Urban Management Analytics
Emerging Research Efforts

Hoong Chuin LAU
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Urban City Phenomenon

Congestion

Crowds

Queues

More Queues

Resource Planning and Coordination for Sustainability
URBAN MANAGEMENT ANALYTICS

THEME: Understanding, optimizing, and coordinating flows & interactions in urban settings

URBAN LOGISTICS
Improving Freight Flow
e.g. last-mile multi-party delivery coordination in a mega city

URBAN MOBILITY
Improving Passenger Flow
e.g. last-mile passenger share-riding at bus/MRT stations

URBAN HEALTHCARE
Improving Patient Flow
e.g. dynamic queue control at hospital emergency departments

URBAN LESISURE & TOURISM
Improving Visitor Flow
e.g. crowd coordination/control at theme parks, trade events, expos, etc

URBAN SAFETY & SECURITY
Enforcement and Surveillance
e.g. deployment of patrols and inspectors at crowded places
URBAN LOGISTICS

MULTI-PARTY LAST MILE DELIVERY COORDINATION

Funded by ASTAR’s Collaborative Urban Logistics Programme

- Management of urban freight transport and distribution systems
- The last mile - transit of urban freight from the distribution center(s) to the city center (malls, offices and homes) – amounting up to 75% of total logistics costs in Singapore

- Stakeholders:
  **Government**
  1. Congestion and mobility
  2. Environmental pollution
  3. Safety and livability

  **Businesses**
  1. Sustainability (CSR)
  2. Service level improvement

Mechanism designs and Optimization for getting business stakeholders (shippers, carriers, retailers) to collaborate to improve last mile delivery operations
URBAN MOBILITY

DEMAND-RESPONSIVE PUBLIC TRANSPORT SYSTEMS

Funded by NRF SMART’s Future Urban Mobility Programme

- Optimized matching of taxi supply and passenger demand
  - Taxis and passengers are self-interested
  - Last-mile passenger ride-sharing mechanism design
  - Online demand-aware routing under stochastic demands
- Agent-based simulator to evaluate new policies and control mechanisms
Adaptive matching of patients and resources
- Dispatch strategies to dynamically prioritise patients in the queue in real-time, taking historical data and real-time demand into consideration
URBAN LEISURE & TOURISM
CROWD COORDINATION AT THEME PARKS
Project with Resorts World Sentosa Singapore (under LARC)

- Dynamic Route Guidance and Multi-agent Orienteering
- Agent-based simulation of visitor movement in an crowded facility
Enforcement and Surveillance

- Randomized scheduling of limited resources (e.g. security officers) to patrol the network that maximizes deterrence of crimes / offenses
- Randomized rostering of health inspectors to enforce food hygiene and sanitation requirement