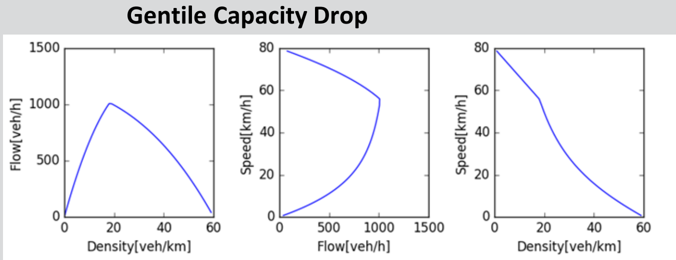
Data-driven calibration of the fundamental diagram for real-time traffic simulation models

Master‘s Thesis of Ahmet Cagri Tekin

Mentoring:
M.Sc. Sasan Amini
M.Sc. Gabriel Tilg

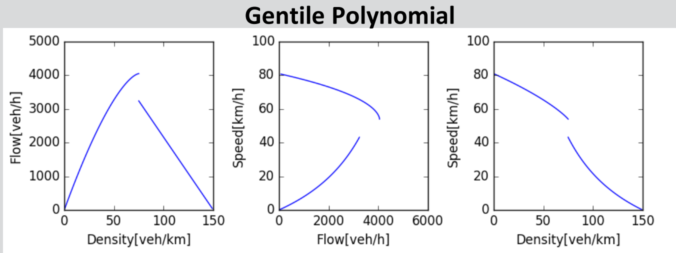
External Mentoring:
Dr. Daniele Tiddi (PTV Group)

Gentile Capacity Drop



V=80, W=40, Q=1200, J=60, $\gamma^0 = 2, \gamma^+ = 3$

Gentile Polynomial



Q=4050, J=150, $\gamma^0 = 1.5, \gamma^+$=1, ω=0.2

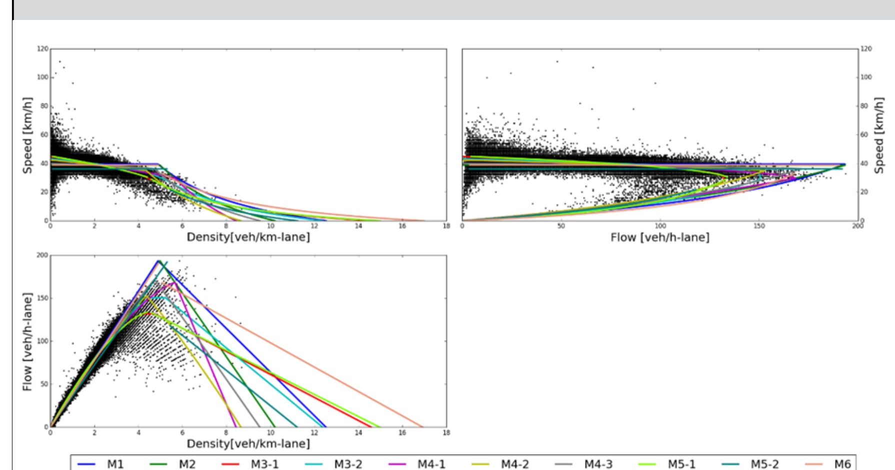
Why?

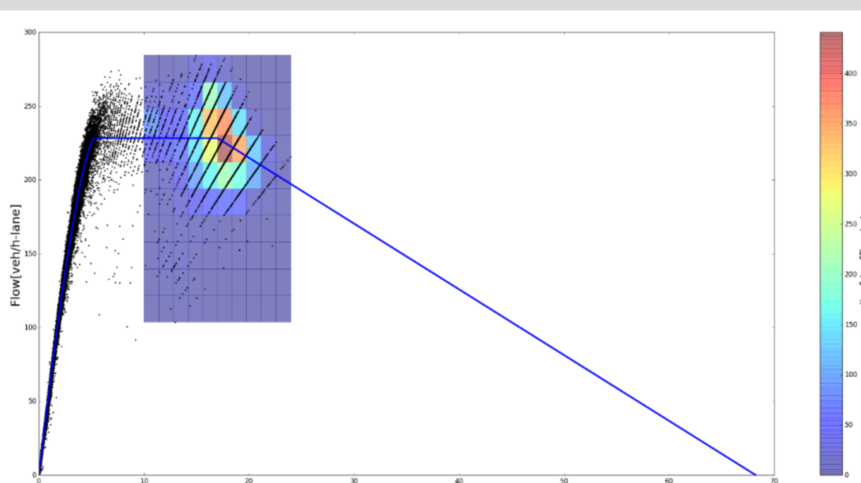
- Real-time traffic models rely on dynamic traffic assignment
- Fundamental diagrams (FD) are used in dynamic traffic assignment procedure
- Links are represented by FDs
- FDs were manually fitted to data
- Spatio-temporal characteristics were not considered

Research goals:

- Developing an automated fundamental diagram fitting algorithm
- Clustering similar fundamental diagrams

Method Code	Optimization Problem	FD Form
M1	Dervisoglu (w/ $V_{init} = 40km/h$)	Triangular
M2	Extended Dervisoglu (w/o V_{init})	
M3	Flow-density costs	Gentile Polynomial
M4	Speed-flow costs	
M5	Flow-density costs	Gentile Capacity-Drop





Conclusion

- Method M4 overperform the others in u-q relation
- Method M5 cannot support flat capacity range
- Method M5 should be preferred over M3 when data does not show trapezoidal trend
- Nonuniform data causes biased estimation
- Data weighting can be applied
- Influence of loss functions should be further investigated