Aaron Babier

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Education

Degree	Institution	Department	Thesis Field	Year
Ph.D.	University of Toronto	Mechanical and Industrial Engineering	Operations Research	2022
M.A.Sc.	University of Toronto	Mechanical and Industrial Engineering	Operations Research	2017
B.Sc., Hons.	Queen's University	Physics, Engineering Physics, and Astronomy	Medical Physics	2015

Refereed Journal Publications

An asterisk (*) is used to denote the primary author for articles that use alphabetical author ordering.

1. B. Zhang, A. Babier, T.C.Y. Chan, M. Ruschin, "3D dose prediction for Gamma Knife radiosurgery using deep learning and data augmentation," *Physica Medica*, Vol. 106, 102533, 2023.

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," *Physics in Medicine and Biology*, Vol. 67, 185012, 2022.

3. A. Babier, C. Fernandes, I.Y. Zhu, "Advising student-driven analytics projects: A summary of experiences and lessons learned," *INFORMS Transactions on Education*, Vol. 23, pp. 121-135, 2022.

4. A. Babier, B. Zhang, R. Mahmood, K.L. Moore, T.G. Purdie, A.L. McNiven, T.C.Y. Chan, "OpenKBP: The open-access knowledge-based planning grand challenge and dataset," *Medical Physics*, Vol. 48, pp. 5549-5561, 2021.

5. A. Babier, T.C.Y. Chan, T. Lee, R. Mahmood*, D. Terekhov, "An ensemble learning framework for model fitting and evaluation in inverse linear optimization," *INFORMS Journal on Optimization*, Vol. 3, pp. 119-138, 2021.

6. M.G. Crowson, J.W. Lee, A. Hamour, R. Mahmood, A. Babier, V. Lin, D.L. Tucci, T.C.Y. Chan, "AutoAudio: Deep learning for automatic audiogram interpretation," *Journal of Medical Systems*, Vol. 44, pp. 163, 2020.

7. A. Babier, R. Mahmood, A.L. McNiven, A. Diamant, T.C.Y. Chan, "The importance of evaluating the complete automated knowledge-based planning pipeline," *Physica Medica*, Vol. 72, pp. 73-79, 2020.

   - Rising Star: One of the seven highest quality submissions by a student at the International Conference on the Use of Computers in Radiotherapy

8. A. Babier, R. Mahmood, A.L. McNiven, A. Diamant, T.C.Y. Chan, "Knowledge-based automated planning with three-dimensional generative adversarial networks," *Medical Physics*, Vol. 47, pp. 297-306, 2020.

9. M. G. Crowson, J. Ranisau, A. Eskander, A. Babier, B. Xu, R.R. Kahmke, J. M. Chen, T.C.Y. Chan, "A contemporary review of machine learning in otolaryngology-head and neck surgery," *Laryngoscope*, Vol. 130, pp. 45-51, 2020.

10. A. Babier, J.J. Boutilier, A.L. McNiven, T.C.Y. Chan, "Knowledge-based automated planning for oropharyngeal cancer," *Medical Physics*, Vol. 45, pp. 2875-2883, 2018.
    - Editors' Choice: One of the top articles in the July 2018 issue

11. A. Babier, J.J. Boutilier, A.L. McNiven, M.B. Sharpe, T.C.Y. Chan, "Inverse optimization of objective function weights for treatment planning using clinical dose-volume histograms," *Physics in Medicine and Biology*, Vol. 63, pp. 105004, 2018.

Submitted Manuscripts

1. A. Babier, T.C.Y. Chan, A. Diamant, R. Mahmood*, "Learning to optimize contextually constrained problems for real-time decision-generation," under review at *Management Science*.

Refereed Conference Papers

1. R. Mahmood, A. Babier, A.L. McNiven, A. Diamant, T.C.Y. Chan, "Automated treatment planning in radiation therapy using generative adversarial networks," *Proceedings of Machine Learning Research*, Vol. 85 (*Machine Learning for Healthcare*), pp. 484-499, 2018.

Refereed Conference Abstracts

1. A. Babier, B. Zhang, R. Mahmood, V.G.L Alves, A. Barragan-Montero, J. Beaudry, C. Cardenas, Y. Chang, Z. Chen, J. Chun, H. Eraso, E. Faustmann, S. Gaj, S. Gay, M. Gronberg, J. He, G. Heilemann, S. Hira, Y. Huang, F. Ji, D. Jiang, J. Jimenez-Giraldo, H. Lee, J. Lian, K. Liu, S. Liu, K. Marixa, J. Marrugo, K. Miki, T. Netherton, D. Nguyen, H. Nourzadeh, A. Osman, Z. Peng, J. Quinto-Munoz, C. Ramsl, D. Rhee, J. Rodriguez-Arciniegas, H. Shan, J.V. Siebers, M. H. Soomro, K. Sun, A. Usuga-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, "An international validation of knowledge-based planning," *Medical Physics*, Vol. 48, p. e422, 2021.

2. B. Zhang, A. Babier, T.C.Y. Chan, M. Ruschin, "Three-dimensional dose prediction methodology for gamma knife," *Medical Physics*, Vol. 48, p. e460, 2021.

3. A. Babier, A.L. McNiven, T.C.Y. Chan, "Predicting treatment plans with reinforcement learning," *Medical Physics*, Vol. 47, p. e333, 2020.

4. A. Babier, R. Mahmood, A.L. McNiven, T.C.Y. Chan, "An optimization method for knowledge-based automated planning that leverages ensemble dose predictions," *Medical Physics*, Vol. 46, p. e368, 2019.

5. A. Babier, R. Mahmood, A. Diamant, A.L. McNiven, T.C.Y. Chan, "Comparing deep learning architectures for knowledge-based automated planning," *Medical Physics*, Vol. 46, p. e368, 2019.

6. A. Babier, M. McGrail, A.L. McNiven, T.C.Y. Chan, "A robust approach to dose mimicking," *Medical Physics*, Vol. 45, p. 2747, 2018.

7. A. Babier, A.L. McNiven, T.C.Y. Chan, "Knowledge-based automated planning for oropharyngeal cancer," *Medical Physics*, Vol. 45: p.2745, 2018.

8. A. Babier, J.J. Boutilier, A.L. McNiven, M.B. Sharpe, T.C.Y. Chan, "Knowledge-based automated planning for oropharyngeal cancer," *Medical Physics*, Vol. 44 p. 3294, 2017.

9. A. Babier, J.J. Boutilier, A.L. McNiven, M.B. Sharpe, T.C.Y. Chan, "Reverse engineering fluence maps from dose volume histograms using inverse optimization and inverse planning," *Medical Physics*, Vol. 44 p. 3084, 2017.

10. J.J. Boutilier, A. Babier, T. Craig, A.L. McNiven, M.B. Sharpe, T.C.Y. Chan, "Sample size requirements for knowledge-based treatment planning," *Medical Physics*, Vol. 43, p. 3724, 2016.

11. A. Babier, C.P. Joshi, "A simulation study to investigate maximum allowable deformations of implant geometry before plan objectives are violated in prostate HDR brachytherapy," *Medical Physics*, Vol. 43, pp. 3651-3652, 2016.

Awards

Year	Award Title	Awarded By	Terms of Award
2021	Bonder Award	*INFORMS*	Support for top students to attend INFORMS annual meeting
2021	Postgraduate Affiliate Award	*Vector Institute for Artificial Intelligence*	Support for top students engaged in artificial intelligence research ($12,000)
2019	Milligan Graduate Fellowship	*Faculty of Applied Science and Engineering, University of Toronto*	Support for top students engaged in biomedical research ($5,000)
2019	Alexander Graham Bell Canada Graduate Scholarship	*NSERC*	Support for top Canadian doctoral students ($70,000)
2019	Rising Star Finalist	*The International Conference on the Use of Computers in Radiation Therapy (ICCR)*	One of the seven highest quality submissions by a student
2019	Conference Travel Grant	*School of Graduate Studies, University of Toronto*	Travel support for conference
2018	Editors' Choice	*Medical Physics*	One of the top articles in the July 2018 issue
2017	CORS Graduate Student Travel Grant	*Canadian Operational Research Society (CORS)*	Travel support for annual meeting
2017, 2015	Graduate Student Travel Grant	*Mechanical and Industrial Engineering, University of Toronto*	Travel support for conference
2015	Harold E. Johns Studentship	*Cancer Care Ontario*	Support to top undergraduate students to pursue summer medical physics research ($3,000)
2011	Principal's Scholarship	*Queen's University*	Support for top incoming students ($8,000)

1. A. Babier, B. Zhang, R. Mahmood, K.L. Moore, T.G. Purdie, A.L. McNiven, T.C.Y. Chan, "OpenKBP: The open-access knowledge-based planning challenge (an AAPM grand challenge)," *AAPM Webinar*, Virtual, Oct. 29, 2020.

2. A. Babier, A.L. McNiven, T.C.Y. Chan, "Generating treatment plans for radiation therapy with artificial intelligence and optimization," *San Diego Physics Research Meeting*, San Diego, CA, USA, Mar. 12, 2020.

3. A. Babier, A.L. McNiven, T.C.Y. Chan, "Generating treatment plans for radiation therapy with artificial intelligence and optimization," *Sunnybrook Physics Research Seminar*, Toronto, ON, Canada, Nov. 29, 2019.

4. A. Babier, "The role of knowledge-based planning in automation and its sample size requirements," *2017 AQPMC Annual Meeting*, Trois-Rivières, QC, Nov. 18, 2017.

CONFERENCE PRESENTATIONS

1. A. Babier, B. Zhang, R. Mahmood, K.L. Moore, T.G. Purdie, A. McNiven, T.C.Y. Chan, "An open source analysis of optimization models for knowledge-based radiotherapy treatment planning," *2021 INFORMS Annual Meeting*, Virtual, Oct. 24, 2021.

2. A. Babier, B. Zhang, R. Mahmood, V.G.L Alves, A. Barragan-Montero, J. Beaudry, C. Cardenas, Y. Chang, Z. Chen, J. Chun, H. Eraso, E. Faustmann, S. Gaj, S. Gay, M. Gronberg, J. He, G. Heilemann, S. Hira, Y. Huang, F. Ji, D. Jiang, J. Jimenez-Giraldo, H. Lee, J. Lian, K. Liu, S. Liu, K. Marixa, J. Marrugo, K. Miki, T. Netherton, D. Nguyen, H. Nourzadeh, A. Osman, Z. Peng, J. Quinto-Munoz, C. Ramsl, D. Rhee, J. Rodriguez-Arciniegas, H. Shan, J.V. Siebers, M. H. Soomro, K. Sun, A. Usuga-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, "An international validation of knowledge-based planning," *2021 AAPM Annual meeting*, Virtual, July 29, 2021.

3. A. Babier, A.L. McNiven, T.C.Y. Chan, "Predicting optimal radiation therapy plans for cancer treatment," *2021 CORS Annual Meeting*, Virtual, Jun. 8, 2021.

4. A. Babier, A.L. McNiven, T.C.Y. Chan, "Predicting high quality radiation therapy plans for cancer treatment," *2020 INFORMS Annual Meeting*, Virtual, Nov. 11, 2020.

5. A. Babier, A.L. McNiven, T.C.Y. Chan, "Predicting treatment plans with reinforcement learning," *2020 AAPM Annual Meeting*, Virtual, Jul. 14, 2020.

6. A. Babier, R. Mahmood, A.L. McNiven, T.C.Y. Chan, "An Optimization method for knowledge-based automated planning that leverages ensemble dose predictions," *2019 AAPM Annual Meeting*, San Antonio, TX, USA, Jul. 16, 2019.

7. A. Babier, R. Mahmood, A. Diamant, A.L. McNiven, T.C.Y. Chan, "Comparing deep learning architectures for knowledge-based automated planning," *2019 AAPM Annual Meeting* , San Antonio, TX, USA, Jul. 16, 2019.

8. A. Babier, R. Mahmood, A. Diamant, A.L. McNiven, T.C.Y. Chan, "The importance of evaluating the complete knowledge-based automated planning pipeline," *ICCR 2019*, Montreal, QC, Canada, Jun. 19, 2019.

9. A. Babier, A.L. McNiven, T.C.Y. Chan, "Dose mimicking with inverse optimization," *2018 INFORMS Annual Meeting*, Phoenix, AZ, USA, Nov. 7, 2018.

10. A. Babier, M. McGrail, A.L. McNiven, T.C.Y. Chan, "A robust approach to dose mimicking," *2018 AAPM Annual Meeting*, Nashville, TN, USA, Jul. 29, 2018.

11. A. Babier, A.L. McNiven, T.C.Y. Chan, "Inverse optimization as a tool for advanced dose mimicking," *2018 AAPM Annual Meeting*, Nashville, TN, USA, Jul. 29, 2018.

12. A. Babier, J.J. Boutilier, A.L. McNiven, T.C.Y. Chan, "Using inverse optimization to evaluate knowledge based planning methods for oropharyngeal cancer," *2017 INFORMS Annual Meeting*, Houston, TX, USA, Oct. 25, 2017.

13. A. Babier, J.J. Boutilier, A.L. McNiven, T.C.Y. Chan,"Knowledge-based automated planning for oropharyngeal cancer," *2017 AAPM Annual Meeting*, Denver, CO, USA, Aug. 3, 2017.

14. A. Babier, J.J. Boutilier, A.L. McNiven, T.C.Y. Chan, "Coupling knowledge-based planning and inverse optimization," *2017 IFORS Annual Meeting*, Quebec City, QC, Canada, Jul. 27, 2017.

15. A. Babier, J.J. Boutilier, A.L. McNiven, M.B. Sharpe, T.C.Y. Chan,"Automating cancer treatment planning with inverse optimization," *Centre in Computational Science and Engineering Seminar*, Toronto, ON, Canada, Dec. 16, 2016.

16. A. Babier, J.J. Boutilier, A.L. McNiven, M.B. Sharpe, T.C.Y. Chan, "Using inverse optimization to produce IMRT treatment plans from DVH curves," *2016 INFORMS Annual Meeting*, Nashville, TN, USA, Nov. 16, 2016.

17. A. Babier, J.J. Boutilier, A.L. McNiven, M.B. Sharpe, T.C.Y. Chan, "Using inverse optimization to produce IMRT treatment plans from DVH curves," *MIE Symposium*, Toronto, ON, Canada, Jun. 9, 2016.

Poster Presentations

1. A. Babier, B. Zhang, R. Mahmood, K.L. Moore, T.G. Purdie, A.L. McNiven, T.C.Y. Chan,, "OpenKBP: An international competition for predicting cancer treatment plans," *Vector Institute Computer Vision Symposium*, Virtual, Oct. 28, 2021.

2. A. Babier, R. Mahmood, A.L. McNiven, A. Diamant, T.C.Y. Chan, "Automated radiation therapy treatment planning using 3-D generative adversarial networks," *Neural Information Processing Systems Machine Learning for Health Workshop*, Montreal, QC, Canada, Dec. 8, 2018.

3. A. Babier, J.J. Boutilier, A.L. McNiven, T.C.Y. Chan, "Reverse engineering fluence maps from dose volume histograms using inverse optimization and inverse planning," *2017 AAPM Annual Meeting*, Denver, CO, USA, Jul. 27 2017.

4. A. Babier, C.P. Joshi, "A simulation study to investigate maximum allowable deformations of implant geometry before plan objectives are violated in prostate HDR brachytherapy," *2016 AAPM Annual Meeting*, Washington, DC, USA, Jul. 31, 2016.

Media Features

1. "U of T Engineering team develops redeployment tool to optimize hospital staffing amid COVID-19," *University of Toronto Engineering News*, Apr. 23, 2020.

2. "This is how artificial intelligence has gone from diagnosing cancer to treating it," *EL PAÍS*, Oct. 18, 2018.

3. "Optimizing radiation therapy plans with AI," *Healthcare Business News*, Oct. 1, 2018.

4. "AI designs radiation therapy treatment plan for cancer in twenty minutes," *Forbes*, Aug. 1, 2018.

5. "Smarter cancer treatment: AI tool cuts time of developing radiation therapy plans from days to hours," *University of Toronto News*, Aug. 1 2018.

REVIEW ACTIVITIES

Year	Journal	Activity	Papers
2022	*Medical Image Analysis*	Referee	One
2022	*International Journal of Radiation Oncology*	Referee	One
2022	*Medical Physics*	Referee	Four
2022	*IEEE Transactions on Medical Imaging*	Referee	One
2021	*Medical Physics*	Associate Editor	One
2021	*Journal of Applied Clinical Medical Physics*	Referee	One
2021	*Physics in Medicine and Biology*	Referee	Three
2020	*Physics in Medicine and Biology*	Referee	One
2020	*Medical Physics*	Referee	One
2019	*Medical Physics*	Referee	Two

SPECIAL INITIATIVES

Year	Name	Affiliations	Purpose
2020	OpenKBP: An AAPM Grand Challenge	*American Association of Physicists in Medicine*	Encourage fair and consistent comparisons of dose prediction methods for knowledge-based planning
2020	Redeploy	*University Health Network, Unity Health Toronto*	Enable hospitals to quickly redeploy their staff during the COVID-19 pandemic

Teaching and Mentorship Experience

Teaching Assistant
Department of Mechanical and Industrial Engineering
University of Toronto, Toronto, Ontario

Years	Term	Course No.	Course Title
2019 to 2021	Fall	MIE368	Analytics in Action
2019	Winter	MIE465	Analytics in Action
2016 to 2018	Fall	MIE258	Engineering Economics and Accounting

Undergraduate Student Research Supervisor
Department of Mechanical and Industrial Engineering
University of Toronto, Toronto, Ontario

Date	Student	Project Title
May 2019 - Apr. 2020	Tamara Kecman	Augmenting the training set of dose prediction models with synthetic plans to improve model performance
Sept. 2018 - Apr. 2019	Anna Ye	Robust optimization of radiation treatment plans to account for patient setup uncertainty in automated treatment planning
Sept. 2018 - Apr. 2019	Richard Chavez	Predicting intensity modulated radiation therapy dose distributions using generative adversarial networks with partitioned images
May 2018 - Aug. 2018	Jamal Chu	Filtering data for improved knowledge-based planning
May 2017 - Aug. 2017	Molly McGrail	Feature engineering for knowledge-based radiation therapy treatment planning

Extra Curricular

Year	Position	Organization	Responsibilities
2015 - 2020	Coach, Team Member	University of Toronto Sailing Team	Ran team practices and helped organized team events
2018 - 2019	Chairperson of Student Steering Committee	Centre in Computational Science and Engineering (CCSE)	Organized events and managed the student committee activities
2016 - 2018	President, Treasurer	University of Toronto Operations Research Group	Organized events for the group's members
2014 - 2015	Head Instructor	Queen's University Recreational Sailing Club	Organized a large staff to deliver beginner sailing lessons to over 100 students