Stochastic Optimization Model for Smart Freight Matching and perspective of the application in Montreal

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Abstract

Smart freight platforms are emerging as a key component of the new sustainable and smart mobility paradigm. These platforms enable efficient and flexible matching of freight demand and supply, reducing costs and environmental impacts. However, the matching process is subject to various uncertainties, such as weather, traffic, and truck failures, which can affect the performance and reliability of the platform and provided services. In this study, we develop a two-stage stochastic optimization model for matching smart freight platform that considers these uncertainties. The model aims to maximize the matching rate of the platform while satisfying the service level requirements of the customers and minimizing the environmental impacts considering the consolidation. We apply the model to the case of Montreal, Canada, using a simulated data set that reflects the characteristics of the city's freight market. The results show that the model can improve the matching quality and robustness of the platform under different scenarios of uncertainty.

Keywords
Smart Freight Platform, Uncertainty, Matching, Stochastic Optimization

Biographies
Ali Yahyatabar received his B.S degree in Industrial Engineering from Shomal University in 2009 and M.Sc. degree in Industrial Engineering from Sharif University of Technology (SUT) in 2012. He received a PhD in Industrial Engineering in the area of optimization at Khaje Nasirodin Toosi University of Technology in 2018. As an ERP consultant at Industries for more than ten years, he has been dealing with data and business analysis. Mathematical modelling and optimization, data analysis and statistical root analysis are the most important contents of his work. He has published and presented many papers in the area of stochastic optimization, data analysis and decision making in well-known journals such as Computers and Industrial Engineering and international conferences. His latest paper has been published in Journal of Industrial and Systems Engineering, January 2023, in the area of stochastic optimization. As a lecturer, he has been participating in teaching at university of Mazandaran and K.N Toosi university of Technology more than seven years.

Elham Haji Sami is a Ph.D. student in Industrial Engineering at Polytechnique Montréal, where she commenced her studies in May 2023. Holding a master's degree in Industrial Engineering with a focus on uncertain optimization from the Islamic Azad University South Tehran Branch, Throughout her academic and professional journey, Elham has consistently showcased his expertise in areas such as Robust Optimization, Mathematical Modelling, and Data Envelopment Analysis (DEA). Her research contributions and notable projects underscore her dedication to addressing Mathematical Modelling and advancing optimization, particularly in the realm of transportation and supply chain, ultimately driving toward a more efficient and sustainable future.

Samira Keivanpour is an assistant professor in the Department of Mathematical and Industrial Engineering at Polytechnique Montréal, Canada. She conducts research on sustainable solutions for supply chain and logistics management, with a focus on end-of-life product treatment, circular manufacturing, and the integration of Industry 4.0 technologies.

Amina Lamghari After receiving a BSc and a Master's in Applied Mathematics, Amina Lamghari obtained a PhD in Operations Research from the University of Montreal, Canada, after which she worked as a post-doctoral fellow and later as a research associate at the COSMO Stochastic Mine Planning Laboratory at McGill University. Amina is currently an associate professor in the Management School at the University of Quebec at Trois-Rivières. Her research interests are centered on various techniques and algorithms —(meta)heuristics, hyper-heuristics, and matheuristics -- for optimization and their integration and application to solve complex scheduling and planning problems in an efficient manner accounting for uncertainty.

Asad Yarahmadi is a PhD candidate in Civil Engineering - Transportation Engineering at Polytechnique Montreal University. He completed his master in GIS and Remote sensing. With his unique blend of expertise in Geographic Information System (GIS) tools, Machine Learning techniques, and Remote Sensing, he excel at integrating technology to address the environmental impact of transportation. Throughout his academic and professional journey, Asad has demonstrated his commitment to sustainable transportation solutions. He also has a proven track record of effectively managing both academic research and industrial projects aimed at tackling crucial environmental issues, such as vehicle emissions. His ultimate goal? Facilitating a greener, more sustainable future.