Rafid Mahmood

Nvidia Toronto AI Lab
Nvidia Corporation
Toronto, Ontario, Canada

Phone: +1 (647) 784 6242
Email: rafid.mahmood@mail.utoronto.ca
Homepage: http://rafidrm.github.io

Employment

Nvidia Corporation

AI Resident Researcher 2020–pres.

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, *under review in Physics in Medicine and Biology*, 2022.

[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 with Hidden Constraints, *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

1. **R. Mahmood***, J. Lucas, D. Acuna, D. Li, J. Philion, J. 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.

2. **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.

3. 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.**

4. 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.

5. **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.

6. **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.

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

8. **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.

9. 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

1. 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.

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. **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

1. 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

CS Department, University of Calgary 2021

MSBE Group, University of Edinburgh Business School 2021

AOIS Department, Alberta School of Business 2020

Nvidia Research, Toronto AI Lab 2020

IE Department, University of Pittsburgh 2020

GERAD, Université de Montréal 2019

Conferences[2]

Low Budget Active Learning: An Integer Programming Approach

(scheduled) CORS Annual Conference, Vancouver, BC, Canada 2022

INFORMS Annual Meeting, Anaheim, CA, USA 2021

Learning to Optimize with Hidden Constraints

(scheduled) 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

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

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

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).

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

Other Professional Experience

NHL Expansion Draft Optimizer (`http://nhlexpansiondraft.com`**)** 2017, 2021

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

- Implemented an online tool demonstrating the power of optimization in simulating team choices for the 2017 and 2021 NHL Expansion Draft with the Vegas Golden Knights and Seattle Kraken, respectively.
- Our site received media coverage from *The Toronto Star*, *OR/MS Today*, and *The Seattle Times*.

OpenKBP Grand Challenge, American Association of Physicists in Medicine 2019–2020

Machine Learning Expert

- Released the OpenKBP Data Set, which is the first public-access data set (of 400 ML-generated treatments) to standardize research in automated planning.
- Organized the OpenKBP Grand Challenge, which was an international competition for predicting radiation therapy dose treatments in head-and-neck cancer.

Opus One Solutions, Toronto, ON, Canada 2019

Power Systems Optimization Expert (Consultant)

- Developed and implemented algorithms to solve optimal power flow, dispatch, and related power systems problems.

Service

Academic

Ad-hoc Journal Referee

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

Ad-hoc Conference Referee

ICML 2021–2022; IEEE ISIT 2017, 2022; ICLR 2022; NeurIPS 2020–2021; 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

Last updated: April 14, 2022
http://rafidrm.github.io