Rafid Mahmood

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Ottawa, Ontario, Canada

Email: mahmood@telfer.uottawa.ca
Homepage: http://rafidrm.github.io

Employment

University of Ottawa, Telfer School of Management

Assistant Professor 2023–pres.

NVIDIA Corporation

Senior Research Scientist 2022–pres.

AI Resident Researcher 2020–2022

Education

University of Toronto, Mechanical and Industrial Engineering

Ph.D Industrial Engineering 2015–2020

Vector Institute for Artificial Intelligence Postgraduate Affiliate 2019–2020

University of Toronto, Electrical and Computer Engineering

M.A.Sc. Electrical Engineering 2013–2015

Honors B.A.Sc. Electrical Engineering 2008–2013

Publications [1]

Papers Under Review

1. **Deep Learning-Assisted Appointment Scheduling Under Uncertainty**
   A. Moosavi*, O. Ozturk, R. Mahmood, and J. Patrick
   major revision in INFORMS Journal on Data Science (IJDS), 2025.

2. **Routing, Cascading, and User Choice for Large Language Models**
   R. Mahmood*
   under review, 2026.

3. **Scaling-Aware Data Selection for End-to-End Autonomous Vehicles**
   T. Dimiloglu*†, N. Chang, M. Shen, S. Yan, R. Mahmood, and J. M. Alvarez
   under review, 2026.

4. **AdaDeDup: Adaptive Data Pruning for Efficient Large-Scale Object Detection Training**
   F. Kang*†, N. Chang, M. Shen, M. T. Law, R. Mahmood, R. Jia, and J. M. Alvarez
   under review, 2026.

[1] Articles that were published with alphabetical author ordering are denoted with $^{\alpha-\beta}$. The primary author is denoted with *. Supervised students are denoted with †.

Published Journal Articles and Conference Proceedings

5. **AutoScale: Automatic Prediction of Compute-optimal Data Compositions for Training LLMs**
F. Kang*, Y. Sun, B. Wen, S. Chen, D. Song, R. Mahmood, and R. Jia
Conference on Language Modeling (COLM), 2025.

6. **Optimizing Data Collection for Machine Learning**
R. Mahmood*, J. Lucas, J. M. Alvarez, S. Fidler, and M. T. Law
Journal of Machine Learning Research (JMLR), 26(38), 1–52, 2025.
   - Preliminary version at NeurIPS 2022.

7. **Inverse Optimization: Theory and Applications**
$^{\alpha-\beta}$T. C. Y. Chan, R. Mahmood*, and I. Y. Zhu*
Operations Research (OR), 73 (2), 1046-1074, 2025.

8. **Learning to Optimize Contextually Constrained Problems for Real-Time Decision Generation**
$^{\alpha-\beta}$A. Babier, T. C. Y. Chan, A. Diamant, and R. Mahmood*
Management Science (MS), 71(2), 2025.

9. **Can Large Vision-Language Models Correct Semantic Grounding Errors By Themselves?**
Y.-H. Liao*, R. Mahmood, S. Fidler, and D. Acuna
Computer Vision and Pattern Recognition (CVPR), 14667–14678, 2025.

10. **Got (Optimal) Milk? Pooling Donations in Human Milk Banks with Machine Learning and Optimization**
$^{\alpha-\beta}$T. C. Y. Chan, R. Mahmood, D. L. O'Connor, D. Stone, S. Unger, R. K. Wong*†, and I. Y. Zhu
Manufacturing & Services Operations Management (M&SOM), 27(6), 1721–1739, 2025.
   - **First Place for Pierskalla Best Paper Award.**
   - **Finalist for MSOM 2023 Practice-Based Research Competition.**
   - **Runners' Up (second place) for POMS 2023 College of Healthcare Operations Management (CHOM) Best Paper Award.**
   - **Runners' Up (second place) for INFORMS 2024 Innovative Applications in Analytics Award (IAAA).**
   - **Finalist for INFORMS 2023 Public Sector Operations Research (PSOR) Best Video Award.**
   - **Honorable Mention (third place) for CORS 2023 Practice Prize Competition.**
   - **Presented at MSOM 2023 Healthcare SIG.**
   - Preliminary version at The Journal of Nutrition.

11. **Pricing and Competition for Generative AI**
R. Mahmood*
Neural Information Processing Systems (NeurIPS), 2024.

12. **Reasoning Paths with Reference Objects Elicit Quantitative Spatial Reasoning in Large Vision Language Models**
Y.-H. Liao*, R. Mahmood, S. Fidler, and D. Acuna
Empirical Methods in Natural Language Processing (EMNLP), 2024.

13. **Prospective Human Validation of Artificial Intelligence Interventions in Cardiology: A Scoping Review**
A. Moosavi*, S. Huang*, M. Vahabi†, B. Motamedivafa, N. Tian, R. Mahmood, P. Liu, and C. L. F. Sun
Journal of the American College of Cardiology (JACC): Advances, 2024.

14. **Translating Labels to Solve Annotation Mismatches Across Object Detection Datasets**
Y.-H. Liao*†, J. Lucas, R. Mahmood, V. Prabhu†, D. Acuna, and S. Fidler
International Conference on Learning Representations (ICLR), 2024.

15. **Bridging the Sim2Real Gap with CARE: Supervised Detection Adaptation with Conditional Alignment and Reweighting**
V. Prabhu*†, D. Acuna, Y.-H. Liao†, R. Mahmood, M. T. Law, J. Hoffman, S. Fidler, and J. Lucas
Transactions on Machine Learning Research (TMLR), 2023.

16. **Optimizing Data Collection for Machine Learning**
R. Mahmood*, J. Lucas, J. M. Alvarez, S. Fidler, and M. T. Law
Neural Information Processing Systems (NeurIPS), 35, 29915–29928, 2022.

17. **How Much More Data Do I Need? Estimating Requirements for Downstream Tasks**
R. Mahmood*, J. Lucas, D. Acuna, D. Li, J. Philion, J. M. Alvarez, Z. Yu, S. Fidler, and M. T. Law
Computer Vision and Pattern Recognition (CVPR), 275–284, 2022.

18. **Low Budget Active Learning via Wasserstein Distance: An Integer Programming Approach**
R. Mahmood*, S. Fidler, and M. T. Law
International Conference on Learning Representations (ICLR), 2022.

19. **OpenKBP-Opt: An International and Reproducible Evaluation of 76 Knowledge-Based Planning Pipelines**
A. Babier*, R. Mahmood, B. Zhang, V. G. L. Alves, A. M. Barragán-Montero, J. Beaudry, C. E. Cardenas, Y. Chang, Z. Chen, J. Chun, K. Diaz, H. D. Eraso, E. Faustmann, S. Gaj, S. Gay, M. Gronberg, B. Guo, J. He, G. Heilemann, S. Hira, Y. Huang, F. Ji, D. Jiang, J. C. J. Giraldo, H. Lee, J. Lian, S. Liu, K. Liu, J. Marrugo, K. Miki, K. Nakamura, T. Netherton, D. Nguyen, H. Nourzadeh, A. F. I. Osman, Z. Peng, J. D. Q. Muñoz, C. Ramsl, D. J. Rhee, J. D. Rodriguez, H. Shan, J. V. Siebers, M. H. Soomro, K. Sun, A. U. Hoyos, C. Valderrama, R. Verbeek, E. Wang, S. Willems, Q. Wu, X. Xu, S. Yang, L. Yuan, S. Zhu, L. Zimmermann, K. L. Moore, T. G. Purdie, A. L. McNiven, and T. C. Y. Chan
Physics in Medicine & Biology, 67 (18), 2022.

20. **An Ensemble Learning Framework for Model Fitting and Evaluation in Inverse Linear Optimization**
$^{\alpha-\beta}$A. Babier, T. C. Y. Chan, T. Lee, R. Mahmood*, and D. Terekhov
INFORMS Journal on Optimization (IJOO), 3 (2), 119–138, 2021.
    - Presented at CORS 2020 Canadian Healthcare Optimization Workshop.
    - **Honorable Mention (second place) for CORS 2018 Best Student Paper Competition.**

21. **Prediction of Protein and Fat Content in Human Donor Milk Using Machine Learning**
R. K. Wong*†, M. A. Pitino, R. Mahmood, I. Y. Zhu, D. Stone, S. Unger, D. L. O'Connor, and T. C. Y. Chan
The Journal of Nutrition, 2021.

22. **OpenKBP: The Open-access Knowledge-Based Planning Grand Challenge and Dataset**
A. Babier*, B. Zhang, R. Mahmood, K. Moore, T. Purdie, A. McNiven, and T. C. Y. Chan
Medical Physics, 48 (9), 5549–5561, 2021.

23. **Sampling from the Complement of a Polyhedron: An MCMC Algorithm for Data Augmentation**
$^{\alpha-\beta}$T. C. Y. Chan, A. Diamant, and R. Mahmood*
Operations Research Letters (ORL), 48 (6), 744–751, 2020.

24. **The Importance of Evaluating the Complete Knowledge-Based Planning Pipeline**
A. Babier*, R. Mahmood, A. McNiven, A. Diamant, and T. C. Y. Chan
Physica Medica: European Journal of Medical Physics, 72, 73–79, 2020.

  - Preliminary version at ICCR 2019.

25. **AutoAudio: Deep Learning for Automatic Audiogram Interpretation**
    M. J. Crowson*, A. Hamour, R. Mahmood, A. Babier, V. Lin, D. Tucci, and T. C. Y. Chan
    Journal of Medical Systems, 44 (163), 2020.

26. **Predicting Post-Operative Cochlear Implant Performance Using Supervised Machine Learning**
    M. J. Crowson*, P. Dixon, R. Mahmood, J. W. Lee, D. Shipp, T. Le, V. Lin, J. Chen, and T. C. Y. Chan
    Otology & Neurotology, 41 (8), 1013–1023, 2020.

27. **The Importance of Evaluating the Complete Knowledge-based Automated Planning Pipeline**
    A. Babier*, R. Mahmood, A. McNiven, A. Diamant, and T. C. Y. Chan
    International Conference on the Use of Computers in Radiotherapy (ICCR), 2019.

28. **Knowledge-based Automated Treatment Planning with Three-dimensional Generative Adversarial Networks**
    A. Babier*, R. Mahmood, A. McNiven, A. Diamant, and T. C. Y. Chan
    Medical Physics, 47 (2), 297–306, 2019.

    - Presented at NeurIPS 2018 ML4H Workshop.

29. **Streaming Codes for Multiplicative-Matrix Channels with Burst Rank Loss**
    R. Mahmood*, A. Badr, and A. Khisti
    IEEE Transactions on Information Theory (IT), 64 (7), 5296–5311, 2018.

    - Preliminary version at ISIT 2016.

30. **Automated Treatment Planning in Radiation Therapy with Generative Adversarial Networks**
    R. Mahmood*, A. Babier, A. McNiven, A. Diamant, and T. C. Y. Chan
    Machine Learning for Healthcare (MLHC), PMLR 85, 484–499, 2018.

    - **Runners' Up (second place) for CORS 2019 Health Care Operations Research (HCOR) Student Presentation Competition.**

31. **Convolutional Codes with Maximum Column Sum Rank for Network Streaming**
    R. Mahmood*, A. Badr, and A. Khisti
    IEEE Transactions on Information Theory (IT), 62 (6), 3039–3052, 2016.

    - Preliminary version at ISIT 2015.

32. **Low Delay Network Streaming Under Burst Losses**
    R. Mahmood*, A. Badr, and A. Khisti
    IEEE International Symposium on Information Theory (ISIT), 2898–2902, 2016.

33. **Convolutional Codes with Maximum Column Sum Rank for Network Streaming**
    R. Mahmood*, A. Badr, and A. Khisti
    IEEE International Symposium on Information Theory (ISIT), 2271–2275, 2015.

34. **Embedded MDS Codes for Multicast Streaming**
    A. Badr*, R. Mahmood, and A. Khisti
    IEEE International Symposium on Information Theory (ISIT), 2276–2280, 2015.

Media Articles

35. **Optimizer for the 2021 NHL Expansion Draft**
    M. Shin*, Y. Shalaby*, A. Loa*, B. Potter*, T. C. Y. Chan, and R. Mahmood
    OR/MS Today, 48 (5), 52–54, 2021.

Patents

36. **Uncertainty Estimation for Object Detection in Autonomous and Semi-Autonomous Systems and Applications**
N. Durasov, J. Choi, R. Mahmood, M. T. Law, J. Lucas, and J. M. Alvarez Lopez
US Patent Application Number 19/080666, filed Mar 2025.

37. **Comparative Performance Assessment of Generative Artificial Intelligence Models**
R. Mahmood
US Patent Number 2025/0362953 A1, published Nov 2025.

38. **Using Neural Networks to Generate Bounding Boxes**
D. A. Marrero, R. Mahmood, J. Lucas, A. Liao, S. Fidler
US Patent Number 2025/0086922 A1, published Mar 2025.

39. **Updating Synthetic Image Labels using Neural Networks to Improve Performance on Real-World Applications**
A. Liao, D. A. Marrero, J. Lucas, R. Mahmood, S. Fidler, V. Prabhu
US Patent Number 2025/0054288 A1, published Feb 2025.

40. **Estimating Optimal Training Data Set Sizes For Machine Learning Model Systems And Applications**
R. Mahmood, J. Lucas, Z. Yu, J. M. Alvarez Lopez, S. Fidler, and M. T. Law
US Patent Number 2023/0376849 A1, published Nov 2023.

41. **Estimating Optimal Training Data Set Size For Machine Learning Model Systems And Applications**
R. Mahmood, J. Lucas, D. A. Marrero, D. Li, J. Philion, J. M. Alvarez Lopez, S. Fidler, and M. T. Law
US Patent Number 2023/0385687 A1, published Nov 2023.

42. **Optimized Active Learning Using Integer Programming**
R. Mahmood, S. Fidler, and M. T. Law
US Patent Number 2023/0244985 A1, published Aug 2023.

Presentations

Invited Seminars

York University Center for AI and Society	2025
UTM Management Analytics Research Cluster (MARC) Conference	2025
ICCV Tutorial on Learning with Noisy and Unlabeled Data for Large Models beyond Categorization	2023
University of Toronto Rotman School of Management	2023
University of Ottawa Center for a Responsible Wealth Transition (CRWT)	2022
Wilfrid Laurier University Lazaridis School of Business and Economics	2022
University of Ottawa Telfer School of Management	2022
University of Hong Kong IMSE Department	2022
Rutgers University ISE Department	2021

University of North Carolina Kenan-Flagler Business School 2021
University of Cincinnati Lindner College of Business 2021
University of Iowa IE + EE Department 2021
University of Calgary CS Department 2021
University of Edinburgh Business School 2021
University of Alberta Alberta School of Business 2020
NVIDIA Toronto AI Lab 2020
University of Pittsburgh IE Department 2020
Université de Montréal GERAD 2019

Conference Talk[2]

Minority Reports: Balancing Cost and Quality in Ground Truth Data Annotation
INFORMS RMP Conference, New York City, NY, USA 2025

Pricing and Competition with Generative AI
MSOM Conference, London, UK 2025

Operations for New Machine Learning Products by Optimally Stopping Data Collection
INFORMS Annual Meeting, Seattle, WA, USA 2024

Optimizing Data Collection for Machine Learning
INFORMS Annual Meeting, Phoenix, AZ, USA 2023
INFORMS Workshop on Data Science, Phoenix, AZ, USA 2023
MSOM Conference, Montréal, QC, Canada 2023

Got (Optimal) Milk? Pooling Donations in Human Milk Banks with Machine Learning and Optimization
MSOM Healthcare SIG Conference, Montréal, QC, Canada 2023
POMS Conference, Orlando, FL, USA 2023

Low Budget Active Learning: An Integer Programming Approach
CORS Annual Conference, Vancouver, BC, Canada 2022
INFORMS Annual Meeting, Anaheim, CA, USA 2021

Learning to Optimize with Hidden Constraints
POMS Conference, Orlando, FL, USA 2022
CORS Annual Conference, Toronto, ON, Canada 2021
INFORMS Annual Meeting, Washington, DC, USA 2020
INFORMS Annual Meeting, Seattle, WA, USA 2019
CORS Annual Conference, Saskatoon, SK, Canada 2019

An Ensemble Learning Framework for Inverse Linear Optimization
INFORMS Health Care, Boston, MA, USA 2019
CORS Annual Conference, Saskatoon, SK, Canada 2019
CORS Annual Conference, Halifax, NS, Canada 2018
INFORMS Annual Meeting, Houston, TX, USA 2017
CORS Annual Conference, Quebec City, QC, Canada 2017
INFORMS Annual Meeting, Nashville, TN, USA 2016

[2]Presentations are categorized by the abbreviated main paper discussed. Actual titles may vary.

Automated Treatment Planning with Generative Adversarial Networks
CORS Annual Conference, Saskatoon, SK, Canada 2019
MLHC Conference, Palo Alto, CA, USA 2018

Convolutional Codes with Maximum Column Sum Rank for Network Streaming
IEEE ISIT, Hong Kong, HK, China 2015

Teaching

University of Ottawa

ADM 2304: Applications of Statistical Methods in Business 2023–2025

ADM 4307: Business Forecasting Analytics 2024–2025

MGT 5301: Predictive Analytics 2023–2024

Students Supervised

University of Ottawa PhD Students

1. Maryam Vahabi, *Management* 2023–pres. Co-advised with Christopher Sun.

University of Ottawa MSc Students

2. Viraj Vardhan, *Systems Engineering (Thesis)* 2025–pres.
   Co-advised with Jonathan Li.
3. Yibo Wang, *Digital Transformation & Innovation (Thesis)* 2025–pres.
   Co-advised with Justin Boutillier.
4. Morteza Emadi, *Business Analytics (Project)* 2024–2025
   Co-advised with Michael Mulvey.
5. Hammad Shakir, *Business Analytics (Project)* 2024
6. Hsuan-Wei Liao, *Business Analytics (Project)* 2024
7. Tulika Tahiliani, *Business Analytics (Project)* 2024–2025

University of Ottawa PhD Committee

8. Ziwei Zhang, *Digital Transformation & Innovation* 2025–pres.
9. Saeed Asadi, *Digital Transformation & Innovation* 2025–pres.
10. Shahryar Moradi, *Management* 2023–pres.
11. Amirhossein Moosavi, *Management* 2023

NVIDIA PhD Internships

12. Tolga Dimilioglu, *Research Scientist* 2025.
    Co-supervised with Nadine Chang, Maying Shen, and Jose M. Alvarez.
13. Feiyang Kang, *Research Scientist* 2024.
    Co-supervised with Nadine Chang, Maying Shen, Marc T. Law, James Lucas, and Jose M. Alvarez.
14. Nikita Durasov, *Research Scientist* 2024.
    Co-supervised with Jiwoong Choi, Marc T. Law, James Lucas, and Jose M. Alvarez.
15. Andrew Yuan-Hong Liao, *Research Scientist* 2022–2023.
    Co-supervised with David Acuna, James Lucas, and Sanja Fidler.
16. Viraj Prabhu, *Research Scientist* 2022.
    Co-supervised with David Acuna, Marc T. Law, James Lucas, and Sanja Fidler.

Grants

1. CIHR Project Grant, Co-Investigator, 2025–2030 ($1 365 526).
2. CRWT Grant, Principal Investigator, 2025 ($15 000).
3. CIHR Project Grant, Co-Investigator, 2024–2029 ($1 450 725).
4. SSHRC Insight Development Grant, Co-Investigator, 2024–2026 ($68 000).
5. NSERC Discovery Grant, Principal Investigator, 2023–2027 ($160 000).
6. NSERC Discovery Grant ECR Launch Supplement, Principal Investigator, 2023–2024 ($12 500).
7. University of Ottawa SEED Funding Opportunity, Principal Investigator, 2023 ($20 000).
8. Telfer School of Management Start-up Grant, Principal Investigator, 2023-2024 ($40 000).

Awards

1. Runners’ Up, Innovative Applications in Analytics Award, INFORMS, 2024.
2. First Place, Pierskalla Best Paper Award, INFORMS, 2023.
3. Finalist, Public Sector Operations Research (PSOR) Best Video Award, INFORMS, 2023.
4. *(Declined)* Semi-Finalist, Wagner Prize Competition, INFORMS, 2023.
5. Finalist, Practice-Based Research Competition, MSOM, 2023.
6. Finalist, Practice Prize Award, CORS, 2023.
7. Runners’ Up, College of Healthcare Operations Management (CHOM) Best Paper Prize, POMS, 2023 ($250).
8. University of Toronto Doctoral Completion Award, 2019–2020 ($8 000).
9. Runners’ Up, Health Care Operations Research Student Presentation Competition, CORS, 2019.
10. Postgraduate Affiliate Award, Vector Institute for Artificial Intelligence, 2019 ($12 000).

11. Honourable Mention, Student Paper Competition: Open Category, CORS, 2018 ($100).
12. Postgraduate Doctoral Scholarship, NSERC, 2017 ($42 000).
13. First Place, Waterfront International Ltd. Quantathon, 2016 ($7 500).

Other Professional Experience

NHL Expansion Draft Optimizer 2017, 2021

`http://nhlexpansiondraft.com`

Back-end Software Developer (2017), Adviser (2021)

We deployed a web app simulating the 2017 and 2021 NHL Expansion Drafts. Our site was featured in *The Toronto Star*, *OR/MS Today*, and *The Seattle Times*.

OpenKBP Grand Challenge 2019–2020

`https://www.aapm.org/GrandChallenge/OpenKBP/`

Machine Learning Expert

We organized an international competition for automating radiation therapy dose treatments in head-and-neck cancer, featuring 28 teams of 195 participants. We also released the public-access OpenKBP Data Set containing 400 treatments.

Opus One Solutions, Toronto, ON, Canada 2019

Power Systems Optimization Expert (Consultant)

Service

Organizational Service for the Academic Community

ICLR 2026

Area Chair

CVPR Workshop on Exploring the Next Generation of Data (NexD) 2025

Workshop Organization Committee Member

INFORMS HAS Pierskalla Award Committee 2024

Co-Chair

Refereeing

Grants

SSHRC Insight Grant (External Reviewer) 2024–2025

Journals

Manufacturing & Services Operations Research; Operations Research; INFORMS Journal on Computing; European Journal of Operational Research; Computers and Operations Research; Health Care Management Science; IEEE Transactions on Knowledge and Data Engineering; IEEE Transactions on Cybernetics; IISE Transactions

Conferences

ICLR 2022–2025; NeurIPS 2020–2025; ICML 2021–2025; IEEE ISIT 2017, 2022; ACM CHIL 2020–2021; NeurIPS ML4H Workshop 2019–2020

Service for the University of Ottawa

Telfer Business Healthcare Society 2023–pres.
Faculty Advisor

University of Ottawa UCaaS 2022–2023
Steering Committee Member

Personal

Languages: English (fluent), French (beginner)

Citizenship: Canadian

Last updated: December 19, 2025
http://rafidrm.github.io