

Dynamic Pricing for Urban Parking Lots

Summer Analytics 2025 - Final Capstone Project

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Overview:

This project builds a dynamic pricing engine for 14 urban parking spaces.

The pricing adjusts based on:

- Occupancy
- Queue length
- Traffic conditions nearby
- Special day indicator (holidays/events)
- Vehicle type
- Competitor prices (optional in Model 3)

Models Implemented:

Model 1: Baseline Linear Model

- Price increases linearly as occupancy increases

Model 2: Demand-Based Model

- Price adjusts using a formula:

$$\text{demand} = (0.3 * \text{occupancy_rate} + 0.1 * \text{queue_length}$$

$$- 0.05 * \text{traffic} + 0.2 * \text{is_special_day}$$

$$+ 0.1 * \text{vehicle_weight})$$

- Normalized demand adjusts price between 0.5x and 2x base

Model 3 (Optional): Competitive pricing

- Adjusts price considering competitor lots nearby

Tech Stack:

- Python (Pandas, Numpy)
- Pathway (real-time streaming)
- Bokeh (visualization)
- Google Colab

Architecture Diagram:

Refer to `architecture_diagram.png` in the GitHub repo

How to Run:

1. Open the notebook in Google Colab
2. Upload the dataset
3. Run cells sequentially
4. View the live price trend graph

Conclusion:

The system dynamically updates parking prices in real time, improving utilization while managing demand efficiently.