The influence of a charging station's location on its profitability

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Background

The increasing number of electric vehicles can cause congestion at charging stations, since charging takes longer than fueling. Novel routing solutions are required

Routing algorithms

MAX: Maximises utility function, assuming zero waiting times

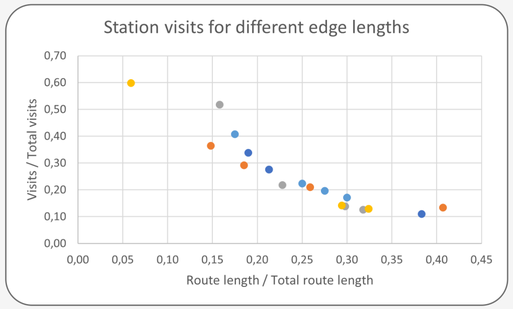
IARS[1]: Maximises utility function, registers intentions of each vehicle to calculate waiting times at charging stations

Utility function: Weighted average of time and money spent, based on trade-off factor γ

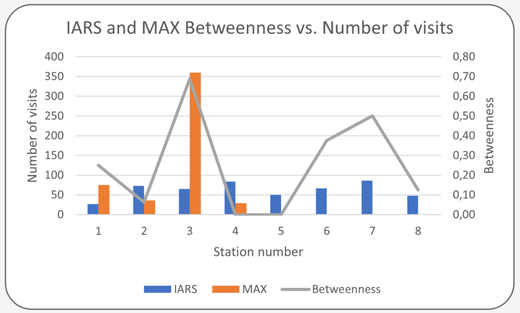
Research question

How does the location of a charging station for electric vehicles, within a road network modelled as a graph, affect its profitability?

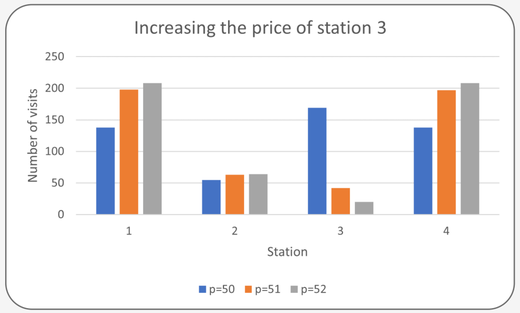
Results



Relation between route length and number of visits for IARS on bottleneck topology



Relation between number of visits and betweenness for grid topology



Effect of increasing price for a station on a shorter route on number of visits (for bottleneck topology)

Conclusions

- Number of visits can be easily predicted using betweenness centrality for MAX algorithm

- IARS spreads over all stations

- Increasing prices on better locations does not increase profit

Future work

- Use graphs representing real road networks

- Find most profitable location for a new station

- Add dynamic pricing

- Explore more algorithms

[1] de Weerdt, M. M., Stein, S., Gerding, E. H., Robu, V., & Jennings, N. R. (2016). Intention-Aware Routing of Electric Vehicles. IEEE Transactions on Intelligent Transportation Systems, 17(5), 1472–1482.