Beyond Conventional Dispatching Rules: End-to-End Deep Reinforcement Learning for Dynamic Scheduling

Chien-Liang Liu
Department of Industrial Engineering and Management
National Yang Ming Chiao Tung University

Dispatching rules like SPT and FIFO have anchored dynamic scheduling for decades, offering fast, easily implemented policies even under real-time disruptions, such as machine breakdowns or last-minute job arrivals. However, these heuristics typically rely on static priority measures and may struggle with more complex interdependencies and multi-objective constraints in modern production lines. This presentation ventures beyond those methods by demonstrating an end-to-end deep reinforcement learning (DRL) framework tailored for dynamic scheduling problems. Specifically, we illustrate how advanced actor–critic algorithms and graph-based neural networks (e.g., graph convolutional or graph attention networks) can unify disjunctive graph models (capturing machine-sharing conflicts) with temporal precedence constraints, thereby producing adaptive scheduling policies directly from data. The result is a system that handles real-time disruptions and optimizes performance metrics like makespan and machine utilization across diverse, fast-evolving shop floors. Empirical comparisons with dispatching rules and metaheuristics show the benefits of this data-driven, end-to-end approach, including robustness, scalability, and superior adaptability to stochastic environments. We conclude by highlighting future avenues for heterogeneous graph neural networks and DRL to further advance the real-world applicability of dynamic scheduling.