

Last-Mile Delivery in High-Density Emerging Economy Cities using Crowd-Generated Data and Artificial Intelligence

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Abstract

Efficient last-mile delivery in densely populated emerging economy cities faces significant challenges, including severe traffic congestion, unpredictable travel times, limited transportation infrastructure, and high customer expectations for timely deliveries. This paper proposes an integrated framework leveraging crowd-generated data and advanced Artificial Intelligence techniques to address these complex challenges. The framework employs real-time traffic predictions based on sentiment analysis and geo-tagged data from public digital platforms, effectively capturing dynamic urban conditions missed by traditional sensors. Using a novel combination of Graph Convolutional Networks and Long Short-Term Memory neural networks, the developed model accurately forecasts traffic congestion by extracting spatial and temporal dependencies. Subsequently, an adaptive deep reinforcement learning algorithm optimizes real-time delivery routes and schedules, adjusting dynamically to fluctuating demand and rapidly evolving traffic conditions. A comprehensive case study applied to Bogotá, Colombia—a representative emerging megacity—demonstrates the framework's effectiveness, achieving significant improvements in delivery performance and operational efficiency. The study provides valuable insights into how crowd-sourced digital data and AI can be strategically combined to revolutionize last-mile logistics in emerging economies, contributing toward a more sustainable and resilient urban environment.

Keywords

Deep Learning, Megacities, Social Media, Reinforcement Learning