Data Driven Parking

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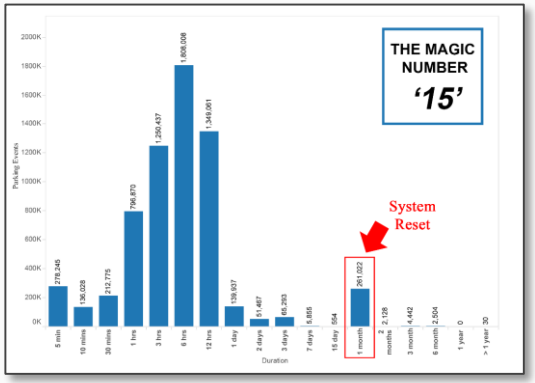
PTX_UID	PER_UID	FAC_UID	ENTRY_TIME	EXIT_TIME	...
3730588	3555452	2001	2015-07-08 07:04:02	2015-07-08 16:23:12	

- Dataset provided in transactional form, hard to perform analytics on.
- Uploaded our data to Google BigQuery and queried the necessary tables.
- Aggregated the data over different time periods and lot ID's.

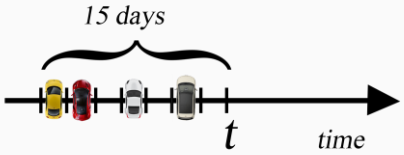


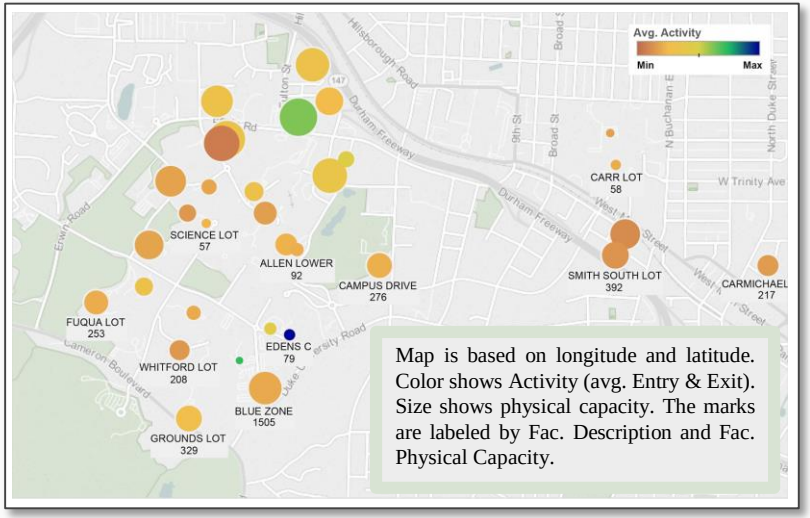
The general parking trend among the Duke Community

The occupancy of lot on day 't' is,

"No. of cars which have entered in '15 days', but not have exited yet."

- 95% of events are less than 15 days.
- Took this time span as an indicator for our Occupancy Prediction Model (OPM).
- Needed the OPM because the table provided to us with the Occupancy counts was filled with logging errors.





Two tools were developed to aid Duke's Department of Parking and Transportation:

- A data visualization tool that connects live data to clear, concise, and beautiful visualizations (as seen on this slide)
- A redirection tool that addresses overflow problem by optimally redirecting vehicles from one to another (as seen on the next slide)

Redirection Tool

One of the major concerns of our client is how to optimally redirect vehicles when the facility it intends to park in is full.

The redirection tool combines everything we've learned in studying the data, most prominently utilization 'u' patterns and capacities 'c' of each facility, with a distance matrix 't' retrieved from Google Maps, to graphically demonstrate our achievement to our client. We use two predictive data models to integrate information of the above mentioned factors into one single score 'α', which we then use to rank alternatives to the facility that is full or over-utilized, and provide the user with three top ranking facilities.

$$\alpha = \beta(1-t)+\gamma(1-u)+\delta\times c \qquad \text{- (linear)}$$

$$\alpha = e^{-\beta\times t}+e^{-\gamma\times u}+(1-e^{-\delta\times c}) \qquad \text{- (exp. decay)}$$

Where t, u, and c are variables representing distance, utilization, and capacity, and β (distance), γ (utilization), and δ (capacity) are user-configurable parameters specifying the significance of each factor in the calculation.