

An Online Deep Reinforcement Learning Based Order Recommendation Framework for Rider-Centered Food Delivery System

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Abstract: *On-demand Food Delivery (OFD) has become a crucial component of intelligent transportation systems, revolutionizing logistics services in contemporary society. With transaction volumes soaring, a shift towards rider-centered assignment methods over traditional platform-centered approaches is evident among food delivery companies. Yet, challenges persist, including dynamic order arrivals, uncertain rider behaviors, and a plethora of false negative feedback, impeding effective decision-making by platforms during interactions with riders. To tackle these issues, we introduce an innovative online Deep Reinforcement Learning-based Order Recommendation (DRLOR) framework to navigate decisionmaking in the OFD setting. Formulated as a Markov Decision Process (MDP), our framework integrates three key networks: an actor-critic network for learning optimal order ranking policies, a rider behavior prediction network to forecast rider actions, and a feedback correlation network leveraging attention mechanisms to discern valid feedback amidst false reports, thereby constructing high-dimensional state representations of rider states. Rigorous offline and online experimentation on the Meituan delivery platform illustrates the efficacy of our DRLOR framework in significantly reducing interaction durations between riders and platforms, culminating in enhanced experiences for both riders and customers.*

Keywords: Online, Deep Reinforcement Learning, Order Recommendation, Rider-Centered, Food Delivery System

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