_data

Browse Folder

☐ Save the output file to the destination folder.

30-Sec Interval Data

Ending Date Volumes

Ending Date Occupancies

Ending Date Speeds

Hourly Volumes

Begin-to-End Dates

Daily Volumes

Begin-to-End Dates

Hourly Average Speeds

Ending Date Only

Hourly Speed Bins

Ending Date Only

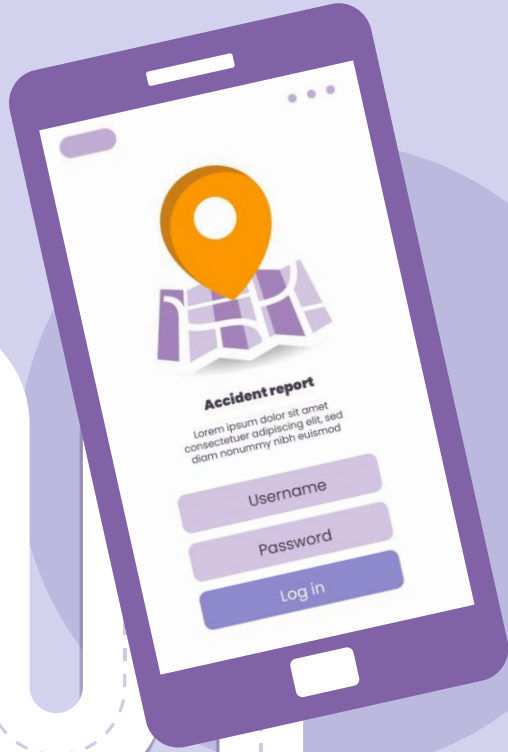
Created and distributed by Dr. Taek M. Kwon



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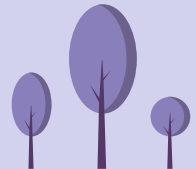
getTraf_data

	A	B	C	D	E	F
1	date	hou	6908	6909	6910	Total Vol
2	01/01/2022	0	259	288	83	630
3	01/01/2022	1	223	296	77	596
4	01/01/2022	2	135	243	84	462
5	01/01/2022	3	103	175	46	324
6	01/01/2022	4	96	95	7	198
7	01/01/2022	5	69	111	17	197
8	01/01/2022	6	116	138	17	271
9	01/01/2022	7	181	205	50	436
10	01/01/2022	8	237	274	72	583
			.			
			.			
			.			
2898	01/05/2022	16	1060	1410	1168	3638
2899	01/05/2022	17	940	1233	840	3013
2900	01/05/2022	18	837	1175	701	2713
2901	01/05/2022	19	722	959	536	2217
2902	01/05/2022	20	583	791	376	1750
2903	01/05/2022	21	503	575	240	1318
2904	01/05/2022	22	394	447	143	984
2905	01/05/2022	23	260	341	105	706



03

Data Pre-Processing



Handling missing values



**Mean
imputation**

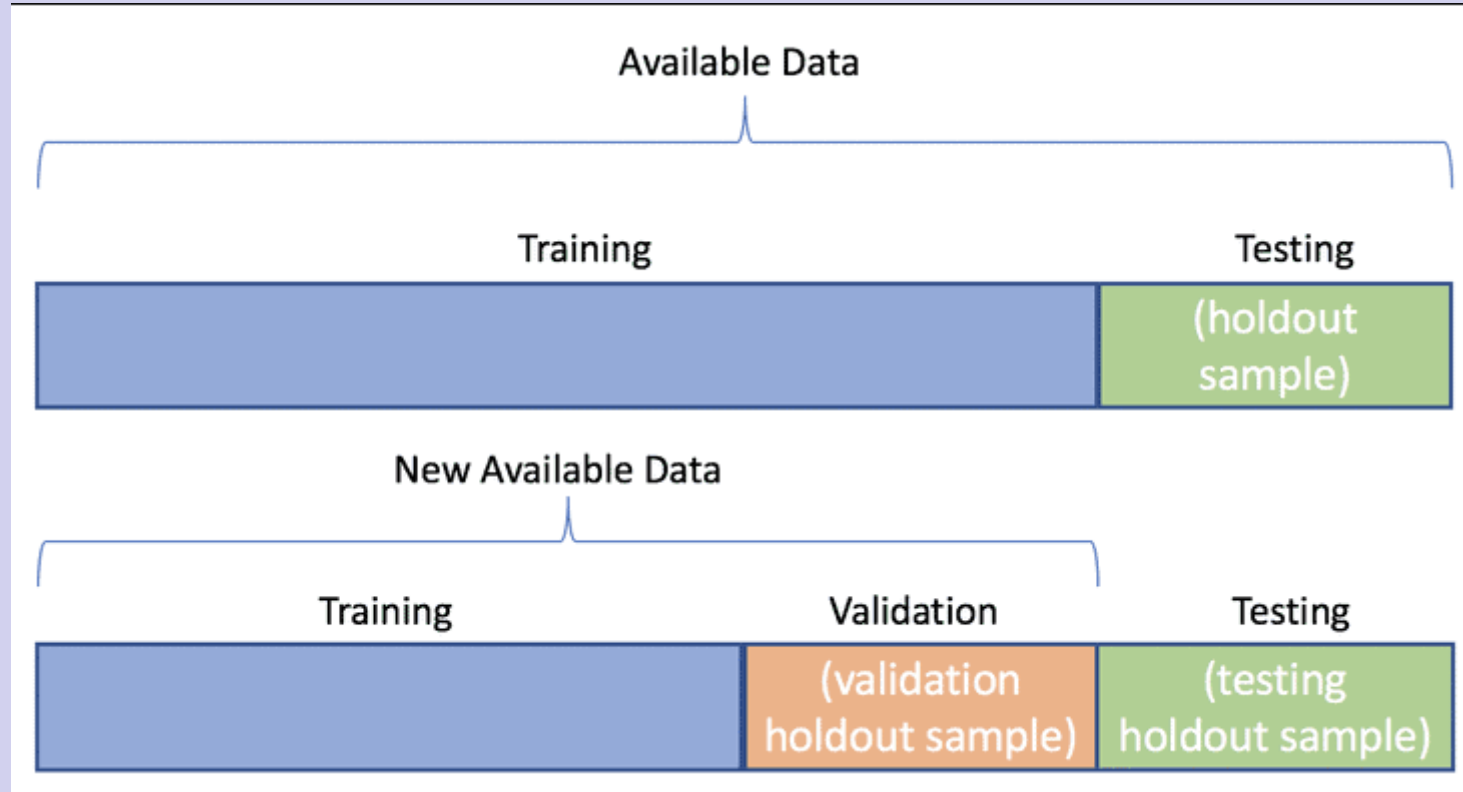


Forward fill



Backward fill

Split the dataset



Feature Scaling

Scaling Techniques

Normalization

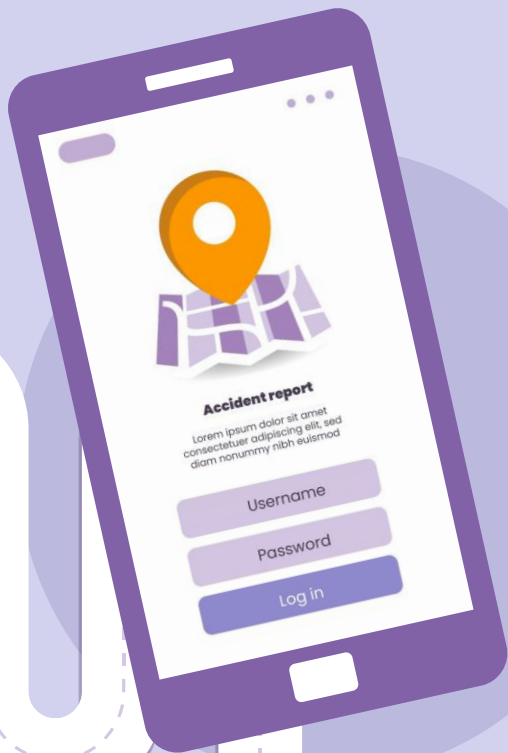
$$X_{new} = \frac{X - X_{min}}{X_{max} - X_{min}}$$

Standardization

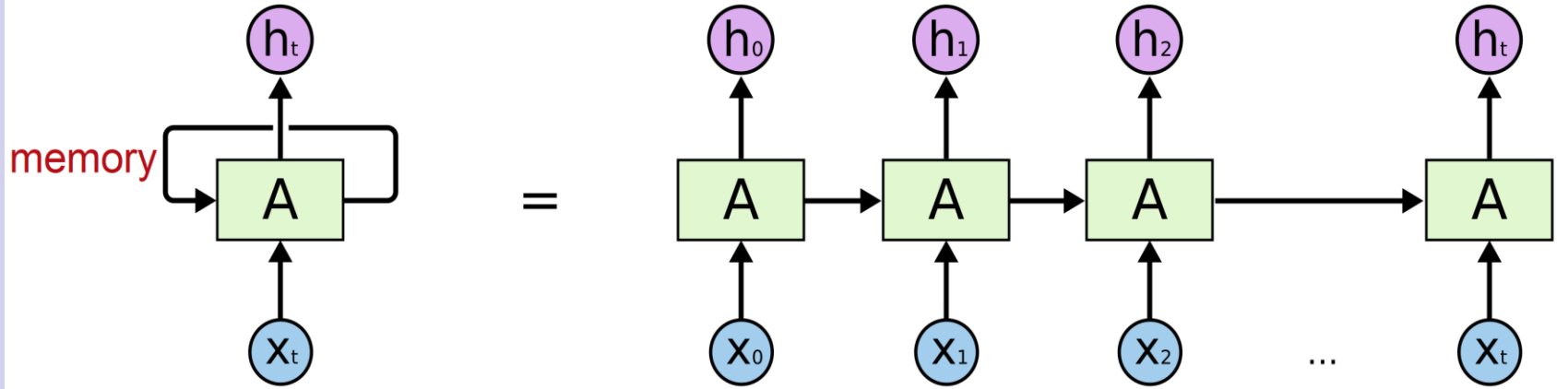
$$X' = \frac{X - \text{Mean}}{\text{Standard deviation}}$$

04

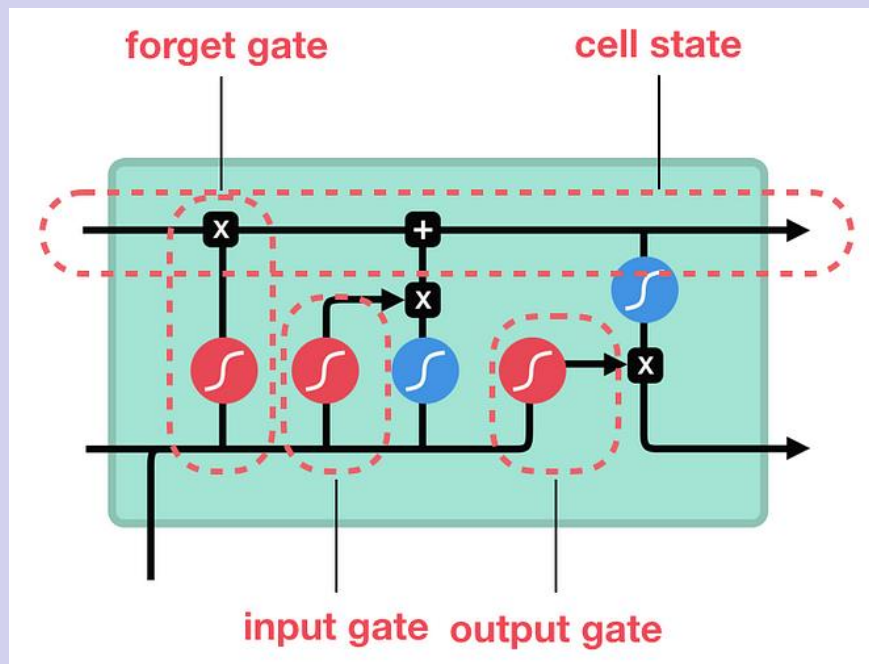
Model Architecture: RNN & LSTM



RNN Model



LSTM Model



sigmoid



tanh



pointwise
multiplication



pointwise
addition



vector
concatenation

Impact of RNN and LSTM on the model

RNN

✓ Lower risk of overfitting

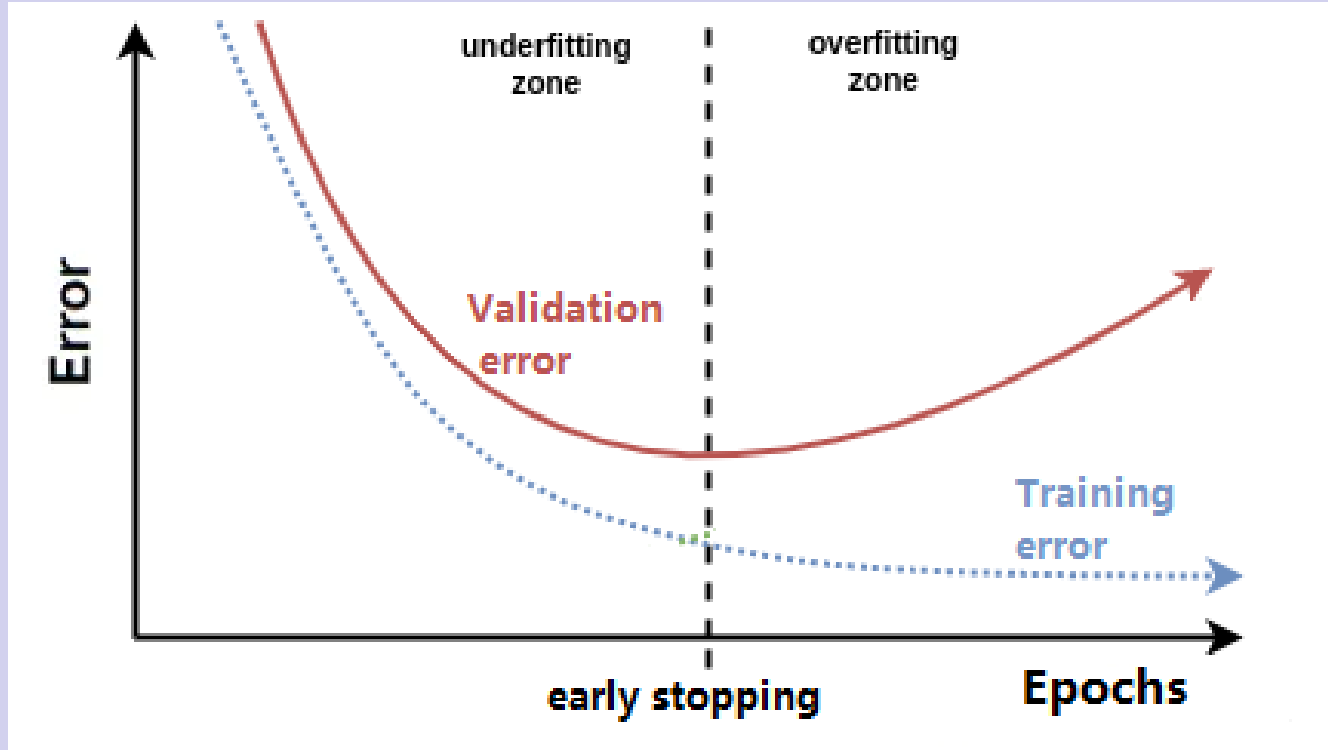
✗ Less robust to noise.

LSTM

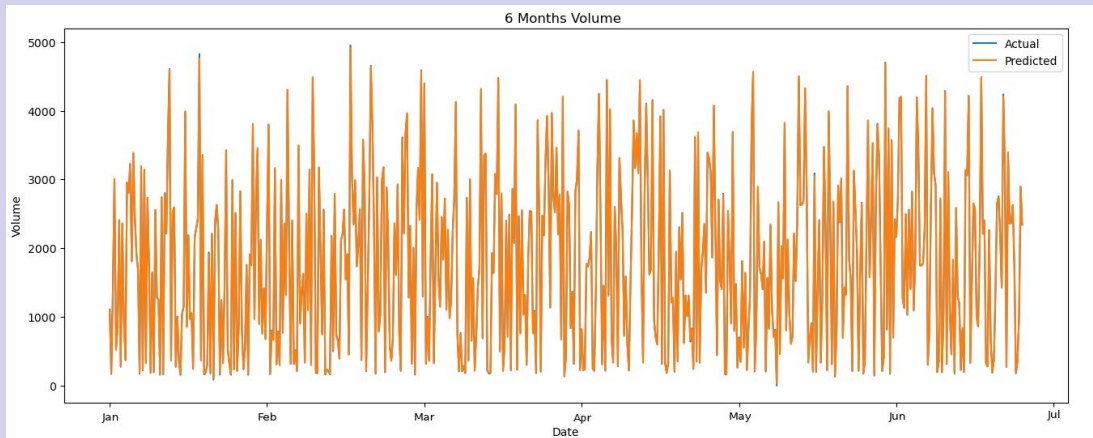
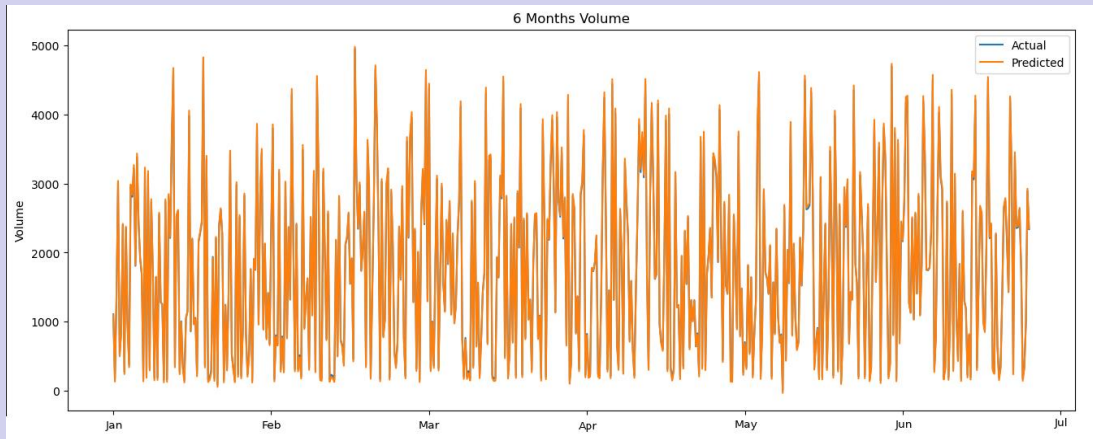
✓ Better performance on long sequences.

✗ Slower to train and run.

Early stopping



Results



Evaluation :

```
# Calculate MAPE for training and test sets
mape_train = mean_absolute_percentage_error(y_train, y_train_pred)
mape_test = mean_absolute_percentage_error(y_test, y_test_pred)

print(f'Training MAPE: {mape_train}%')
print(f'Test MAPE: {mape_test}%')
```

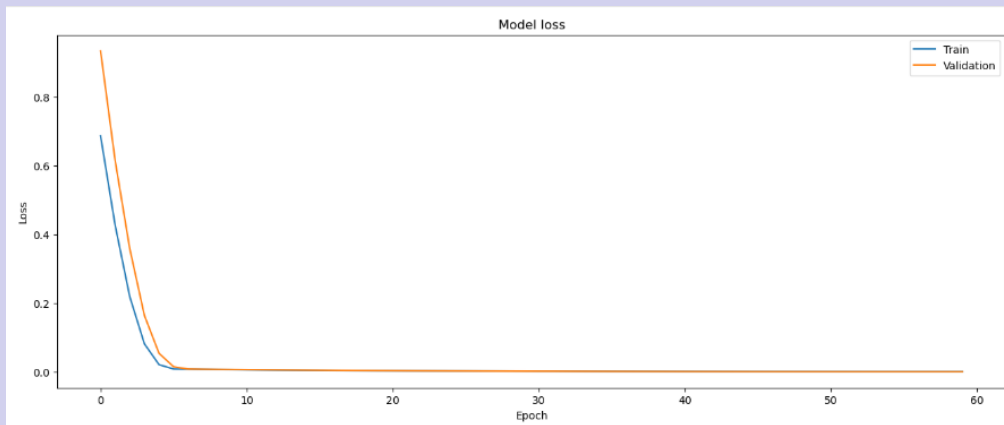
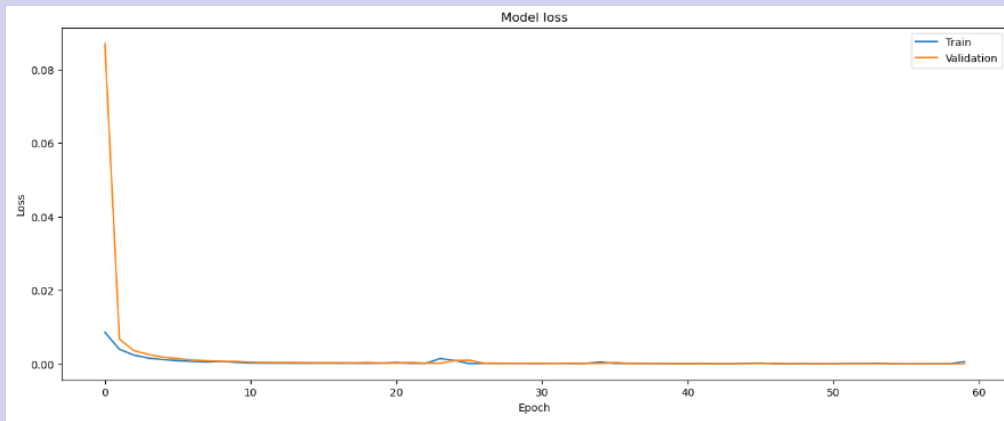
Training MAPE: 5.508993370855774%
Test MAPE: 4.227828255798661%

```
# Calculate MAPE for training and test sets
mape_train = mean_absolute_percentage_error(y_train, y_train_pred)
mape_test = mean_absolute_percentage_error(y_test, y_test_pred)

print(f'Training MAPE: {mape_train}%')
print(f'Test MAPE: {mape_test}%')
```

Training MAPE: 2.6603522927608365%
Test MAPE: 1.9339970744402364%

Training and Validation loss



Conclusion:

"Our research shows that using sensor data and LSTM networks can indeed be a powerful tool for predicting future traffic states"



Potential business applications for our model

■ **Smart Traffic Apps**

■ **Autonomous Vehicles**

■ **Taxi Companies.**

Google Maps

Tesla

Uber



Thank you for your time and attention

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