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2025 SERIES

# Human-in-the-loop Learning for Smart Cities

**DATE & TIME**

**4 FEB 2025 (TUE) 9:00 – 10:00 AM**

## ONLINE VIA ZOOM


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**ABSTRACT**

Smart cities leverage IoT technology and data-driven solutions to enhance the quality of life for their residents, particularly by reducing waiting times in transportation and service facilities. Given that humans play a dual role in sensing and selecting service options (e.g., routes), this talk introduces novel human-in-the-loop learning solutions to optimize smart transportation and service systems by integrating dynamic learning algorithms with incentive mechanism design. The first part of the talk reviews the practices of platforms like Google Maps and Waze, which collect real-time traffic data from users and share it to help others make shortest-path routing decisions. However, by neglecting the need to explore time-varying traffic conditions on alternative routes, this approach can lead to arbitrarily large inefficiencies. We propose selective information disclosure mechanisms to guide user behaviour and ensure that travel costs are capped at no more than twice the optimal level. The second part examines IoT-enabled service facilities, such as restaurants and hospitals, which periodically update online queue length information to assist customers in deciding whether to visit. Surprisingly, we find that providing more frequent or even real-time updates does not always benefit either the system or its users. By modelling actual and announced queue lengths as a two-dimensional Markov chain, we prove a key theorem: under a Poisson sampling process, arrivals perceive queue lengths as time averages (ASTA). Leveraging this insight, we develop optimal algorithms to determine the ideal frequency of information updates, significantly enhancing performance for both the system and its users.


**SPEAKER'S BIOGRAPHY**

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