Model 1 Documentation – Baseline Linear Model

Capstone Project – Dynamic Pricing for Urban Parking Lots
Summer Analytics 2025 | Consulting & Analytics Club × Pathway

🎯 Purpose

To establish a simple reference pricing mechanism that dynamically adjusts price based only on current occupancy relative to capacity. This serves as a benchmark for evaluating more advanced models.

📐 Pricing Formula

$P(t+1) = P(t) + \alpha \times (\text{Occupancy} / \text{Capacity})$

📥 Inputs Used

- Occupancy: Number of currently parked vehicles.
- Capacity: Maximum number of vehicles that can be accommodated.

📤 Outputs

- Price: Dynamically adjusted price based on how full the parking lot is.

🛠️ Assumptions

- The more filled a parking lot is, the higher the price to discourage excess demand.
- When occupancy is low, prices rise slowly or may stay the same.
- The price change is linear, meaning no learning or context-aware behavior is included.

💡 Why This Model?

- Acts as a baseline comparator for more intelligent models.
- Helps evaluate how much smarter the ML models (Model 2 & Model 3) are by comparison.
- Extremely lightweight and interpretable.

🩹 Example

If:
- Base price = $10
- Occupancy = 30
- Capacity = 50
- Alpha = 2.0

Then:
$P(t+1) = 10 + 2.0 \times (30/50) = 10 + 1.2 = 11.2$

Limitations

- Does not consider any contextual features like:
  - Queue Length
  - Traffic Conditions
  - Vehicle Type
  - Special Events
- Cannot adapt based on historical demand patterns or competitor prices.

Strengths

- Very easy to compute
- Stable and explainable pricing adjustments
- Good for initializing the system or fallback logic