

Event-streaming Algorithm for Self-adaptive Distributed Vehicle Route Guidance in Urban Networks

Urban mobility faces significant challenges due to increasing vehicle numbers and traffic congestion. Efficient route guidance systems are essential for alleviating traffic pressure and enhancing vehicle navigation. This master's thesis proposal introduces the design and development of an event-streaming algorithm for self-adaptive, distributed vehicle route guidance explicitly tailored for urban traffic networks. This research aims to dynamically process continuous data streams of GPS locations and vehicle speeds provided by mobile vehicle users to optimize real-time routing decisions. Central to the proposal is a novel adaptation of the Q-routing algorithm to allow for continuously and distributedly updating Q-tables that predict and adapt travel times between urban intersections, thereby minimizing traffic delays and enhancing the efficiency of urban mobility.

The primary research question this thesis seeks to address is: How can large streams of Floating Car Data (FCD), consisting of raw GPS positions and vehicle speed metrics, be effectively transformed into predictive inputs for a distributed Q-learning algorithm that dynamically updates vehicle routes to reduce urban traffic congestion? This question underpins developing an early prototype of a system that handles the real-time complexities of large volumes of urban traffic data and learns from this data to create new routes self-adaptively. By tackling this question, the research will explore two key aspects: the feasibility of real-time data processing in a distributed cloud environment and the effectiveness of reinforced learning techniques in a streaming computing context.

The anticipated outcome is a scalable solution that leverages stream computing and reinforcement learning to provide real-time, adaptive vehicle route guidance.

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References

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