Conclusion

Estimating Parking Spot Occupancy

David M.W. Landry and Matthew R. Morin

Department of Electrical and Computer Engineering Brigham Young University

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> > Brigham Young University

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2 Analytical Model

- Spatial and Temporal Distribution
- Expected Time to Destination
- 3 Simulation Results

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Everybody Parks



Figure: Google Earth. BYU Parking Lot 1A. 40°15′4.49″N and 111°38′58.37″W. Image Taken: Jun 17, 2010. Accessed: Nov 11, 2013.

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Spatial and Temporal Distribution



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Spatial and Temporal Distribution



- Each parking space is a Bernoulli random variable
 The marked billing of a second parked by the second pa
- The probability of occupancy, *p*, changes with
 - distance from the point of interest
 - time of day

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Image: A matrix

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Spatial and Temporal Distribution

Distance



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Spatial and Temporal Distribution

Time of Day



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Spatial and Temporal Distribution

Joint Distribution



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Spatial and Temporal Distribution

Fermi-Dirac - An Alernate Distribution



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$T_{total} = \rho T_o + (1 - \rho) T_u \tag{1}$

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 T_o is the wait time for a space to open up plus the walking time to reach the point of interest



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 T_o

$Y = min(X_1, X_2..., X_N)$ (2)

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T_o - Derived pdf for Wait Time

$$f_Y(x) = N f_X(x) (1 - F_X(x))^{N-1}$$
 (3)

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To - Expected Wait Time

$$E[Y] = \int_{-\infty}^{\infty} x N f_X(x) (1 - F_X(x))^{N-1} dx$$
 (4)

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Expected Time to Destination

$T_o - E$ xpected Distance

$$d_o = rac{1}{N}\sum_i^N d_i$$

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$$T_o = E[Y] + \frac{d_o}{v} \tag{6}$$

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T_u - Which Spot?

$$p_u = (1 - p_n) \prod_{i=1}^{n-1} p_i, n > 1$$
 (7)

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$\overline{T_u}$ - Expected Distance

$$E[d_u] = \sum_{j=1}^N d_j \rho_{u,j} \tag{8}$$

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 T_u

$$T_u = \frac{E[d]}{v}$$

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(9)

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Retail Parking Example



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Street Parking - Time to Point of Interest



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So which street should I park on?



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Who knew you could have so much fun with parking lots?

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And Have Fun Parking



Figure: Munroe, Randall. "Parking". xkcd. Licensed under CC BY-NC 2.5

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