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AI-Enabled Supply Chain Optimization

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Abstract: *As global supply chains become more intricate, the significance of supply chain risk management has significantly increased. This research delves into the utilization of artificial intelligence (AI) in managing supply chain risks, analyzing cutting-edge advancements, obstacles, and potential areas for further exploration.*

Through a comprehensive review of literature sources like Google Scholar, Web of Science, EI, and Scopus, this study investigates how AI methods such as machine learning, deep learning, neural networks, fuzzy logic, genetic algorithms, and evolutionary algorithms can help mitigate supply chain risks. These AI technologies have demonstrated remarkable efficacy in mitigating various risks, including forecasting, anomaly detection, image recognition, text mining, logistics optimization, and emergency response tactics.

Apart from AI-driven approaches, optimization solvers and algorithms play a critical role in tackling complex supply chain dilemmas. Mathematical programming solvers, including linear programming (LP), mixed-integer programming (MIP), and quadratic programming (QP), are commonly used to model and optimize supply chain networks by considering factors like cost, capacity, and demand fluctuations. Fine-tuning solver parameters and strategies to enhance computational efficiency—known as solver tuning—has been crucial in enhancing solution quality and decreasing computation time for large-scale supply chain issues.

Heuristic solvers like genetic algorithms, simulated annealing, and ant colony optimization are frequently employed to resolve conflicts in supply chains. These solvers offer practical solutions to problems where exact methods are computationally impractical, allowing for swift responses to disruptions such as production delays or spikes in demand. Pyramid classification, a hierarchical approach, further refines decision-making by categorizing risks and aligning response strategies based on priority and severity.

Furthermore, the integration of AI technologies and solvers enables advanced conflict resolution techniques, including scenario-based modeling and multi-objective optimization. These approaches enable decision-makers to weigh trade-offs between conflicting objectives like minimizing costs versus maximizing service levels in real-time.

The study underscores that AI technologies and optimization solvers significantly bolster risk management in supply chains. Nonetheless, challenges such as data privacy concerns, security vulnerabilities, technical intricacies, and implementation obstacles pose critical barriers to widespread adoption.

The study offers practical suggestions for businesses and decision-makers while pinpointing key areas for future exploration, such as devising hybrid models that merge heuristic solvers with AI for adaptive and scalable risk management strategies.

Keywords: E-Commerce, Data, Preferences, Accurate, Sales, User-Friendly

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