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

Master's Thesis of Ahmet Cagri Tekin

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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 | Optimization Problem | FD Form |
-------|----------------------|---------|
M1     | Dervisoglu (w/ \( V_{\text{init}} = 40 \text{ km/h} \)) | Triangular |
M2     | Extended Dervisoglu (w/o \( V_{\text{init}} \)) | |
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