



**University of Stuttgart**  
Institute of Industrial Automation  
and Software Engineering



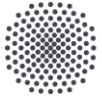
# Deep Learning-based Monitoring of the Urban Traffic using MOBATSIM

## INTERMEDIATE REPORT

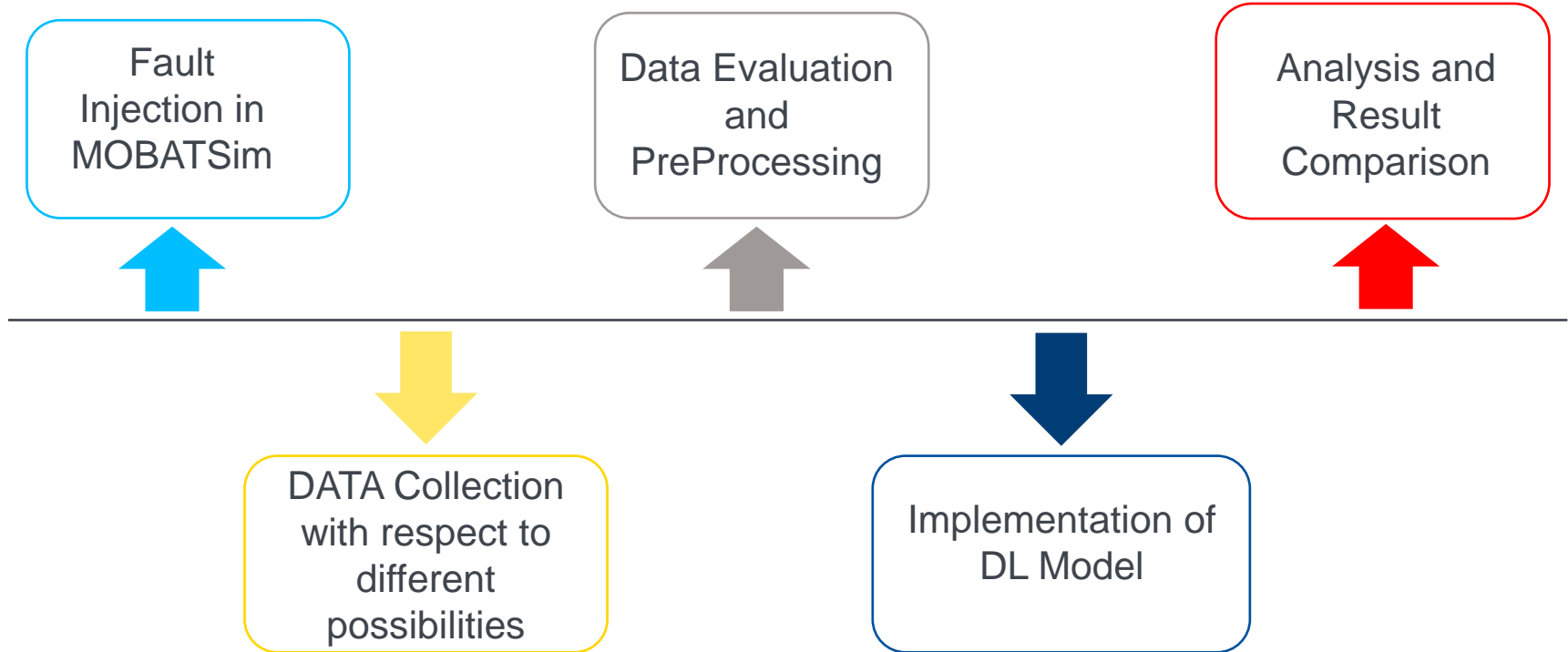
Nikita Jhawar

M.Sc. Electrical Engineering

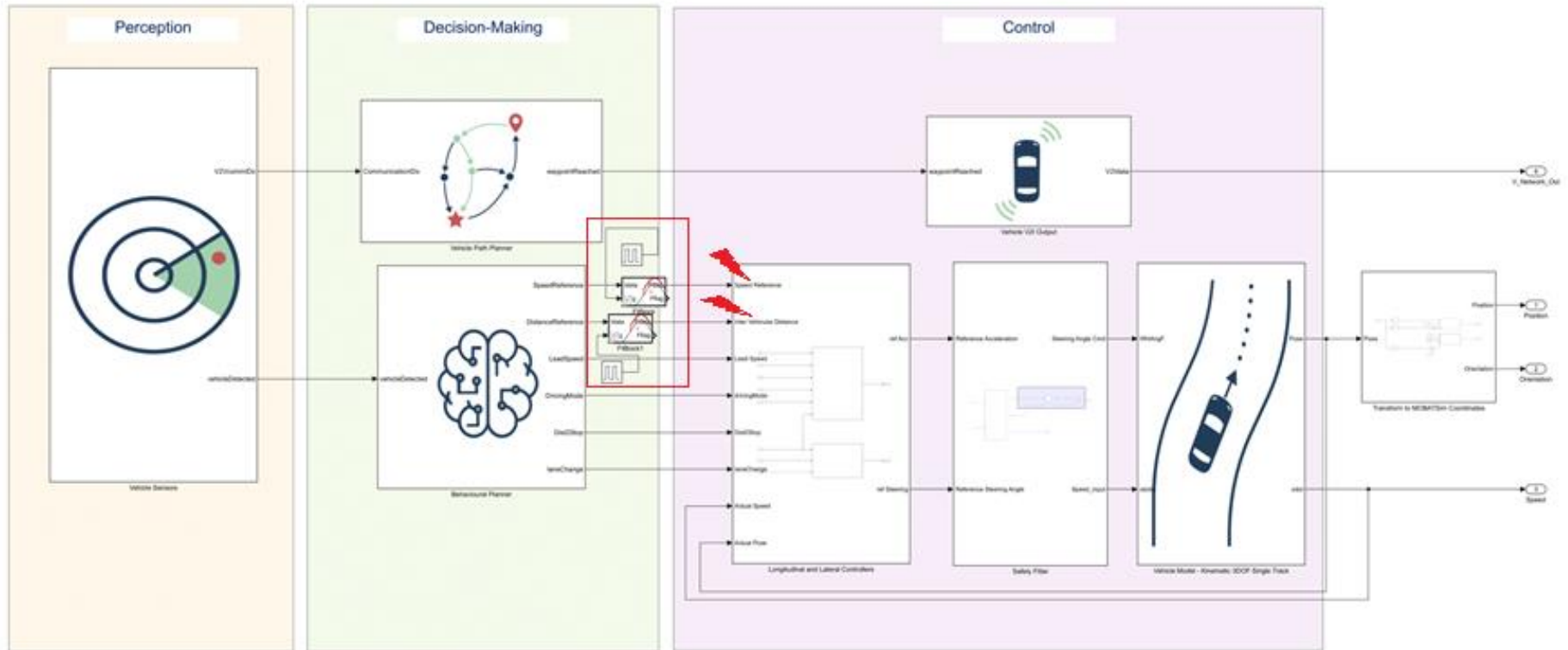


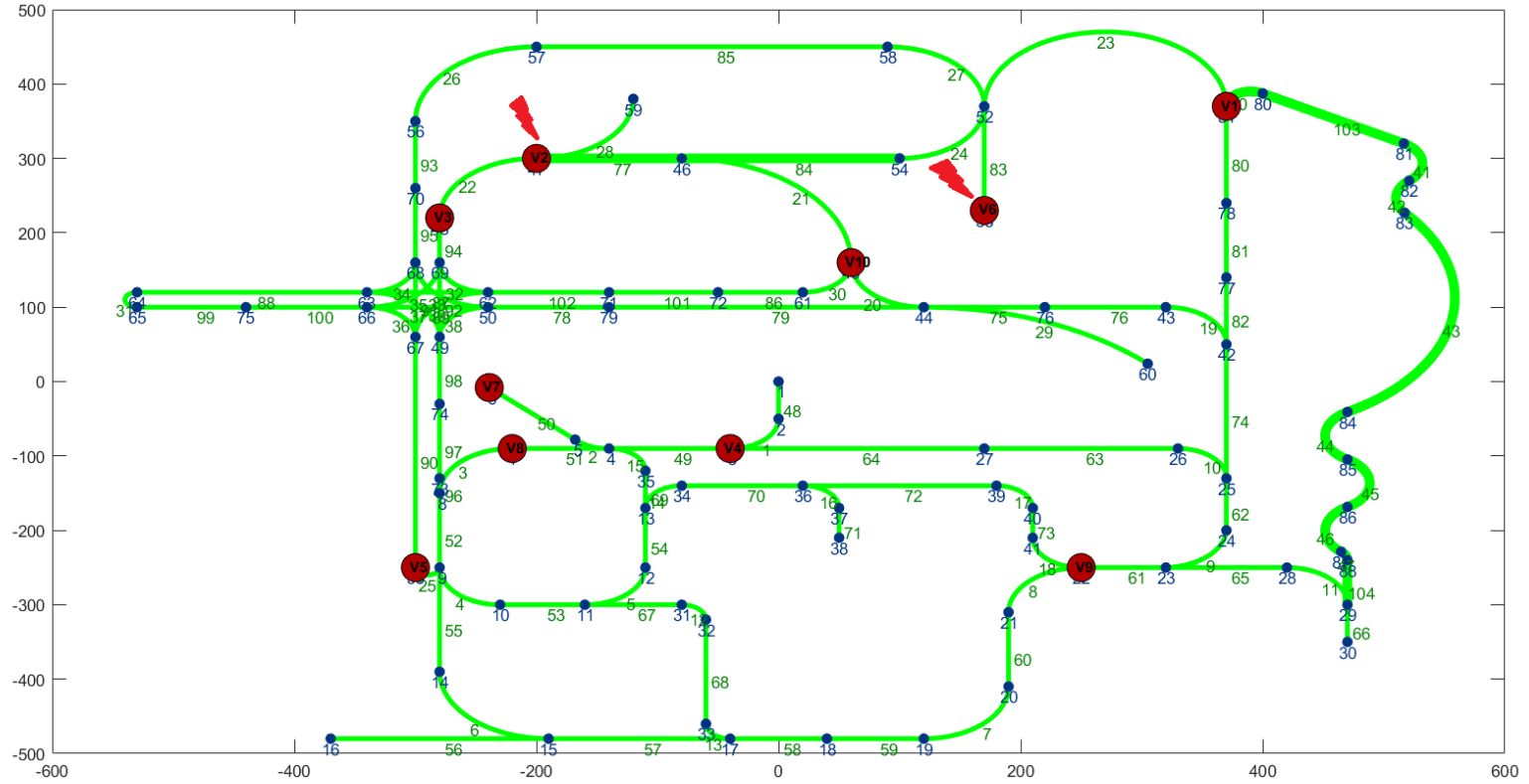


# TIMELINE



# FAULT INJECTION







## FAULT DETAILS

Vehicle	Target Component	Target Variable	Fault type	Fault duration	Injection Type
Vehicle 2	Speed Sensor	Speed Reference	Noise, StuckAt, Offset/Bias	0.6, 1.2, 1.8, 2.4, 3.0, 3.6, 4.2, 5	Uniform (At 10 secs, At 30 secs)
	Distance Sensor	Intervehicular Distance	Noise, StuckAt, Offset/Bias	0.6, 1.2, 1.8, 2.4, 3.0, 3.6, 4.2, 5	Uniform (At 10 secs, At 30 secs)
Vehicle 6	Speed Sensor	Speed Reference	Noise, StuckAt, Offset/Bias	0.6, 1.2, 1.8, 2.4, 3.0, 3.6, 4.2, 5	Uniform (At 10 secs, At 30 secs)
	Distance Sensor	Intervehicular Distance	Noise, StuckAt, Offset/Bias	0.6, 1.2, 1.8, 2.4, 3.0, 3.6, 4.2, 5	Uniform (At 10 secs, At 30 secs)





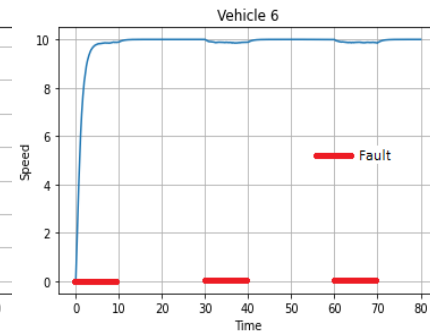
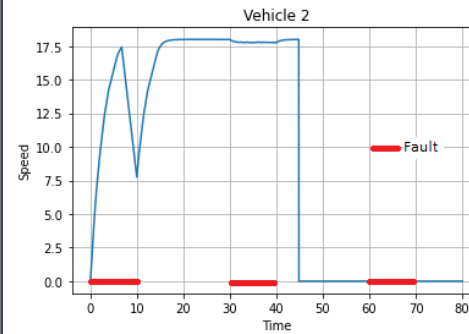
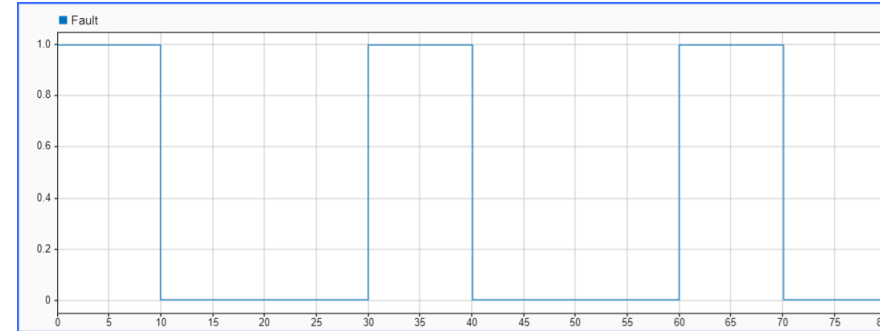
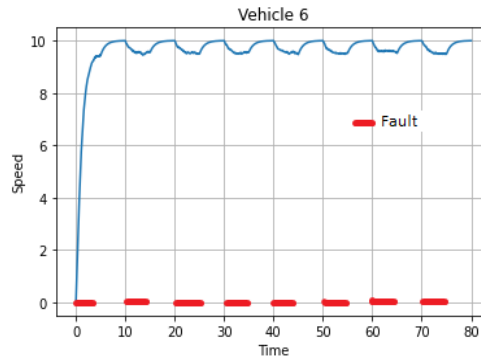
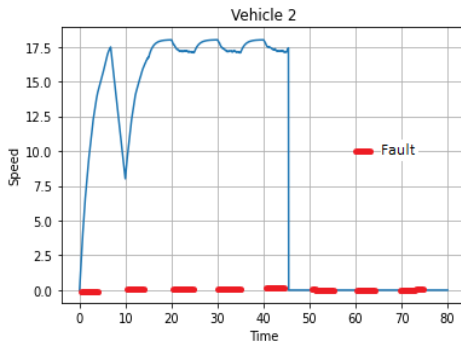
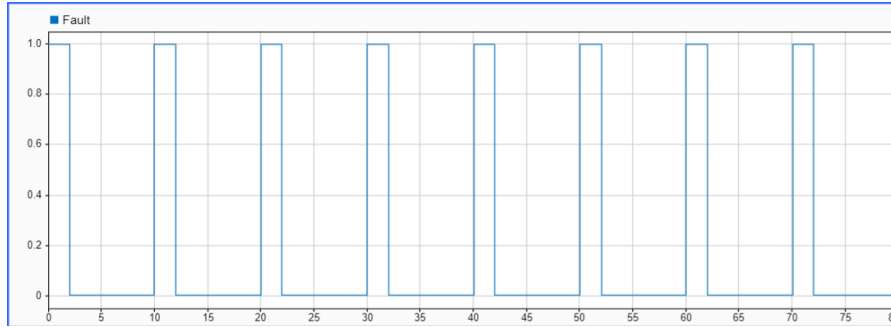
# COLLECTION AND EVALUATION OF DATASET

- Three driving scenarios have been considered: Urban City Traffic, Platoon Control, and Road Merge Collision
- Three Error category has been considered: Bias/Offset, Stuck-at fault, and Noise.
- For every scenario, 8 faulty cases will be simulated for each error category (80 faulty cases for each category as there are 10 vehicles)
- Error values (for offset error), Injection time, and error duration have been predefined and chosen.
- Bias/ Offset and Noise takes value 5.
- Fault duration can any value in: [0.6, 1.2, 1.8, 2.4, 3.0, 3.6, 4.2, 5]
- The data is already resampled to a 0.02-sec sampling rate.
- A total of 4000 samples are collected in every dataset.



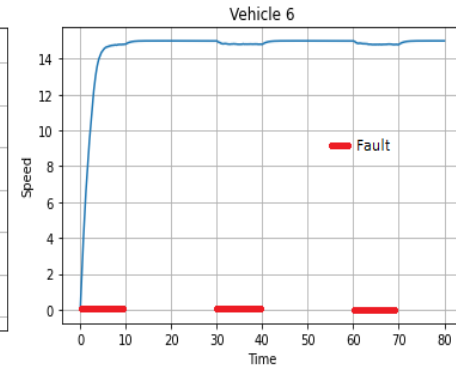
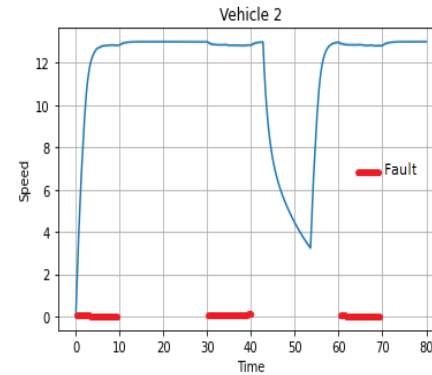
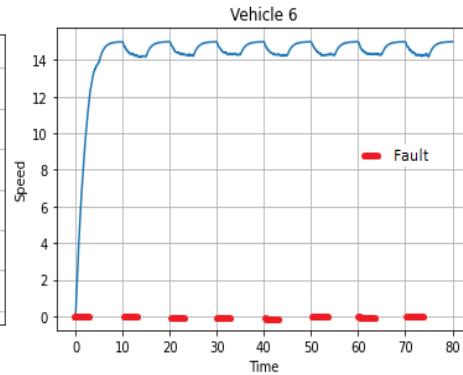
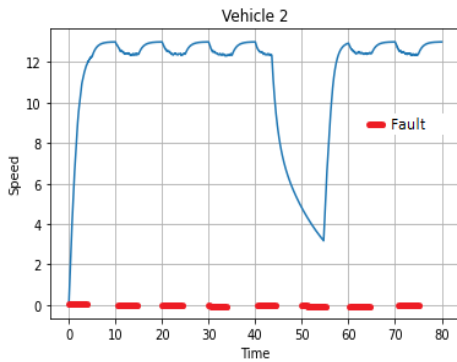
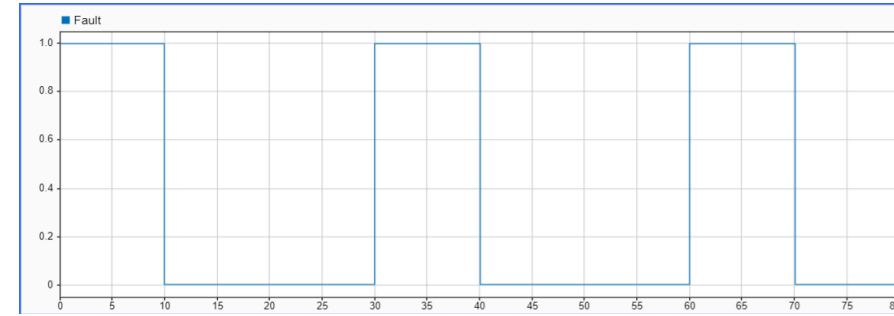
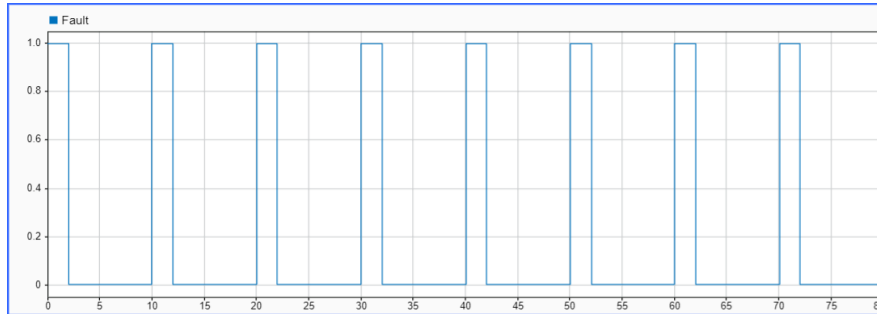


# URBAN CITY TRAFFIC





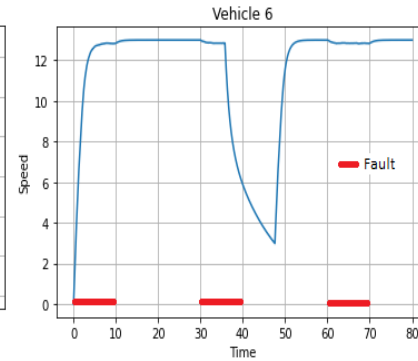
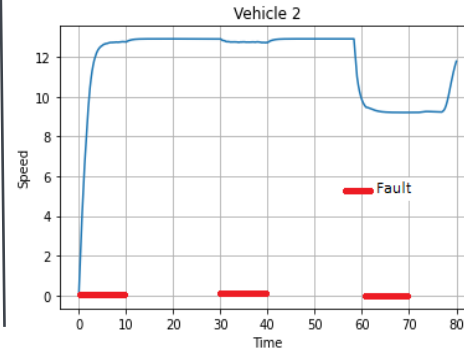
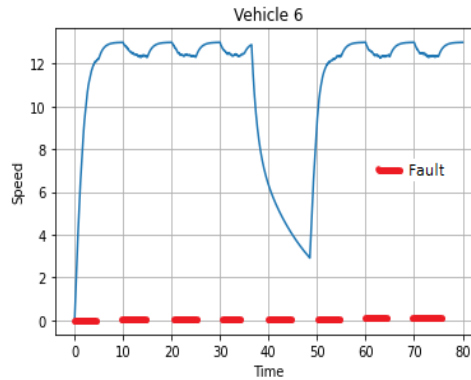
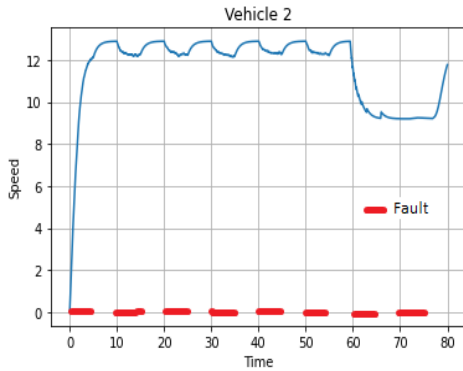
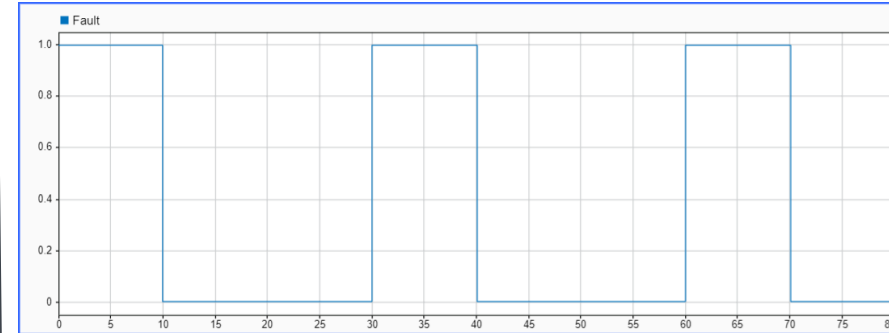
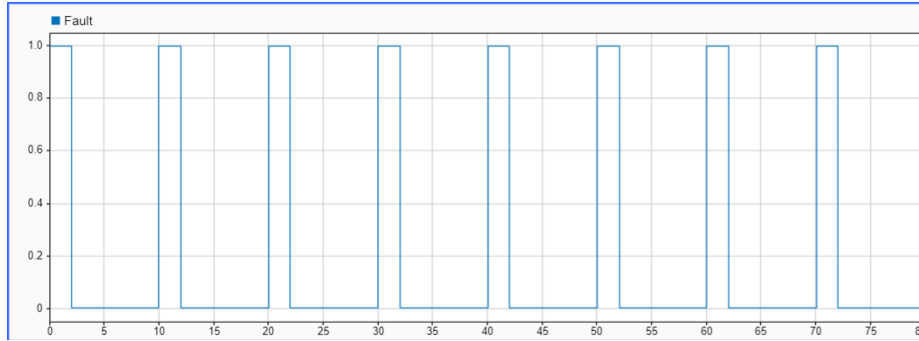
# PLATOON CONTROL







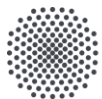
# ROAD MERGE COLLISION



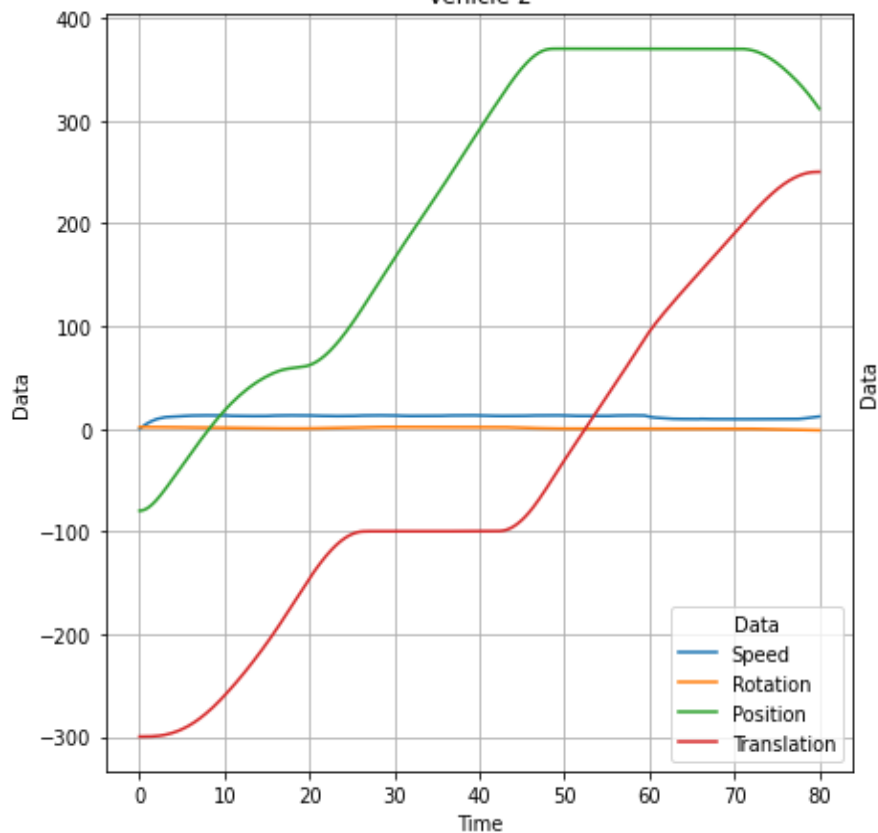
# FINAL DATA FORMAT

Time	Speed	Rotation	Position	Translation
Seconds	Float	Float	Float	Float

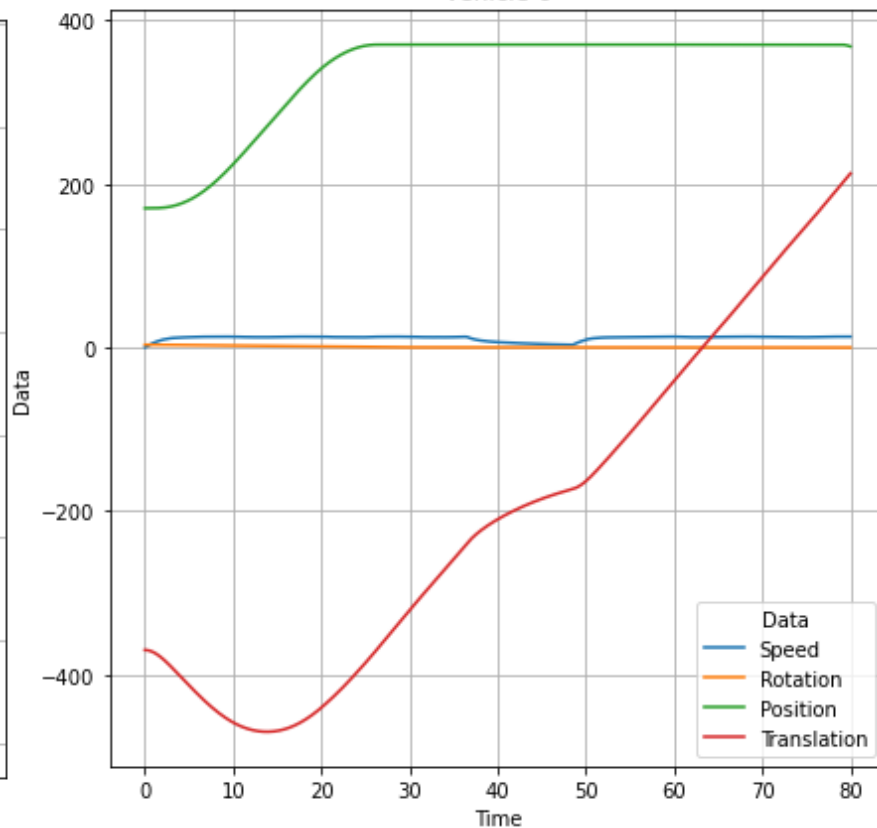
- **Minimum No. of Attributes:** 4
- **Initial Data Sample Rate:** 0.005 seconds
- **Final Data Sample Rate:** 0.02 seconds
- **Every Simulation Duration:** 80 seconds (4000 entries for each simulation)
- **Total no. of simulations:** 30 (Fault-free) +  $240 \times 3$  (Faulty) = 750  
[Faulty data includes fault-free entries where there is no error injection.]



Vehicle 2



Vehicle 6

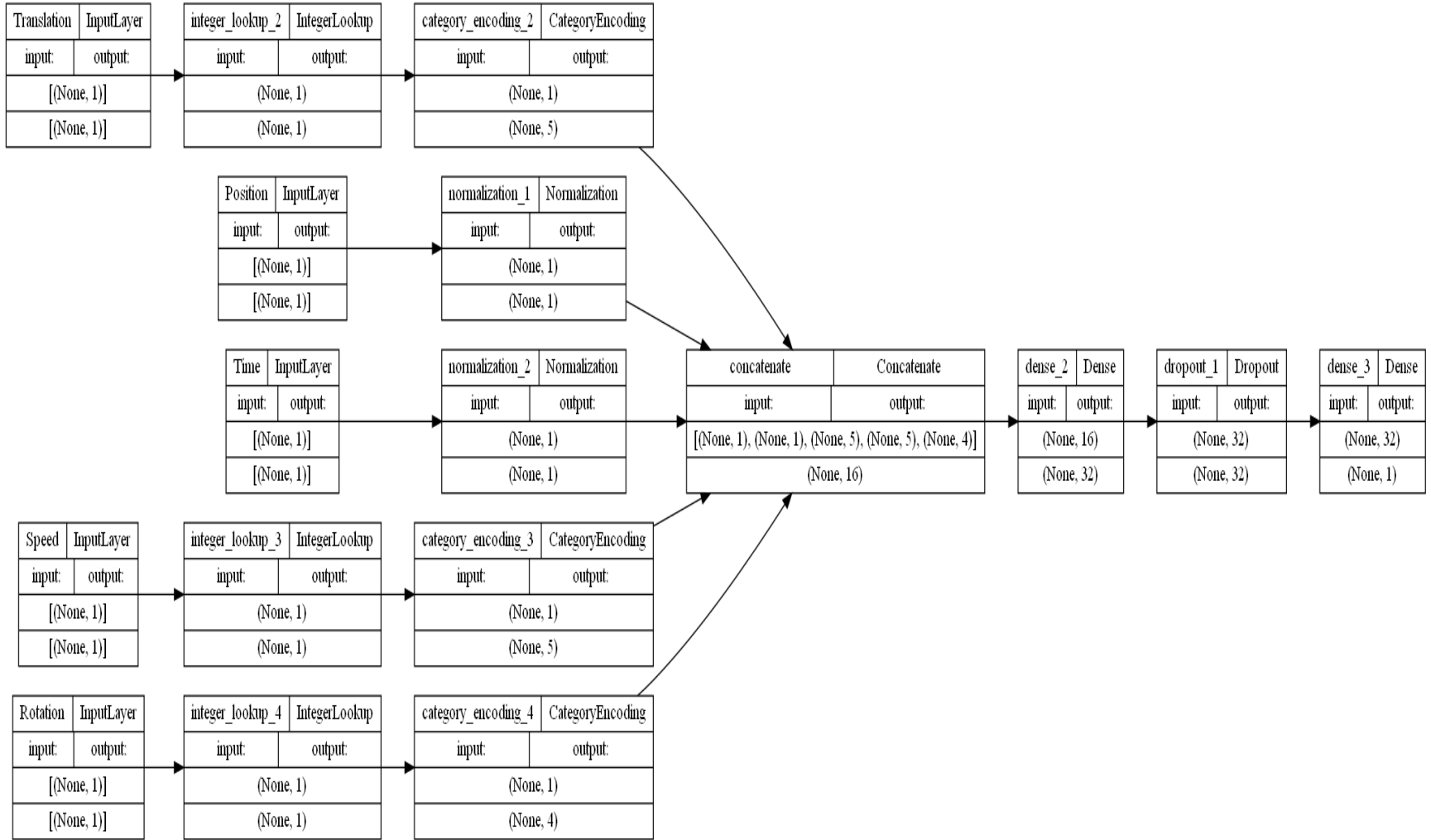




# DATA PREPROCESSING

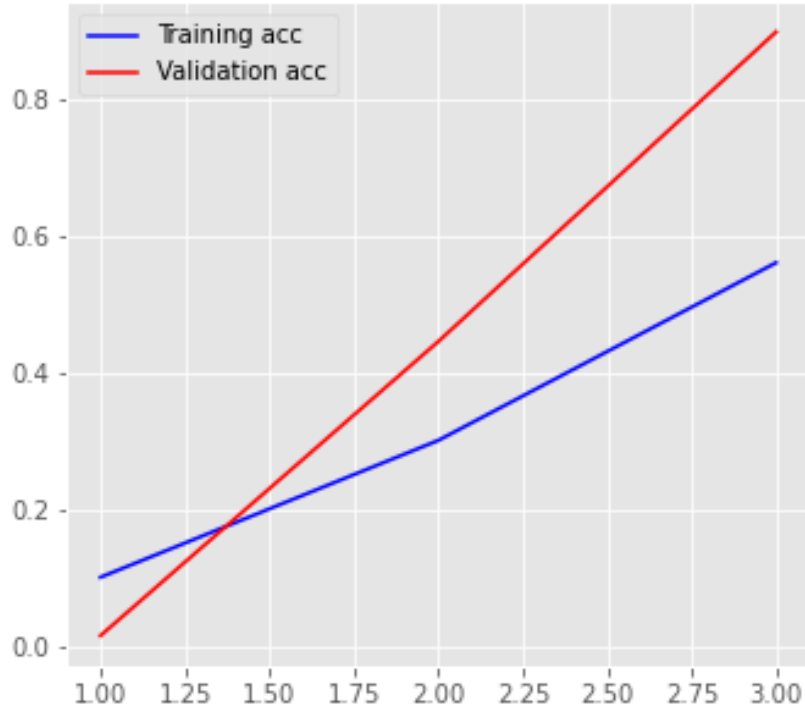
- Initial Dataset is obtained with Timestamp and 8 data columns.
- After evaluation, the final dataset format is Timestamp and 4 columns named: Speed, Rotation, Position, and Translation
- During preprocessing, data is split into training examples, validation examples, and test examples
- Pre-Processing will be performed with respect to every attribute: Speed, Position, Rotation, and Translation
- All the features are concatenated and encoded accordingly for better accuracy in Deep Learning model



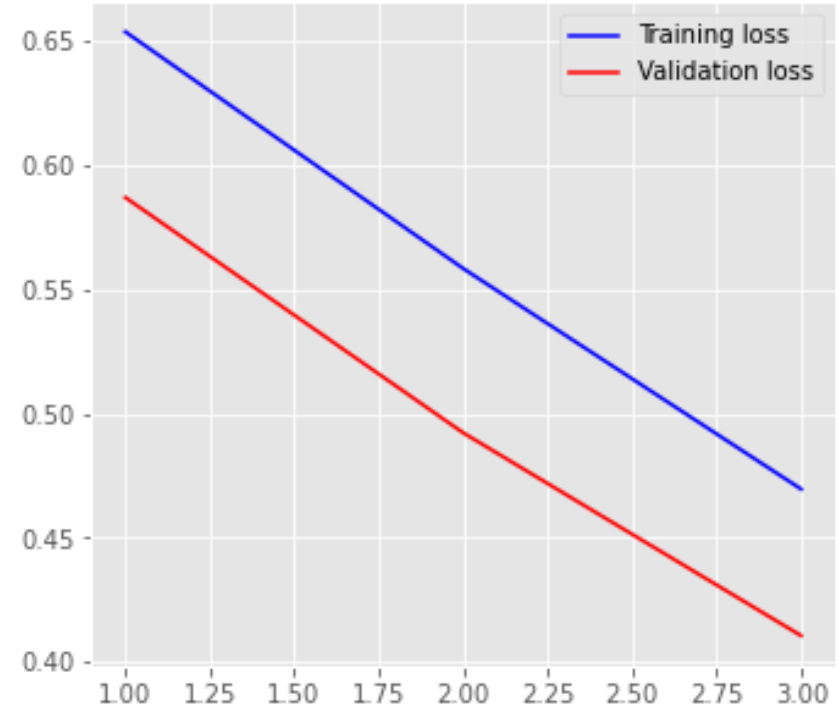


# DL MODEL OUTPUT (Accuracy and Loss)

Training and validation accuracy



Training and validation loss





# TOPICS TO DISCUSS

- **DATA GENERATION:** Willing to include dataset for a non-uniform sample as well
- **DATA PREPROCESSING AND OUTPUT:** Preprocessing and Output (in forms of accuracy and Loss) will be recorded for every attribute as well as for uniform and non-uniform dataset
- **FINAL REQUIREMENTS FOR THE THESIS:** Need to know if any other processes should be executed.
- **SUBMISSION:** Probable submission date for Thesis by 30<sup>th</sup> May, 2022





University of Stuttgart

**THANK YOU FOR YOUR  
TIME AND ATTENTION**

