

Performance of Pheromone Model for Predicting Traffic Congestion



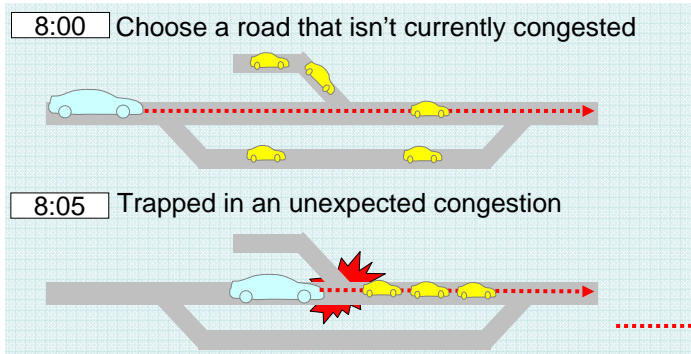
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Traffic Prediction

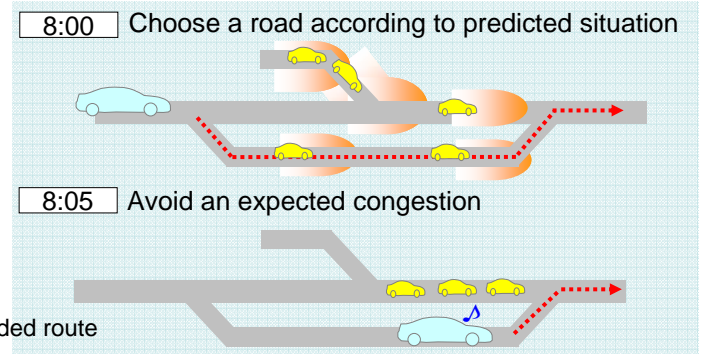
Conventional Traffic System

Route guidance only with **current** traffic situation



Pheromone Traffic System

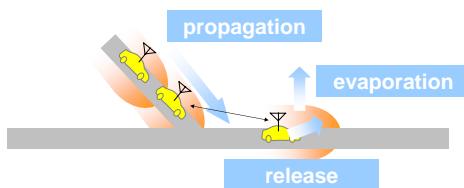
Route guidance with **predictive** traffic situation



Model of Traffic Congestion Pheromone

Overview

- Car **release** "virtual" pheromone
- Pheromone **evaporate** as time goes by
- Pheromone **propagate** according to traffic direction



- Only **locally coupled** pheromone calculation facility is required (such as intelligent traffic light, V2V)

Formulation

- Based on well-known pheromone formula
- Combination of **three flavors** of pheromone to improve prediction performance
- Mixture parameters are calibrated by past data

release

$$d(\Phi_{\text{traffic}}, t, p) = \frac{1}{|C(t, p)|} \sum_{i \in C(t, p)} \frac{1}{v(t, p)}$$

Breaking Pheromone

$$d(\Phi_{\text{brake}}, p, t) = \frac{1}{|C(t, p)|} \sum_{i \in C(t, p)} \text{braking}(t, p)$$

Distance Pheromone

$$d(\Phi_{\text{distance}}, p, t) = \frac{1}{|C(t, p)|} \sum_{i \in C(t, p)} \text{distance}(t, p)$$

evaporation

$$s(\Phi_f, t+1, p) = E_f * (1 - G_f) * (s(\Phi_f, t, p) + d(\Phi_f, t, p)) + g(\Phi_f, t, p)$$

propagation

$$g(\Phi_f, t, p) = \sum_{p' \in N(p)} \frac{G_f}{|N(p')|} (s(\Phi_f, t-1, p') + d(\Phi_f, t-1, p'))$$

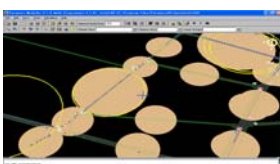
Evaluation

Test Environment

- 30 links of 2 * 2 km area in Tokyo.
- Detailed path observation of 15,000 cars.

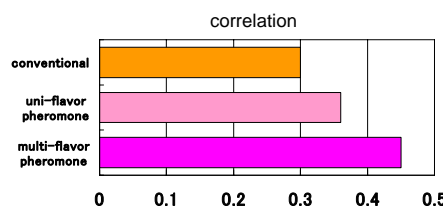
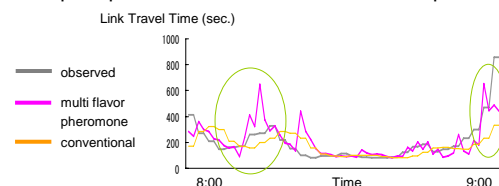


- Paramics microscopic traffic simulator
- Calibrated with real traffic data



Results

- Predict 1 minute later every minutes.
- Compare prediction result with conventional prediction.



Conclusion and Future Works

- Multi flavor pheromone improves prediction performance (30%)

Future work :
 • Different criteria for "favorite road" such as scenery, safety.

