Identification of EV Driving Patterns

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Motivation

- EV uncertainty around EV charging location, time and duration poses a great risk to the power system
- Improving understanding of EV driving patterns assists utilities in grid planning

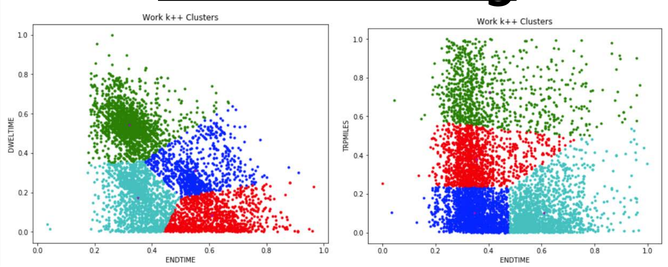
Data

- 2017 National Household Travel Survey (NHTS)
  - Matrix of 1.1 M Trips, 112 Dimensions
- 3 Dominant Charging Locations: Home, Work, Public (or Other)

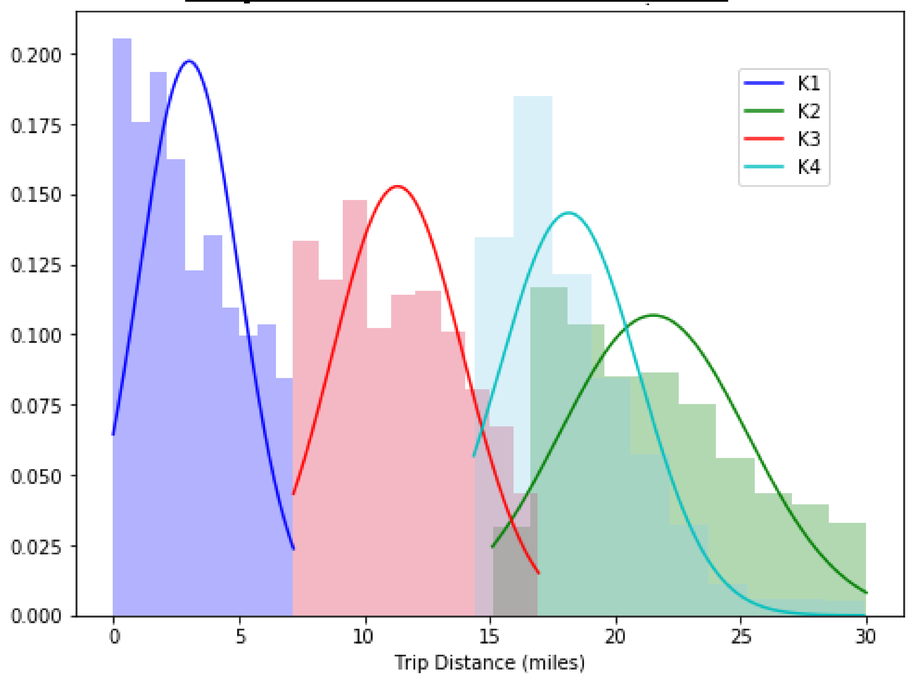
Methods

- Clustering
  - k-Means ++
  - Hierarchical Agglomerative
- Gaussian Fit Approximation

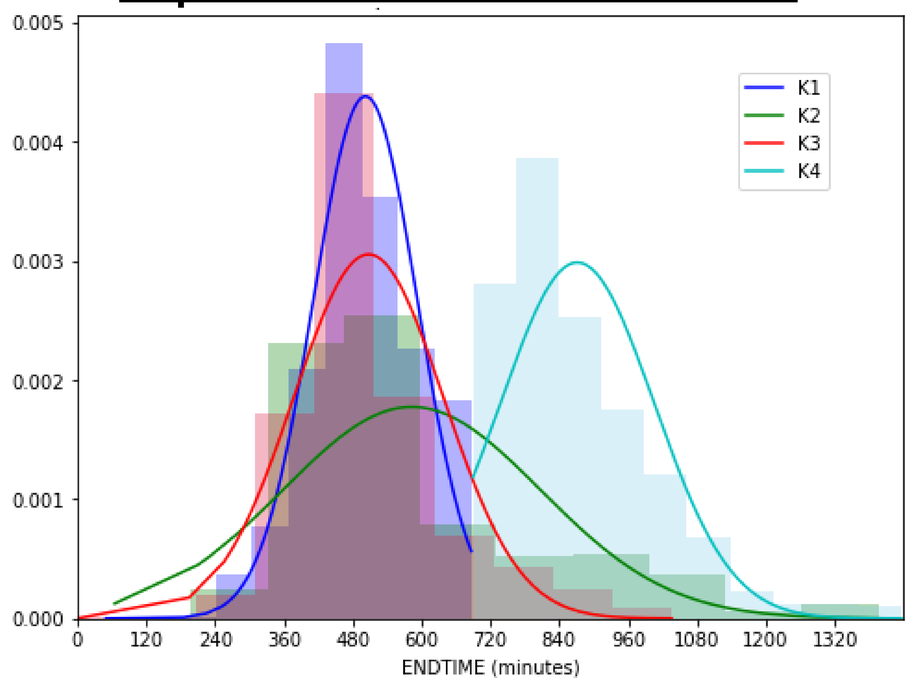
K++ Clustering



Trip Miles Distributions



Trip Dwell Time Distributions



Objective

- Fit Gaussian Distributions to Clusters of Driving Patterns

Results

Arrival Time vs. Dwell Time Distribution Parameters

		Cluster 1	Cluster 2	Cluster 3	Cluster 4
Home	Weight	43%	8%	18%	31%
	Mean (hr)	18.20	16.50	17.30	10.90
	Std. Dev.	135.46	239.43	172.58	161.45
Work	Weight	34%	15%	22%	29%
	Mean (hr)	8.40	9.70	8.50	14.50
	Std. Dev.	91.11	224.86	130.66	133.66
Other	Weight	43%	36%	6%	15%
	Mean (hr)	10.30	17.10	14.20	12.90
	Std. Dev.	126.44	127.60	234.84	197.84

Trip Miles vs. Arrval Time Distribution Parameters

		Cluster 1	Cluster 2	Cluster 3	Cluster 4
Home	Weight	43%	8%	18%	31%
	Mean (mi)	2.51	21.50	10.79	13.59
	Std. Dev.	1.79	3.88	2.70	3.36
Work	Weight	34%	15%	22%	29%
	Mean (mi)	3.02	21.52	11.33	18.15
	Std. Dev.	2.02	3.73	2.61	2.78
Other	Weight	43%	36%	6%	15%
	Mean (mi)	2.37	2.64	21.43	16.14
	Std. Dev.	1.88	2.21	3.93	4.12

Conclusions

- Home & Work trips follow expected patterns of arrival (evening & morning)
- ~38% of Home & Work trips are < 5 miles; 79% of Other trips are < 5 miles
- 8% of Home Trips, 15% of Work Trips & 6% of Other Trips have a roundtrip EVMT > 40 miles requiring charging