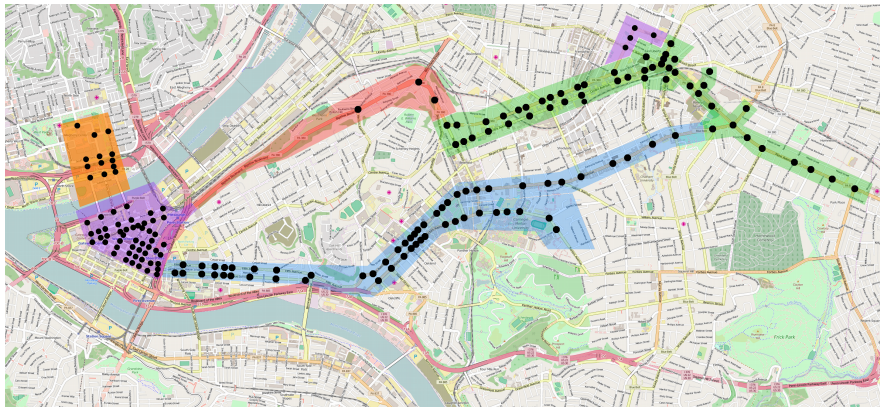# Bus Dwell Time Prediction in Real Time

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Pittsburgh Smart City Vision

Current data study from Pittsburgh, USA

- Automated vehicle location (AVL) data
- Automated passenger counting (APC) data

- September 2012 – August 2014 (September – December 2014)

- The total number of records for routes 71A and 71C inbound
  - removed data: bus dwell time greater than 100 seconds

		All day		7 – 10 am	
	# total	% used	% removed	% used	% removed
71A	995,709	98.71	1.29	21.80	0.29
71C	1,024,518	98.75	1.25	20.73	0.27
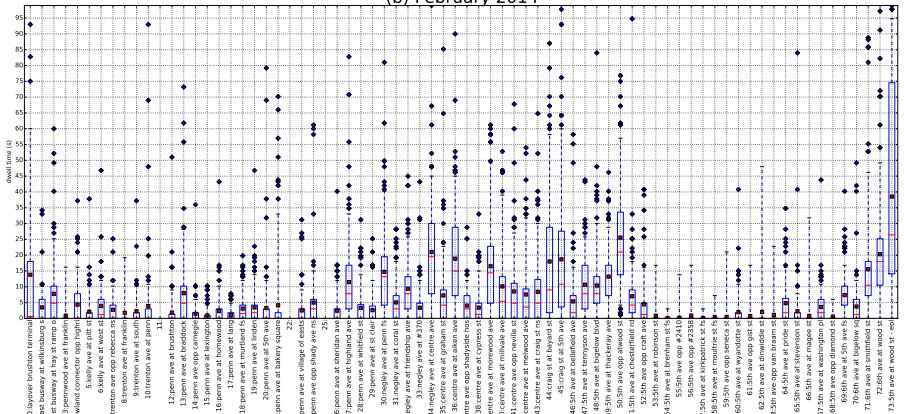
(b) February 2014

(b) February 2014

Baum Boulevard

Centre Avenue

Highland Ave

UPMC
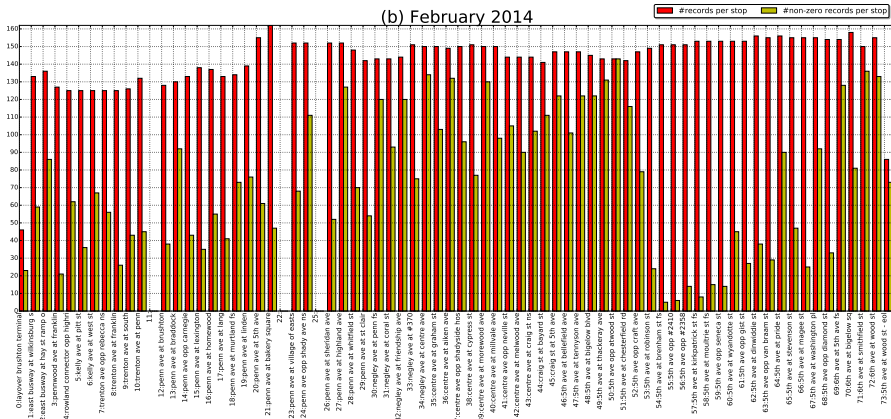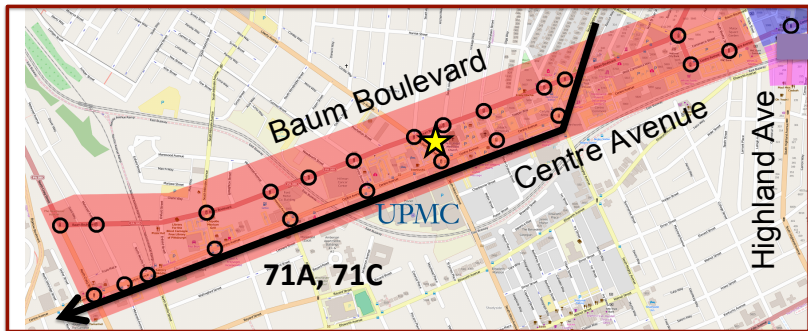
71A, 71C

Cumulative distribution function for dwell times for routes 71A+71C, inbound, 7–10 am

(a) February 2013, 2014

(b) Centre Ave at Aiken Ave
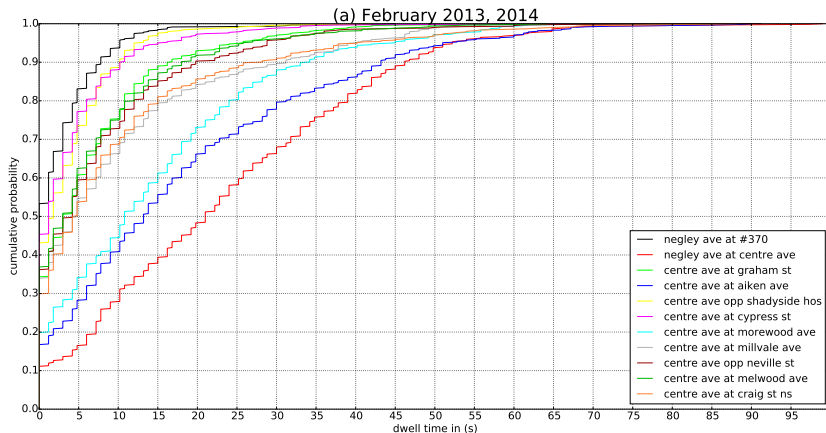
Cumulative distribution function for dwell times for Center Ave at Aiken Ave stop, February 2013+2014 routes 71A+71C, inbound, 7–10 am
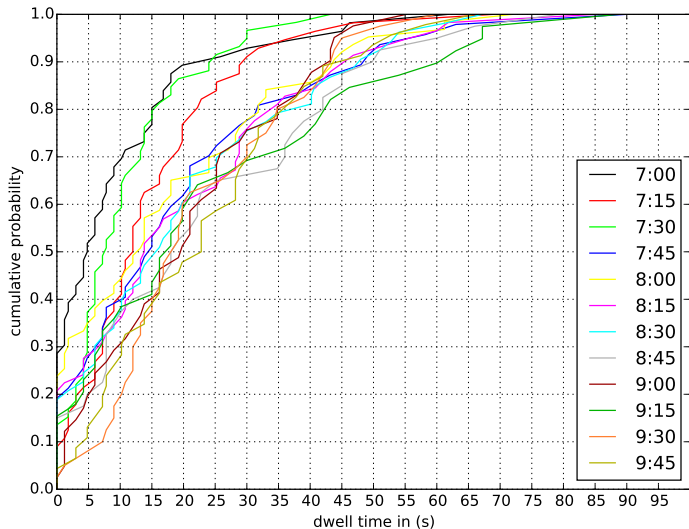
Important data about each bus stopping

- Direction of trip along route
- Bus model (number of seats, bus capacity)
- Day/Month/Year of run
- Stop sequential number (stops may differ over time)
- Stop ID
- Arrival Hour, Min, Second
- Departure Hour, Min, Second
- Observed number of passengers boarding
- Observed number of passengers alighting
- Number of passengers on bus
- Scheduled time if a time point

Analysis in real time

Historical data + data for previous bus

- Bus stop
- Month, (day,) time of day
- Dwell time
- Number of passengers on bus (crowding)
- Observed number of passengers boarding for previous bus
- Observed number of passengers alighting for previous bus

Related work

Offline prediction model

- regression models
  - linear regression based on the numbers of boarding and alighting passengers
- probabilistic models
- decision trees
- time series models

Prediction models in real time

- Kalman filters based on passenger arrival rate and headway
- prediction model for alighting/boarding passengers
  prediction model for bus dwell time based on that
- crowding effects