



# WCX Digital Summit

## RouteE: A Vehicle Energy Consumption Prediction Engine

Jacob Holden

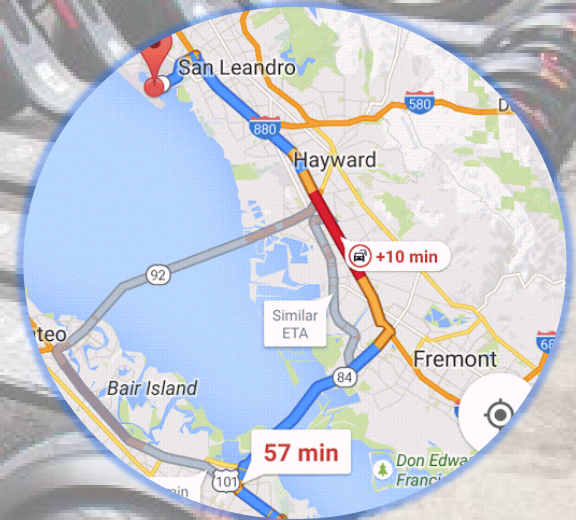
Nicholas Reinicke

Jeff Cappellucci

June 16-18, 2020

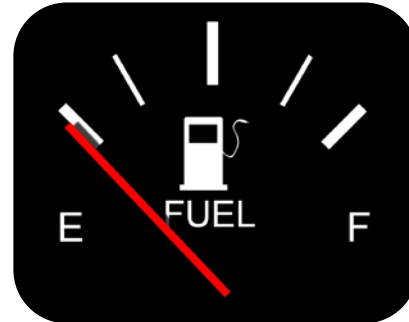


# New Mobility Technology



# Transportation Priorities

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# Route Energy Prediction Model (RouteE)

- A **mesoscopic energy prediction engine** that considers real-time traffic conditions and links features of a road network to accurately predict energy consumption
- Enables prediction of **link and route energy costs** for various vehicle types—among other applications



Link ID	Average Speed (mph)	Distance (ft)	Elevation (ft)	Gradient (%)	Number of Lanes	Road Class
1	24.3	806.2	5103.3	0.5	1	5
2	34.2	772	5097.7	-0.7	2	2
3	59.6	1109.3	5100.5	0.3	4	0
4	45.1	406.9	5145.2	6.4	2	2
...	...	...	...	...	...	...



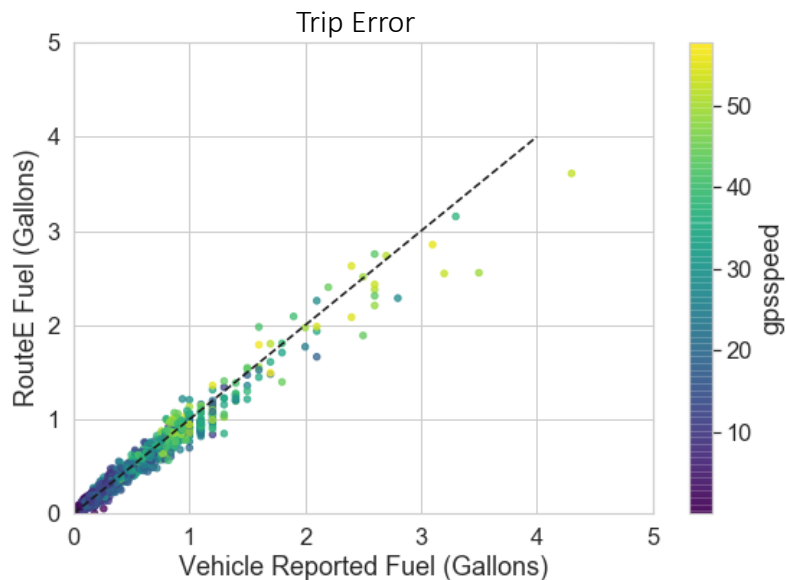
# RouteE Validation

$$e_{net} = \frac{\sum \hat{y} - \sum y}{\sum y}$$

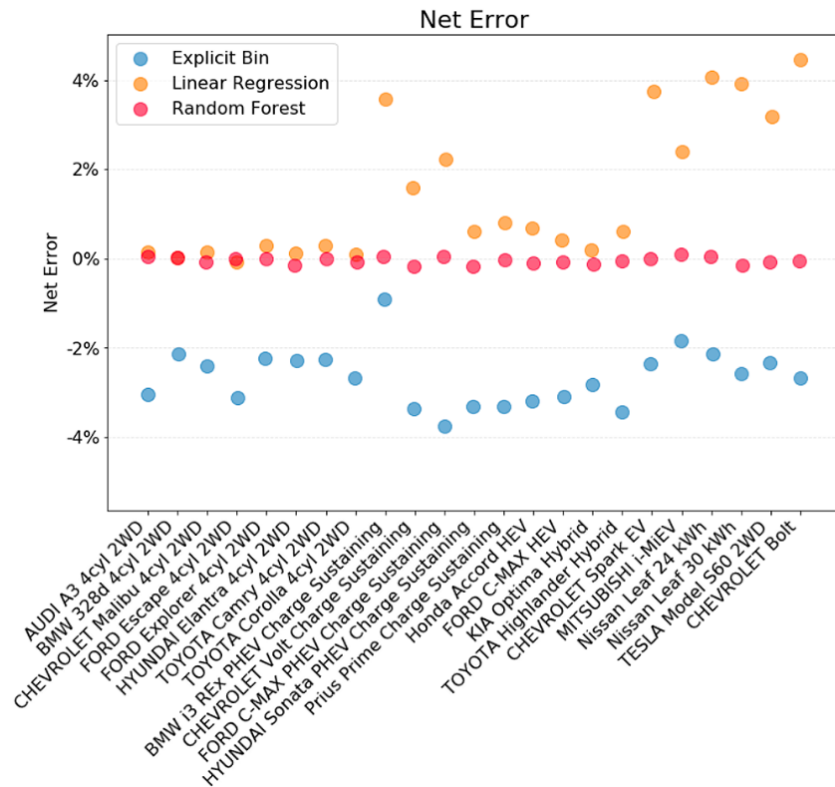
$e_{net}$  = net error in predicted energy consumption compared to actual energy consumption over the entire test data set

$y$  = predicted energy consumption

$\hat{y}$  = actual energy consumption



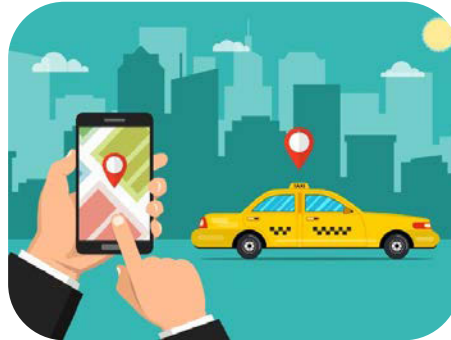
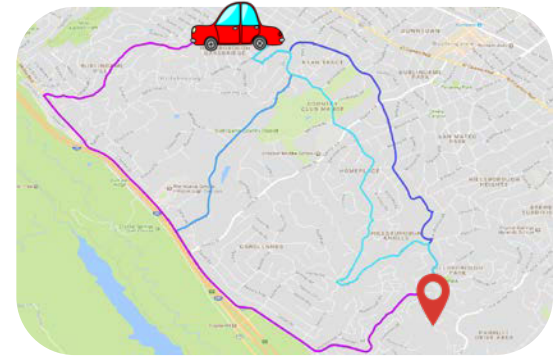
Distance Weighted Relative Error = 11.34%





# RouteE Applications

- Eco-routing
- EV range estimation
- Vehicle optimal controls
- Transportation simulation
- Transit optimization
- Traffic and energy planning
- Trip planning and user incentivization
- Air quality attainment/emissions



# Thank you!

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Please direct any questions/comments to: [Jacob.Holden@nrel.gov](mailto:Jacob.Holden@nrel.gov)

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