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 (Operations Research)   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]

In Preparation

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, Assessment of Machine Learning Regression Models to Predict Protein and Fat Content in Human Donor Milk using Maternal-Infant and Donation Specific Variables, 2020.

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

Under Review

1. A. Babier, T. C. Y. Chan, A. Diamant, and **R. Mahmood***, Learning to Optimize with Hidden Constraints, *under review in Management Science*, 2020.

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, *under review in Medical Physics*, 2020.

Journal Articles

1. 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*, 2020.

   – **Honorable Mention at CORS 2018 Best Student Paper Competition: Open Category.**
   – Preliminary version at the 2019 Canadian Healthcare Optimization Workshop.

2. 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.

3. 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.

4. 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.

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, 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.

7. **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.

8. **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.

   – **Won Runners' Up 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

Learning to Optimize with Hidden Constraints

- 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 Model Fitting and Evaluation in 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 in Radiation Therapy 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

1. Rachel Wong, Machine Learning Regression Models to Predict Protein and Fat Content in Human Donor Milk using Maternal-Infant and Domation Specific Variables, *Masters of Applied Science Thesis*, 2020. Co-supervised with Ian Yihang 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
Power Systems Optimization Expert

– 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

Referee for European Journal of Operations Research, Health Care Management Science, IEEE ISIT (2017), NeurIPS ML4H Workshop (2019, 2020), ACM CHIL (2020), and NeurIPS (2020).

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