Rafid Mahmood

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Employment

Nvidia Corporation

AI Resident Researcher 2020–2021

Education

University of Toronto, Mechanical and Industrial Engineering

Ph.D Industrial Engineering 2015–2020

Vector Institute for Artificial Intelligence Postgraduate Affiliate 2019–2020

Thesis: Learning to Solve Optimization Problems with Hidden Components: Applications in Automated Treatment Planning

Adviser: Professor Timothy C. Y. Chan

University of Toronto, Electrical and Computer Engineering

M.A.Sc. Electrical Engineering 2013–2015

Thesis: Rank Metric Convolution Codes with Applications in Network Streaming

Adviser: Professor Ashish Khisti

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

Publications[1]

Pre-prints

1. A. Babier, T. C. Y. Chan, A. Diamant, and **R. Mahmood***, Learning to Optimize with Hidden Constraints, *major revision in Management Science*, 2021.

2. **R. Mahmood***, M. Law, and S. Fidler, Low Budget Active Learning via Wasserstein Distance: An Integer Programming Approach, *under review at the International Conference for Machine Learning*, 2021.

[1] Articles for operations research journals use alphabetical author ordering. The primary author is starred.

Journal 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, *forthcoming in Journal of Nutrition*, 2021.

2. 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, *forthcoming in INFORMS Journal on Optimization*, 2021.

   – **Honorable Mention (second place) at CORS 2018 Best Student Paper Competition.**
   – Preliminary version at the 2019 Canadian Healthcare Optimization Workshop.

3. 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, *forthcoming in Medical Physics*, 2021.

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. 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.

6. 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 the 2019 International Conference on the Use of Computers in Radiotherapy.

7. 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.

8. 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, 297–306, 2019.

   – Preliminary version at the 2018 NeurIPS Workshop on Machine Learning for Health.

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 the 2016 International Symposium on Information Theory.

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 the 2015 International Symposium on Information Theory.

Conference Proceedings

1. **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*, Proceedings of Machine Learning Research 85, 484–499, 2018.

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

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

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

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

Refereed Workshops and Clinical Abstracts

1. 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*, 2019.

2. A. Babier*, **R. Mahmood**, A. McNiven, and T. C. Y. Chan, An Optimization Method for Knowledge-based Automated Planning that Leverages Ensemble Dose Predictions, *American Association of Physicists in Medicine*, 2019.

3. A. Babier*, **R. Mahmood**, A. McNiven, and T. C. Y. Chan, Comparing Deep Learning Architectures for Knowledge-Based Automated Planning, *American Association of Physicists in Medicine*, 2019.

4. A. Babier, T. C. Y. Chan, T. Lee, **R. Mahmood***, and D. Terekhov, Model Fitting in Generalized Inverse Linear Optimization: Applications in Radiation Therapy, *Canadian Healthcare Optimization Workshop*, 2019.

5. A. Babier*, **R. Mahmood***, A. McNiven, A. Diamant, and T. C. Y. Chan, Automated Treatment Planning in Radiation Therapy with 3-D Generative Adversarial Networks, *NeurIPS Workshop on Machine Learning for Health*, 2018.

Presentations[2]

Low Budget Active Learning: An Integer Programming Approach

– INFORMS Annual Meeting, Anaheim, CA, USA 2021

Learning to Optimize with Hidden Constraints

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

- CORS Annual Conference, Toronto, ON, Canada 2021
- INFORMS Annual Meeting, Washington, DC, USA 2020
- AOIS Seminar, Alberta School of Business, Edmonton, AB, Canada 2020
- Nvidia AI Research Seminar, Toronto, ON, Canada 2020
- IE Department Seminar, University of Pittsburgh, Pittsburgh, PA, USA 2020
- INFORMS Annual Meeting, Seattle, WA, USA 2019
- CORS Annual Conference, Saskatoon, SK, Canada 2019
- GERAD Seminar, Université de Montréal, Montréal, QC, 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

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

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.

Opus One Solutions, Toronto, ON, Canada 2019
Independent Contract/Power Systems Optimization Expert

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

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

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

Back-end Software Developer

– Implemented an online tool to determine optimal draft choices for the 2017 NHL Draft subject to user input preferences. We received media coverage from *The Toronto Star*.

Service

Academic Community

Ad-hoc Journal Referee

Health Care Management Science, *European Journal of Operations Research*

Ad-hoc Conference Referee

NeurIPS 2020–2021, *ICML 2021*, *ACM CHIL 2020–2021*, *NeurIPS ML4H Workshop 2019–2020*, *IEEE ISIT 2017*

Conference Session Chair

INFORMS Annual Meeting 2021, *CORS Annual Conference 2019*

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