Rafid Mahmood

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Employment

University of Ottawa, Telfer School of Management

(Incoming) Assistant Professor in Predictive Analytics and AI   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]

Working Papers and Pre-Prints

1. T. C. Y. Chan, D. L. O'Connor, **R. Mahmood**, D. Stone, S. Unger, R. K. Wong*, and I. Y. Zhu, Milk Bank Batching Operations: A Data-driven Optimization Approach, *in preparation for Manufacturing & Service Operations Management*, 2022.

   – Preliminary version at The Journal of Nutrition.

2. 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, T. C. Y. Chan, OpenKBP-Opt: An International and Reproducible Evaluation of 76 Knowledge-Based Planning Pipelines, *major revision in Physics in Medicine and Biology*, 2022.

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[1]I use alphabetical author ordering for articles in operations research-style journals. The primary author is starred.

3. A. Babier, T. C. Y. Chan, A. Diamant, and **R. Mahmood***, Learning to Optimize Contextually Constrained Problems for Real-Time Decision Generation, *major revision in Management Science*, 2021.

4. T. C. Y. Chan, **R. Mahmood***, and I. Y. Zhu*, Inverse Optimization: Theory and Applications, *under review in SIAM Review*, 2021.

Methodological Articles

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

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

7. A. Babier, T. C. Y. Chan, T. Lee, **R. Mahmood***, and D. Terekhov, An Ensemble Learning Framework for Model Fitting and Evaluation in Inverse Linear Optimization, *INFORMS Journal on Optimization*, 3 (2), 119–138, 2021.

    – **Honorable Mention (second place) at CORS 2018 Best Student Paper Competition.**

8. T. C. Y. Chan, A. Diamant, and **R. Mahmood***, Sampling from the Complement of a Polyhedron: An MCMC Algorithm for Data Augmentation, *Operations Research Letters*, 48 (6), 744–751, 2020.

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

    – Preliminary version at ISIT 2016.

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

    – Preliminary version at ISIT 2015.

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

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

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

Clinical Articles

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

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

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

– Preliminary version at ICCR 2019.

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

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

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

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

   – Preliminary version NeurIPS ML4H Workshop 2018.

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

   – **Runners' Up (second place) at CORS 2019 HCOR Student Presentation Competition.**

Media Articles

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

Presentations

Invited Seminars

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

Conferences[2]

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

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 Assistantship

MIE 465: Analytics in Action	2017–2019

– Responsible for course creation in 2017.

MIE 1620: Linear Programming and Network Flows	2018
MIE 258: Engineering Economics and Accounting	2016–2017
ECE 363: Communication Systems	2015

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

Students Supervised

University of Toronto[3]

1. Rachel Wong, Machine Learning Regression Models to Predict Protein and Fat Content in Human Donor Milk, *Masters of Applied Science Thesis*, 2020. Co-supervised with Ian Y. Zhu.

2. Richard Chavez, Sliding Window Generative Adversarial Networks for Radiation Therapy, *Industrial Engineering 4th Year Thesis*, 2019. Co-supervised with Aaron Babier.

3. Michael Shin, Using Portfolio Theory to Optimize Selection of Daily Fantasy Basketball Contests, *Engineering Science 4th Year Thesis*, 2018. Co-supervised with Ben Potter.

4. Yusuf Shalaby, Inverse Optimization for Measuring Cancer Treatment Pathway Concordance, *Industrial Engineering 4th Year Thesis*, 2018. Co-supervised with Nasrin Youssefi.

5. Palmira Pereira, Netflix Prize Problem Using Inverse Optimization, *Masters of Engineering Thesis*, 2017.

Awards

1. University of Toronto Doctoral Completion Award, 2019–2020 ($8 000).

2. Runners' Up, Health Care Operations Research Student Presentation Competition, CORS Annual Conference, 2019.

3. Postgraduate Affiliate Award, Vector Institute for Artificial Intelligence, 2019 ($12 000).

4. Honourable Mention, Student Paper Competition: Open Category, CORS Annual Conference, 2018 ($100).

5. Postgraduate Doctoral Scholarship, NSERC, 2017 ($42 000).

6. 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 received media coverage from <u>The Toronto Star</u>, <u>OR/MS Today</u>, and <u>The Seattle Times</u>.

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)

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[3]All students were co-supervised with my adviser Timothy C. Y. Chan.

Service

Academic

Ad-hoc Journal Referee

IEEE Transactions on Cybernetics; Health Care Management Science; European Journal of Operational Research

Ad-hoc Conference Referee

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

Conference Session Chair

CORS Annual Conference 2019, 2022; INFORMS Annual Meeting 2021

University of Toronto

Electrical and Computer Engineering Graduate Student Society   2014–2015

Treasurer

Electrical and Computer Engineering Graduate Students Symposium   2014

Organizing Committee Member

Personal

Languages: English (fluent), French (beginner)

Citizenship: Canadian