



NMP Presentation



Data Science in
Redback Racing

Presented by:
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Today's Agenda



Key takeaways:

- Objective & approach
- Pre-processing steps
- Exploratory data analysis (EDA)
- Input parameter analysis
- Predictive modelling

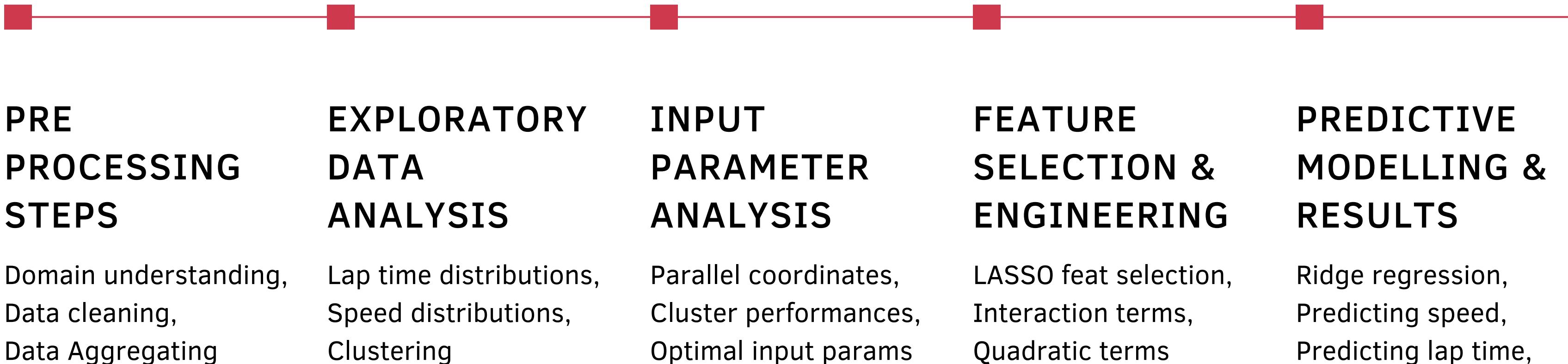
Objective

**Predict the maximum lap time
for a simulated car.**

Redback collects all sorts of data from many sensors on their cars. In our case, we were given rich simulated data on a number of car configurations using Assetto Corsa. We had access to the input parameters and the outputs of each respective car.

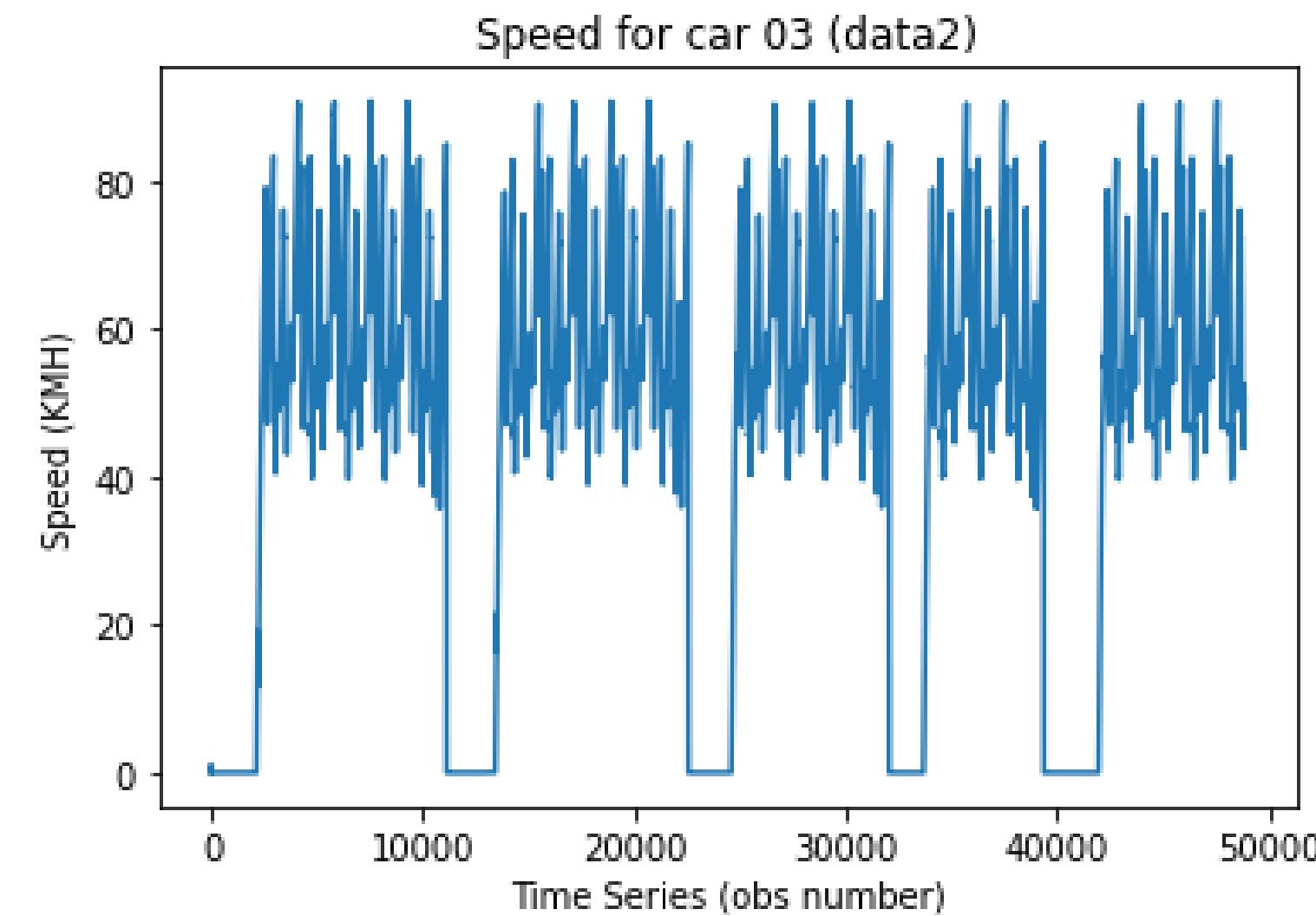
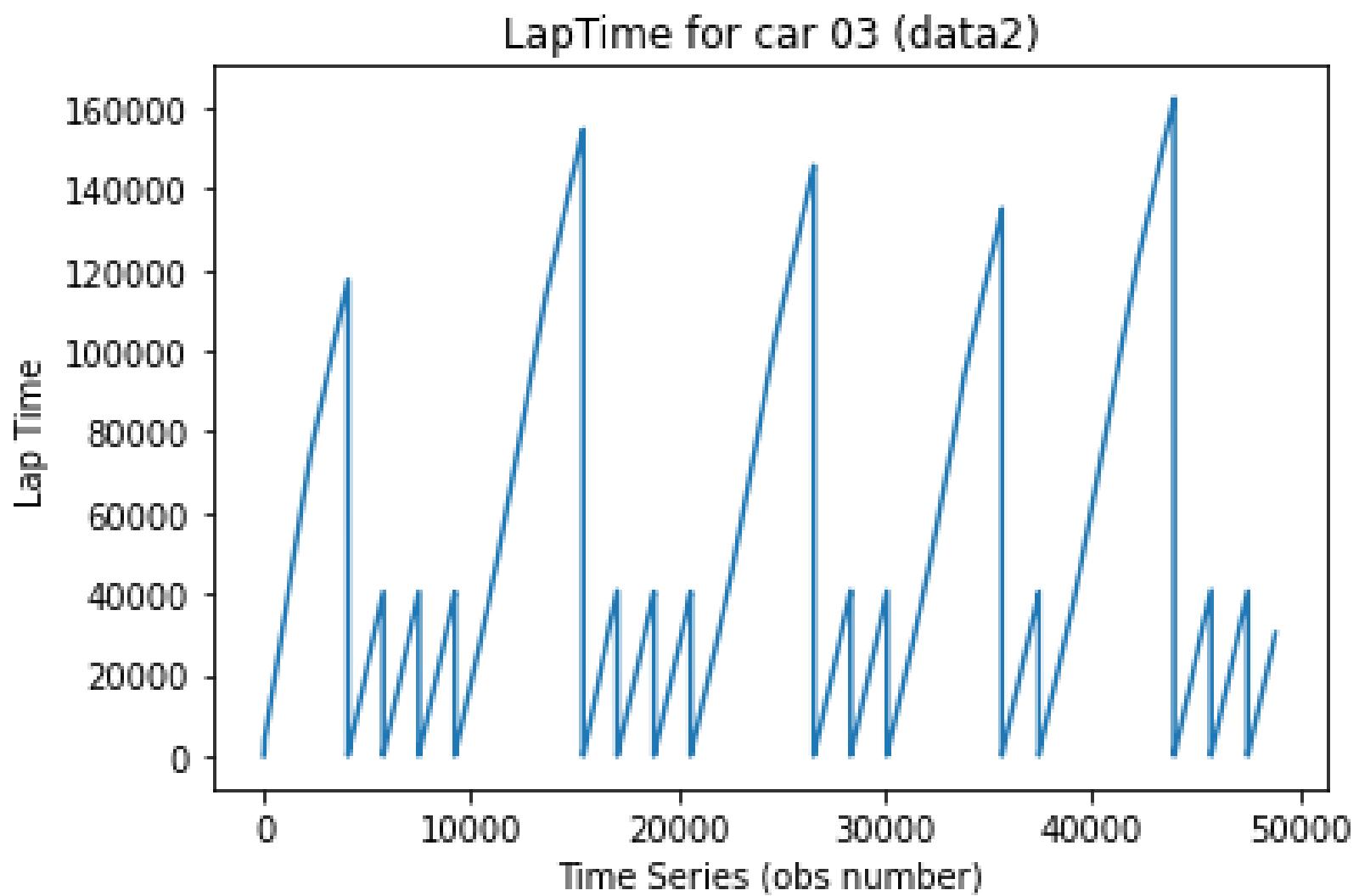


Approach



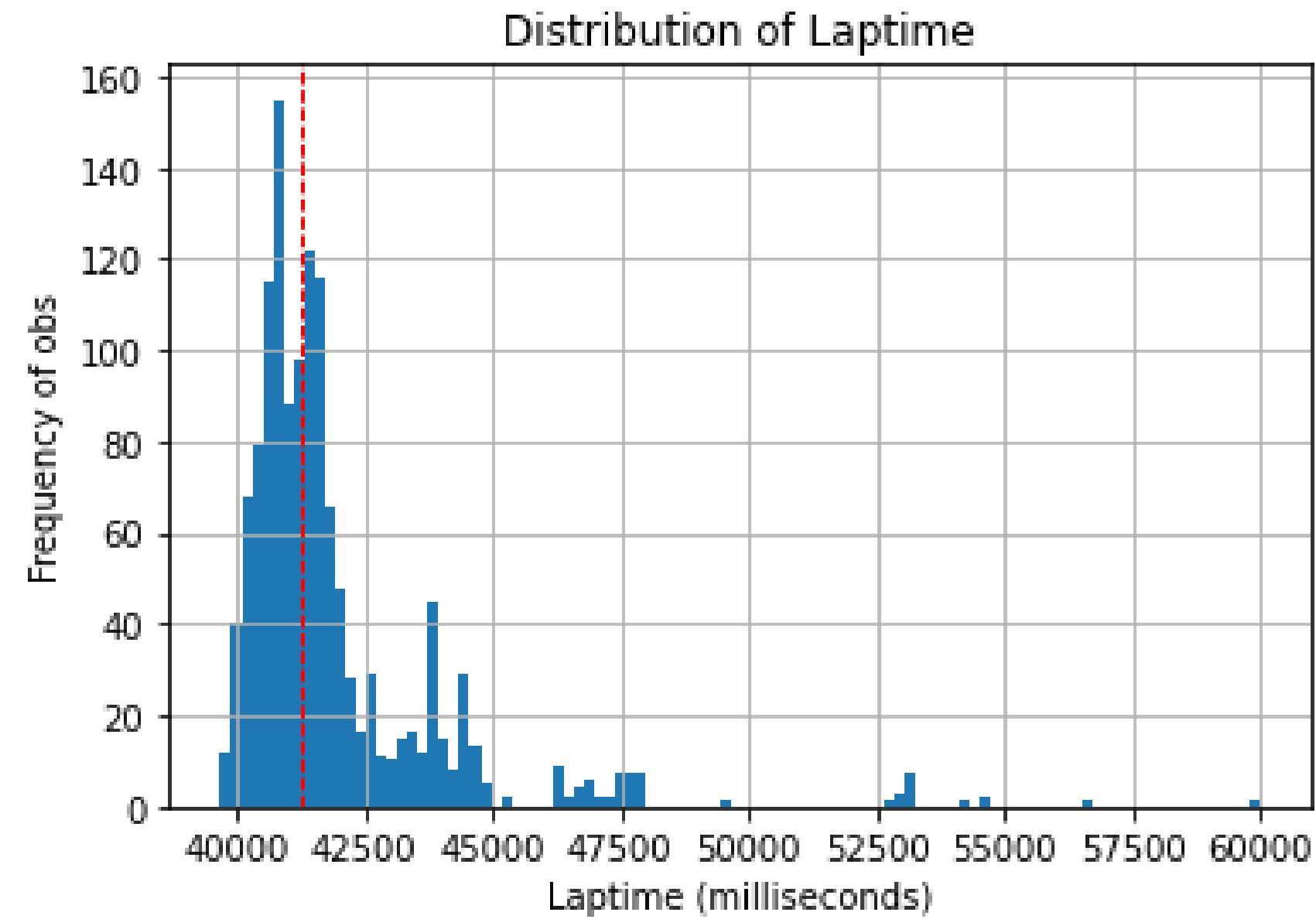
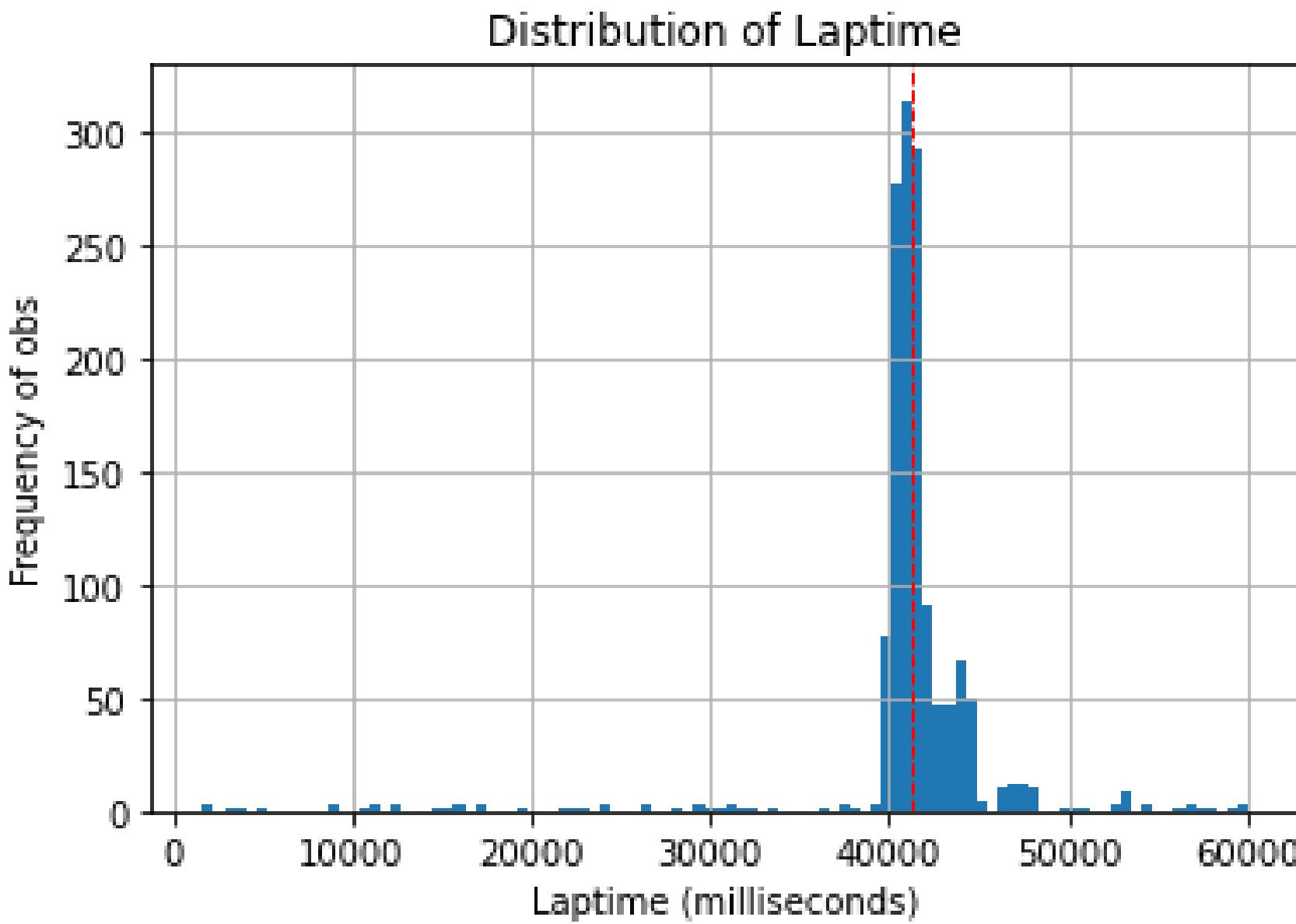
Pre-processing

1. Lap time and Speeds for a simulated car over its race
2. Removed Pit laps from analysis

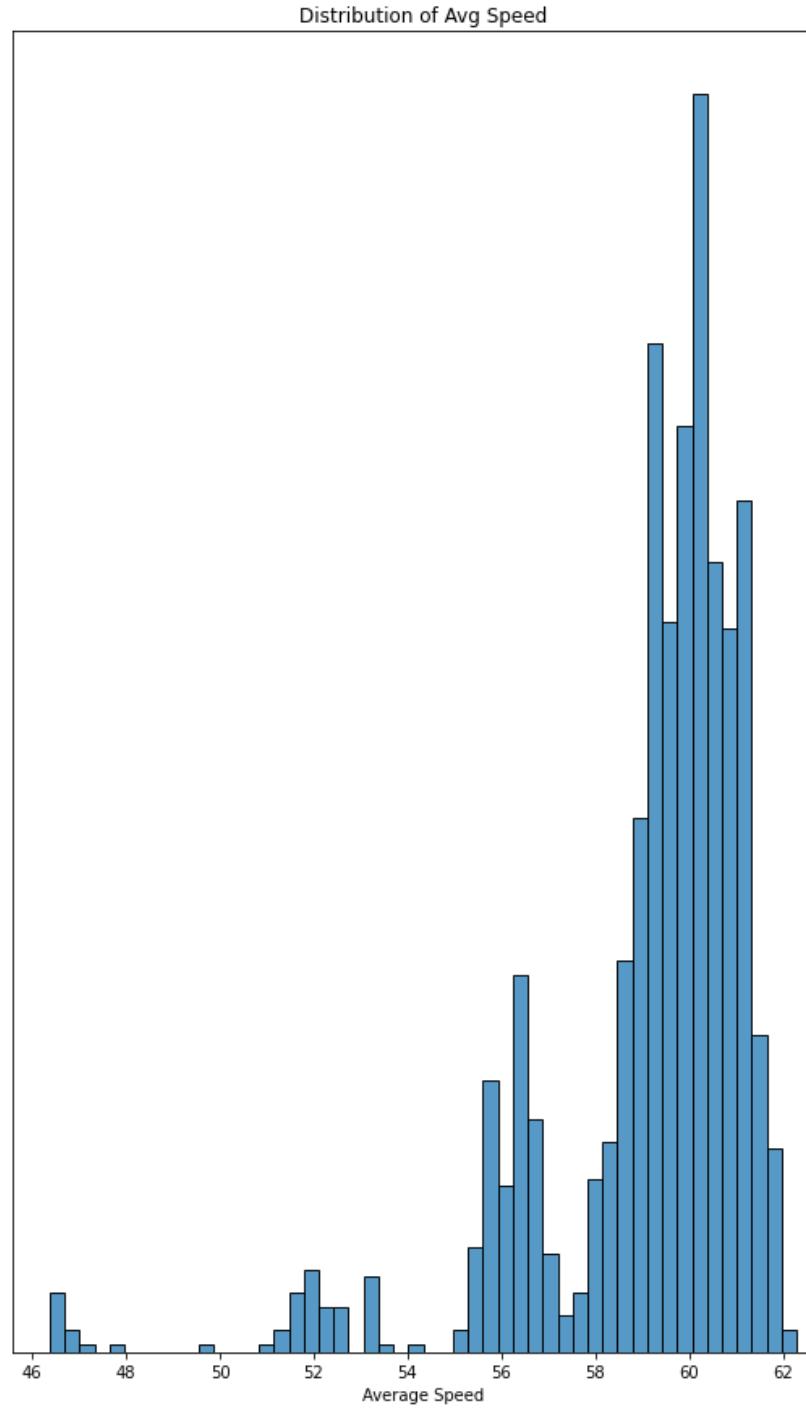
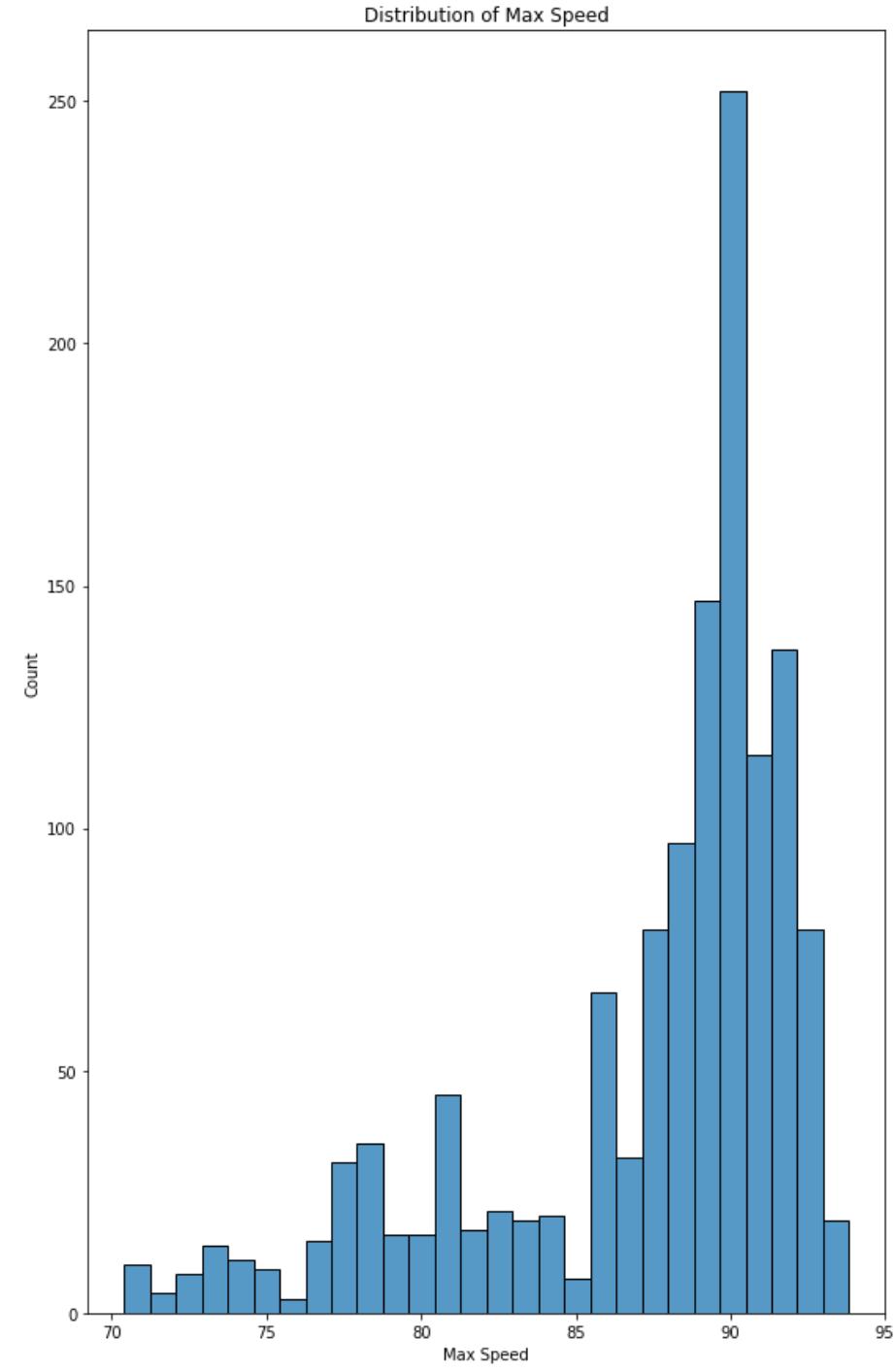


EDA - Lap times

1. Plot on left shows distribution of lap times for all cars
2. Plot on the right shows distribution of lap times for all cars after removing unfinished laps

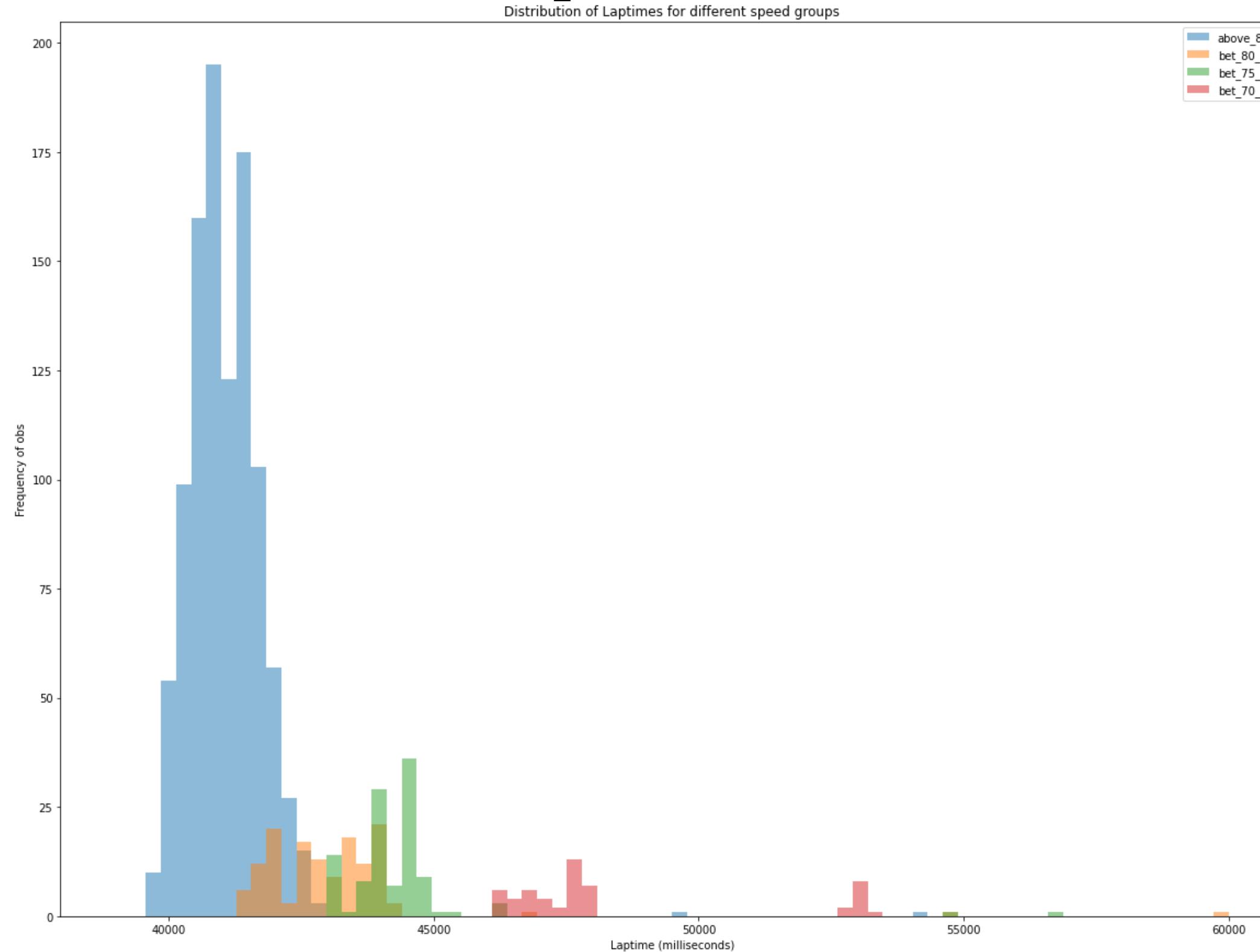


EDA - Speeds



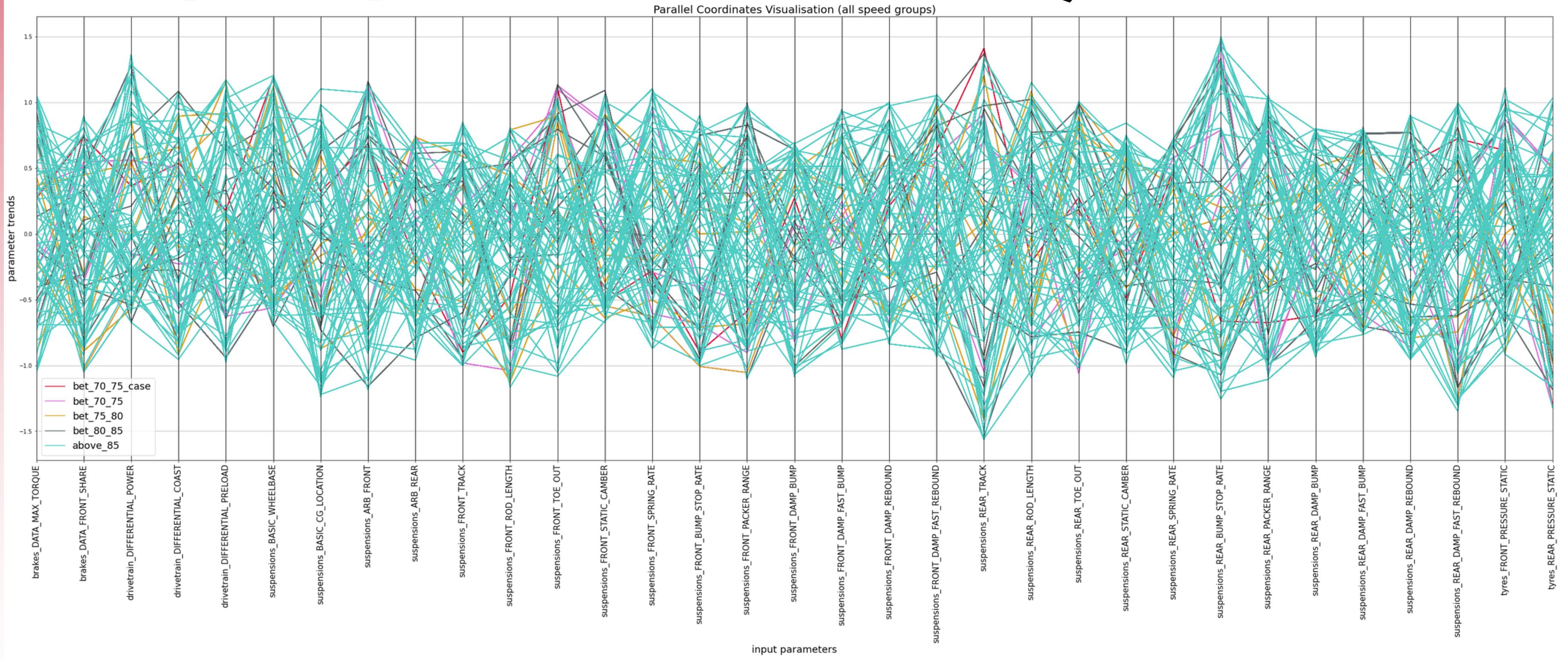
- Distribution of max speed and average speed for all cars
- Some cars seem to only be able to travel around 70KMH whilst others can go above 90KMH

EDA - Lap time and Speed

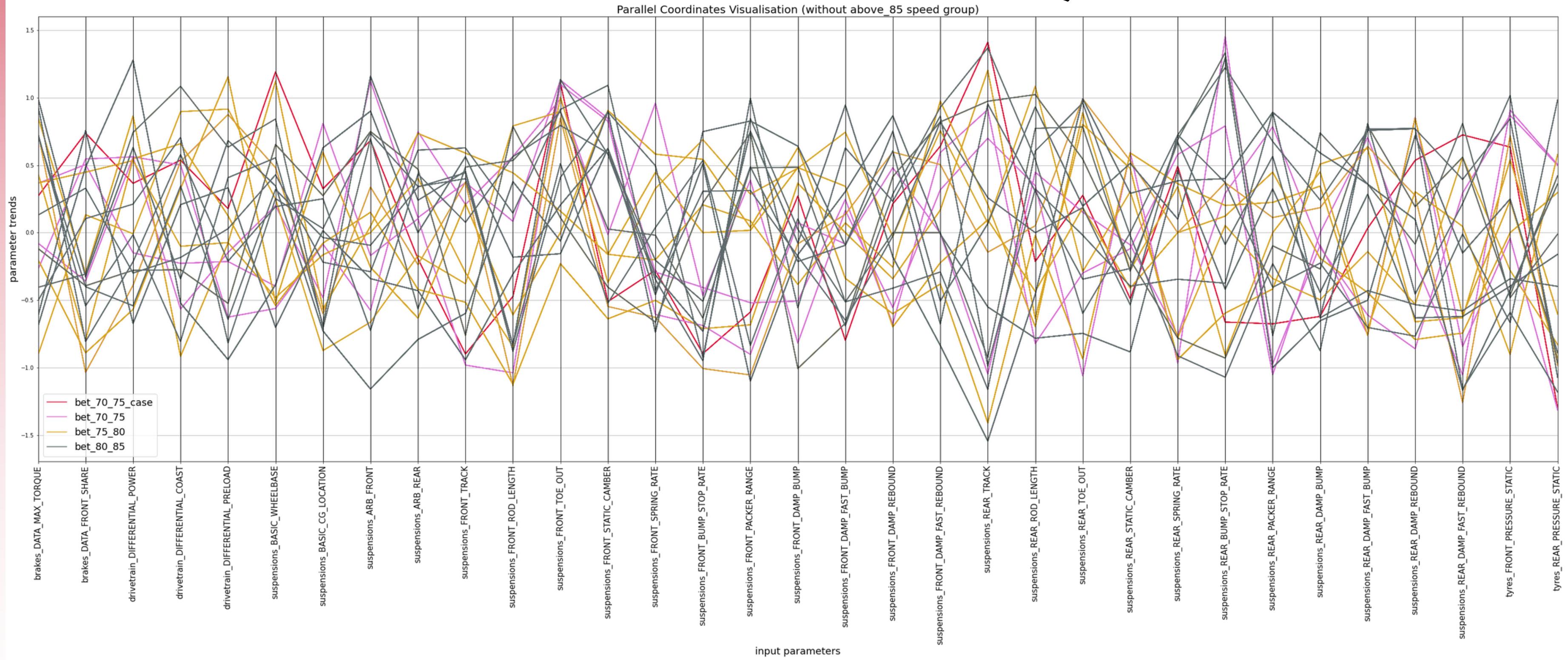


- How different speed groups perform in terms of lap time
- Relationship between max speed and lap time is clear
- There is a large speed group imbalance

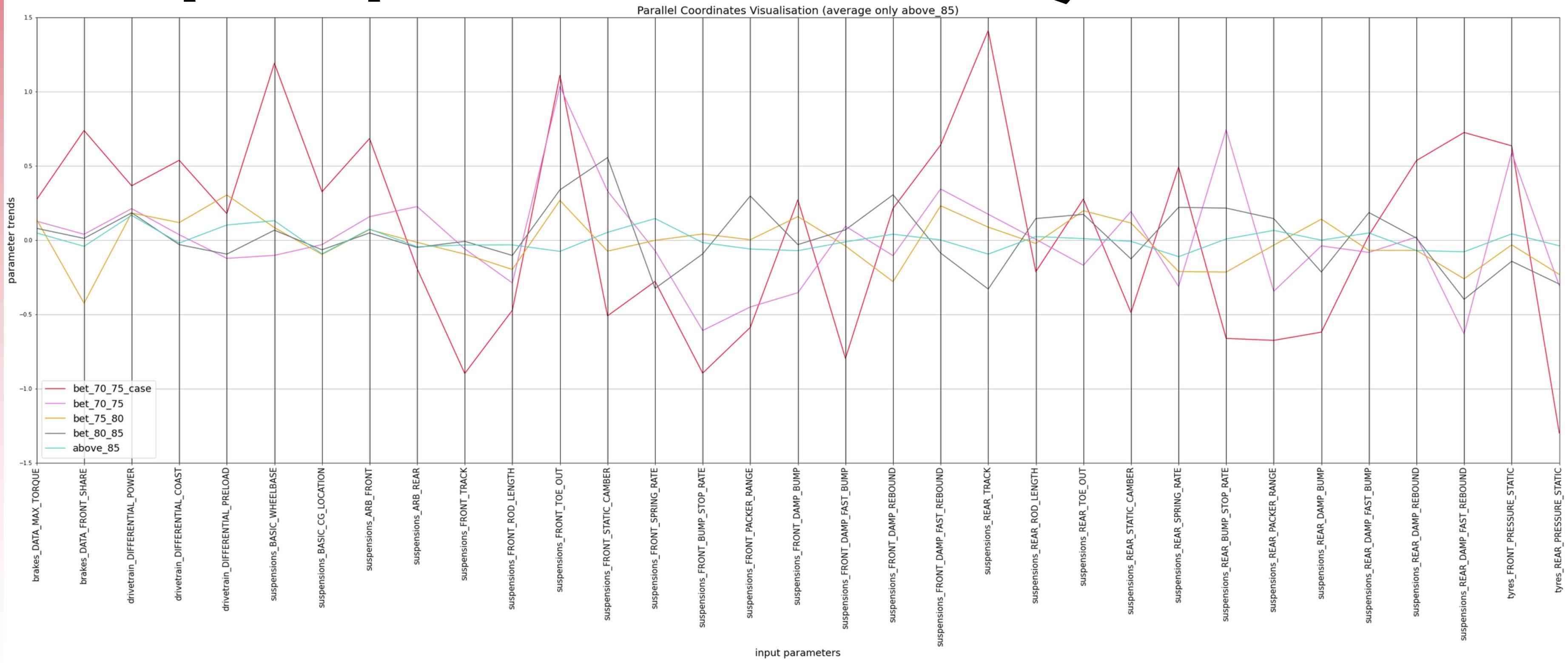
Input parameter analysis



Input parameter analysis



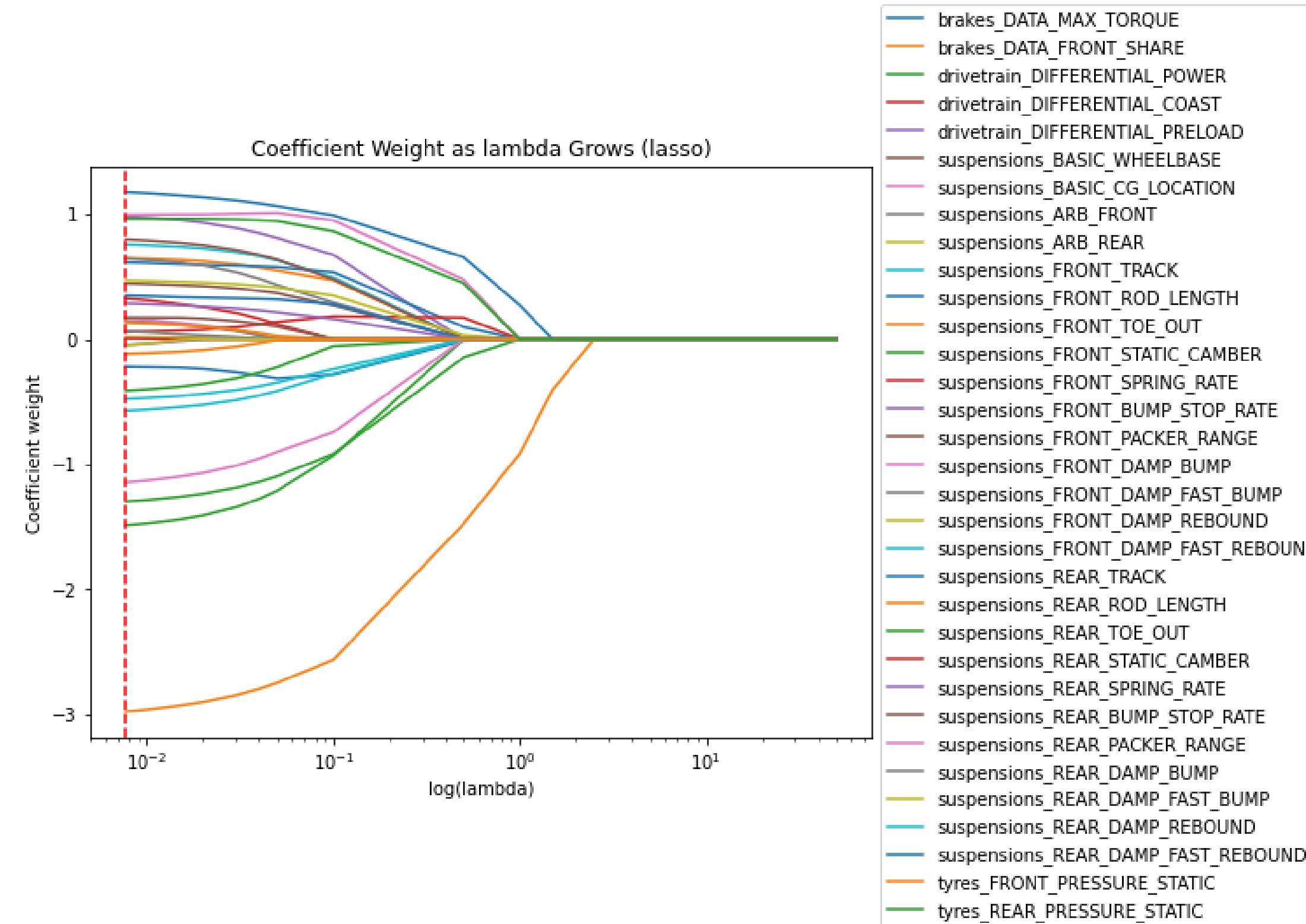
Input parameter analysis



Input parameter analysis

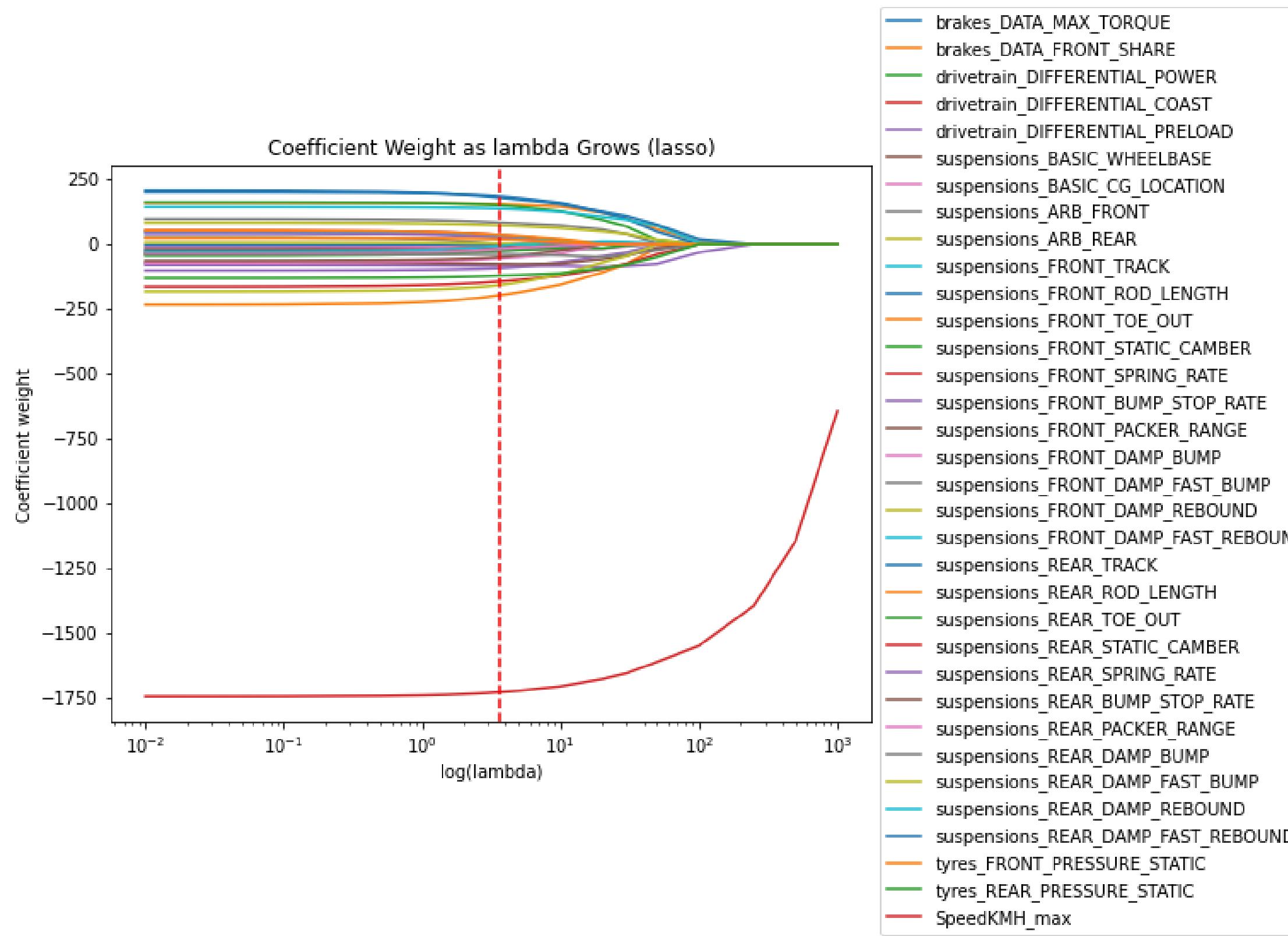
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drivetrain_DIFFERENTIAL_POWER	0.4074694417238000	suspensions_FRONT_DAMP_REBOUND	2690.0004911557300
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drivetrain_DIFFERENTIAL_PRELOAD	12.069866973555300	suspensions_REAR_TRACK	1.2029023800195900
suspensions_BASIC_WHEELBASE	1.6885505093046000	suspensions_REAR_ROD_LENGTH	0.014862086190009800
suspensions_BASIC(CG)_LOCATION	0.4723054358472090	suspensions_REAR_TOE_OUT	0.0013261508325171400
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suspensions_ARB_REAR	81671.1029793046	suspensions_REAR_SPRING_RATE	44650.612396376100
suspensions_FRONT_TRACK	1.207917277179240	suspensions_REAR_BUMP_STOP_RATE	119551.14106624900
suspensions_FRONT_ROD_LENGTH	0.01711711067580800	suspensions_REAR_PACKER_RANGE	0.0834124289911851
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Predictive Modelling - Speed



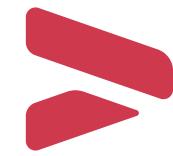
- Feature selection using LASSO
- Ridge regression for predictive modelling using selected features
- Model without interaction terms performed better than the model with interaction terms

Predictive Modelling - Lap Time



- Feature selection using LASSO
- Ridge regression for predictive modelling using selected features
- Model without interaction terms performed better than the model with interaction terms

Model Drawbacks



1

Trained on imbalanced data

Use under sampling of the large group or over sample the smaller groups using SMOTE

2

High bias

Due to class imbalance, it resulted in my model being a bit too optimistic.

Appendix

