Progress Report of Master Thesis in Brief

DEEP LEARNING-BASED MONITORING OF URBAN TRAFFIC USING MOBATSIM

GETTING TO KNOW MOBATSim

- In order to get to know MOBATSim, all the various kinds of small experiments mentioned in the Getting Started and Documentation file have been performed and evaluated the results.
- Also, all script modules present in the MOBATSim repository have been read and understood thoroughly and performed many simulations with different kinds of changes to get a better overview of MOBATSim.

FAULT INJECTION IN MORE THAN ONE VEHICLE

- Fault injection using the FI block from https://de.mathworks.com/matlabcentral/fileexchange/75539-fault-injection-block-fiblock in Vehicle 2 and Vehicle 6 is performed.
- Every Scenario in MOBATSim consists of 10 vehicles.
- Three different scenarios are considered: Urban City Traffic, Platoon Control, and Road Merge Collision, and separate prepare_simuator files are built for all three of them.
- In all these three scenarios, V2 and V6 have been injected with fault at the speed sensor and distance sensor.
- Each fault has three types: Noise, StuckAt, and Offset/Bias.
- Each type has 8 fault durations: [0.6, 1.2, 1.8, 2.4, 3.0, 3.6, 4.2, 5.0]

DATASET GENERATION OF FAULT-FREE AND FAULTY CASES

- Each Simulation generated 30 Timeseries datasets for each scenario. V1, V2, …. V10 for 10 vehicles
  V1_speed, V1_Rotation, and V1_Translation for each vehicle.
- Datasets for all three properties of each vehicle are then concatenated into one named after the vehicle number V1, V2, V3, V4, V5, V6, V7, V8, V9, and V10.
- Therefore, for every scenario 10 time-series data files are generated representing each vehicle running. In total, 30 fault-free datasets are generated by running a fault-free MOBATSim Model.
- Also, the faulty and fault-free Models are differentiated in the repository.
- In the same way, after injecting faults in each scenario, faulty datasets for all 10 vehicles are generated for each fault type.
- Lastly, for each fault type, datasets are generated for each fault duration.
- Total number of faulty datasets:
  3(Driving scenario) *3(Fault type) *8(Fault Duration)*10(vehicles) = 720 dataset files.
- Overall, 720 + 30 = 750 dataset files in. mat format are generated.
- Note: Faulty datasets contain fault-free files for places where the fault has not been injected.

DATA EVALUATION AND PRE-PROCESSING

- Initially, the time-series datasets obtained are in .mat format. They are then converted into .txt and .csv formats for easy processing and evaluation in DL model.
- The datasets initially consist of 8 attributes and a Timestamp.

- It is then shortened to only 4 attributes because the other 4 attributes have always been constant.
- Therefore, the CSV data files contain the final format of data as shown in the presentation (Time, Speed, Rotation, Position and Translation)
- These CSV files are then preprocessed and split into training examples, validation examples, and test examples with respect to every attribute.
- All the features are properly encoded to fit in a DL Model

IMPLEMENTATION OF Deep Learning MODEL

- A deep learning model is defined and trained in order to provide maximum accuracy and minimum loss.
- A trained dataset is then evaluated using this Deep Learning Model showing an accuracy varying between 90-100% depending on the attribute considered during pre-processing.
- Graphs for the same distinguishing between training and validation datasets are generated.
- A python file 'DL Model for MOBATSim.ipynb' is created that consists of all the steps for preprocessing, defining, and training the deep learning model.

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