Marta Kryven, Ph.D.

mkryven@mit.edu +1 (226) 507-5893
https://scholar.google.ca/citations?user=VwblkpMAAAAJ&hl=en&oi=ao
linkedin.com/in/marta-kryven

Education

2012 – 2017 **Ph.D., University of Waterloo** Computer Science.
Thesis title: *Attributed Intelligence.*

2017 **Visiting Scholar, Massachusetts Institute of Technology**
Advisor: Prof. Joshua Tenenbaum.

2015 **'Brains, Minds Machines', Summer School**, The Marine Biological Laboratory, Woods Hole

Teaching Fundamentals Certificate, Centre for Teaching Excellence, University of Waterloo

2008 – 2011 Fine Art courses, Trinity College, Dublin

2004 BSc in Applied mathematics

Employment

2018 – · · · · **Postdoctoral Research Scientist, Massachusetts Institute of Technology**
Research interests: Generative Inference, Planning, Spatial navigation, Language models, Program Induction, Structure Learning, Computational Social Perception, Human-centered AI
Advisor: Prof. Joshua Tenenbaum
Built models of human spatial navigation in real cities, and used them to model human behaviour in a large data-se of GPS traces, demonstrating evidence of vector navigation in humans for the first time. This work was **featured in annual collection of Nature Computational Science**.
Built generative inference models using RL & program induction for efficient exploration of novel environments, that outperform state of the art Partially Observable Monte Carlo planners
Built and evaluated computational models of human planning under uncertainty in naturalistic environments.
Collaborated on, and led interdisciplinary projects, bridging AI/ML, statistics and neuroscience.
Supervised four graduate students, and over 10 undergraduate research assistants

2012 – 2018 **PhD candidate in Computer Science, University of Waterloo**
Research interests: Bayesian models, Machine Learning, Natural Language Processing, Computational perception, Generative computer graphics, Planning, Reinforcement Learning, Eye-movement analysis, Computational Neuroscience
Built computational models of human cognition, social perception and attention based on Partially Observable Markov Decision processes, and validated these models in human behavioral experiments using Inverse Bayesian Inference.
5 years of experience as a Teaching Assistant and Lab Instructor, focusing on Artificial Intelligence, Computer Graphics and Real-time programming. Supervised student course projects, assisted students during office hours, designed curriculum and assignments.

2008-2011 **Senior Software Engineer.** Newbay Software, Dublin, Ireland.
Developed a failure-proof telecom server, a personalized cloud for mobile networks, and desktop applications (Mac, Windows and Linux) for providing social media access (e.g. Facebook, Twitter) through mobile devices.
Took initiative to automate server stress-testing, by building multi-threaded Linux software for red teaming with simulated network requests, which saved significant costs.

2006-2007 **Senior Software Engineer, Team Leader.** Radvision, Tel-Aviv, Israel.
Developed a software service for a VoIP gateway – a specialized server used to manage calls from IP (e.g. Skype) to mobile phone networks.

2005-2006 **Software Engineer.** Weather Services International, Boston, USA
Programming weather visualisation for The Weather Channel

Technical Skills

ML/AI	Generative Inference, Planning, RL, Program Induction, Bayesian Modeling, Deep Neural Networks, Cross-validation, Classification, Natural Language Processing
General	Statistics, Experiment design, Literature review, Writing papers and technical reports, Interdisciplinary Collaborations, Presenting to diverse stakeholders, Lecturing, Dataset Curation
LLM Tools	ChatGPT, Codex, CODEGEN, Mistral and other models available through Hugging Face
Programming	Python, transformers, PyTorch, R, Java, C/C++/C#, MATLAB, SQL, XML/XSL, LaTeX, SQL, OpenGL, HTML, CSS, JavaScript, PHP, Apache Web Server
Software	Code editors (Jupyter, IntelliJ IDEA, Sublime, Eclipse, Microsoft Visual Studio, vi), Version control tools (e.g. Git, subversion), Libre/Microsoft Office, Adobe Creative Suite, Unity

Publications

Articles

Kryven, M., S. Yu, Kleiman-Weiner, U. T. M., and J. Tenenbaum, "Approximate planning in spatial search," 2024, (Submitted).

T. Shu, **Kryven, M.**, T. Ullman, and J. Tenenbaum, "Perceiving social interactions under physical dynamics," 2024, (In preparation).

S. Acquaviva, Y. Pu, **M. Kryven**, *et al.*, "Communicating natural programs to humans and machines," *Advances in Neural Information Processing Systems*, vol. 35, pp. 3731–3743, 2022.

M. Kryven, S. Yu, M. Kleiman-Weiner, and J. Tenenbaum, "Planning ahead in spatial search," *The 5th Multidisciplinary Conference on Reinforcement Learning and Decision Making*, 2022.

S. Sharma, A. Curtis, **M. Kryven**, J. Tenenbaum, and I. Fiete, "Map induction: Compositional spatial submap learning for efficient exploration in novel environments," *International Conference of Learning Representations*, 2022.

T. Shu, A. Magaro, **M. Kryven**, T. Ullman, and J. Tenenbaum, "Social attribution guides similarity judgment of abstract scenes," *Journal of Vision*, vol. 22, no. 14, pp. 3644–3644, 2022.

C. Bongiorno, Y. Zhou, **M. Kryven**, *et al.*, "Vector-based pedestrian navigation in cities," *Nature Computational Science*, vol. 1, no. 10, pp. 678–685, 2021.

M. Kryven, T. D. Ullman, W. Cowan, and J. B. Tenenbaum, "Plans or outcomes: How do we attribute intelligence to others?" *Cognitive Science*, vol. 45, no. 9, pp. 13–41, 2021.

Y. Qian, **M. Kryven**, T. Gao, H. Joo, and J. Tenenbaum, "Modeling human intention inference in continuous 3d domains by inverse planning and body kinematics," *arXiv preprint arXiv:2112.00903*, 2021.

T. Shu, A. Netanyahu, **M. Kryven**, *et al.*, "Perceiving social events in a physical world," *Journal of Vision*, vol. 21, no. 9, pp. 2463–2463, 2021.

Y. Pu, K. Ellis, **M. Kryven**, J. Tenenbaum, and A. Solar-Lezama, "Program synthesis with pragmatic communication," *Advances in Neural Information Processing Systems*, vol. 33, pp. 13 249–13 259, 2020.

T. Shu, **M. Kryven**, T. D. Ullman, and J. Tenenbaum, "Adventures in flatland: Perceiving social interactions under physical dynamics.," *Proceedings of the Annual Meeting of the Cognitive Science Society*, 2020.

L. Tian, K. Ellis, **M. Kryven**, and J. Tenenbaum, "Learning abstract structure for drawing by efficient motor program induction," *Advances in Neural Information Processing Systems*, vol. 33, pp. 2686–2697, 2020.

B. Cowan, E. Fourquet, and **M. Kryven**, "Teaching the societal consequences of computer science: New ideas for increasing student involvement," *Proceedings of the 23rd Annual ACM Conference on Innovation and Technology in Computer Science Education*, pp. 242–247, 2018.

M. Kryven, T. D. Ullman, W. Cowan, and J. Tenenbaum, "Outcome or strategy? a bayesian model of intelligence attribution.," *Proceedings of the Annual Meeting of the Cognitive Science Society*, 2016.

M. Kryven and W. Cowan, "What does water look like?" *Proceedings of the Workshop on Computational Aesthetics*, pp. 53–56, 2014.

M. Kryven and W. Cowan, "Modelling perceptually efficient aquatic environments," *Proceedings of the ACM Symposium on Applied Perception*, pp. 131–131, 2013.

M. Kryven and E. Fourquet, "Generating knitting patterns from a sketch: A csp approach," *Proceedings of the Symposium on Computational Aesthetics*, pp. 53–61, 2013.

Refereed Poster Abstracts

N. Vlavianos, T. Nagakura, and **M. Kryven**, "A novel method for measuring psychophysical immersion in sacred architectural space in vr and in reality," in *Society for Philosophy and Psychology*, 2023.

S. Sharma, A. Curtis, **M. Kryven**, J. Tenenbaum, and I. Fiete, "Efficient exploration of spatial environments through map induction using adaptable compositional map representations," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, vol. 44, 2022.

S. Sharma, A. Curtis, **M. Kryven**, J. Tenenbaum, and I. Fiete, "Map induction: Compositional spatial submap learning for efficient exploration in novel environments," in *COSYNE*, 2022.

N. Vlavianos, T. Nagakura, and **M. Kryven**, "Human information seeking in architectural spaces simulated in virtual reality," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, vol. 44, 2022.

G. Ecanow, C. Wong, S. Acquaviva, Y. Pu, **M. Kryven**, and J. Tenenbaum, "Core knowledge objects in reasoning and language use for highly abstract inductive tasks," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, vol. 43, 2021.

S. Sharma, A. Curtis, **M. Kryven**, J. Tenenbaum, and I. Fiete, "Learning spatial environments by adaptable compositional map representations," in *Proceedings of the 42th Annual Conference of the Cognitive Science Society*, vol. 44, 2021.

Z. Yang, **M. Kryven**, H. Shrobe, and J. Tenenbaum, "Modeling human planning in a life-like search-and-rescue mission," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, vol. 43, 2021.

S. Yu, **M. Kryven**, J. Tenenbaum, and M. Kleiman-Weiner, "Unpacking the computations of human spatial search under uncertainty: Noisy utility maximization, discounting, and probability warping," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, vol. 43, 2021.

M. Kryven, S. Croom, B. J. Scholl, and J. Tenenbaum, "Look out, it's going to fall!: Does physical instability capture attention and lead to distraction?" In *Proceedings of the Annual Meeting of the Cognitive Science Society*, 2019, p. 3500.

M. Kryven, L. Niemi, L. Paul, and J. Tenenbaum, "Choosing the unimaginable: Social psychological factors in seeking transformative experiences.," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, 2019, p. 3300.

M. Kryven, T. D. Ullman, W. Cowan, and J. Tenenbaum, "Thinking and guessing: Bayesian and empirical models of how humans search.," in *Proceedings of the Annual Meeting of the Cognitive Science Society*, 2017.

M. Kryven and W. Cowan, "Attending to the future," in *Center for Visual Science Symposium, University of Rochester*, 2016.

M. Kryven and W. Cowan, "Semi-automated classification of free-form participant comments," in *WiML workshop at Neural Information Processing Systems*, 2016.

M. Kryven, T. Ullman, W. Cowan, and J. Tenenbaum, "People explore under uncertainty by looking ahead," in *Computational Approaches to Cognition Symposium at Psychonomics, Boston, USA*, 2016.

M. Kryven, T. Ullman, W. Cowan, and J. Tenenbaum, "Two types of exploratory behaviour," in *Applied Vision Association Xmas 2016 Meeting at Queen Mary University of London*, 2016.

M. Kryven and C. W, "Why magic works? attentional blink with moving stimuli," in *International Conference on Perceptual Organization. York University Centre for Vision Research*, 2016.

Conference Talks and Invited Presentations

2021 Modeling human planning under uncertainty, *Harvard, Department of Neuroscience*
Modeling human planning under uncertainty, *MIT, Department of Brain and Cognitive Sciences*

2020 Probabilistic Programming, *Lecture at CBMM Summer School, Woods Hole*

2019 Plan-generation and social attribution, *Boston College, Department of Psychology*
Plan-generation and social attribution, *Harvard, Department of Neuroscience*
Research Methods, *Lecture at CBMM Summer School, Woods Hole*

Conference Talks and Invited Presentations (continued)

2018 Planning under uncertainty. *Yale University, Department of Neuroscience*
Decision-making experiments, *Invited talk at MIT Museum*
Perception as Inference, *Invited talk at MIT Museum*
Perception as inference - what visual illusions tell us about the brain. Guest lecture, *Suffolk University, The New England School of Art and Design*
Planning under uncertainty. *MIT, Rosenholtz lab*

2017 Value Based Decision-Making under Uncertainty. *MIT, Department of Brain and Cognitive Sciences*

2016 What do people mean by intelligence? *Future of Humanity Institute, Oxford*
Attributing intelligence: Outcome and Strategy. *Conference, Cognitive Sciences Society*, University of Pennsylvania, USA
Comparing own decision making to evaluation of others' actions. *MIT, Department of Brain and Cognitive Sciences*
Attributing intelligence to Others. *York University, Neuroscience Student Research Symposium*
Vision as inference in the real world, University of Waterloo, Guest Lecture in a 4th year Artificial Intelligence class
Automated analysis of natural language data in behavioural experiments, University of Waterloo

2015 Facilitating effective class discussions, Centre for Teaching Excellence, teaching session, University of Waterloo
Change blindness. Centre for Teaching Excellence, teaching session, University of Waterloo
Counting permutations. Centre for Teaching Excellence, teaching session, University of Waterloo

2014 What does water look like? Psychophysics of image perception. Conference talk, *Computational Aesthetics in Graphics, Visualization and Imaging*, Vancouver, Canada

2013 Generating knitting patterns from a sketch: a CSP approach. Conference talk, *Symposium on Computational Aesthetics*. ACM, 2013.

Teaching and Mentorship

2018-2022 **Advised graduate students at MIT** Yingdong Quian (now at Google), Suhyoun Yu (now at Amazon), Zhutian Yang (PhD student at MIT), Nik Vlavianos (startup CEO)
Advised undergraduates at MIT's Summer Research Program (MSRP) Ronald Alvarez (transferred to undergraduate program in Cognitive Science at MIT), Ruisi Zhong (now in medical school) **Research Assistants** Damarcus Peterson, Sholei Croom, Adeline Hillier, Roksi Freeman
Advised graduate students at CSMM Summer School Grace Ang, Sunwoo Kwon, Lior Fox (project won fellowship from Fujitsu)

2019-2022 **Teaching Assistant, Computational Cognitive Science, MIT**. Mentored teams of students on developing their course projects – from formulating an original research question to presenting the results.

2019-2020 **Teaching Assistant,Marine Biological Laboratory: Brains, Minds and Machines Summer School** Advised students on research projects in Development of Intelligence and Core Knowledge. Supported students during tutorials and running online experiments.

2015-2017 **Teaching Assistant, Lab facilitator CS492, Societal Implications of Computing, University of Waterloo**.
Received a **Distinguished Teaching Assistant Award**
Modernized course curricula, selected readings, designed interactive assignments, facilitated in-class discussions, and edited students' essays to improve writing style. Introduced weekly quizzes, which **improved class attendance at a bi-weekly 8:30 class by 30 %**

Teaching Assistant, CS686: Introduction to Artificial Intelligence, University of Waterloo.
Met with students during office hours, designed and marked weekly quizzes, marked assignments and exams, supervised final projects where students developed original research.

2015-2016 **Teaching Assistant, CS452: Real-Time programming, University of Waterloo**.
Met with students during office hours, marked assignments, exams, and final projects.

2016-2015 **Lab instructor, CS116X, Introduction to Computer Science for Digital Arts, University of Waterloo**
Guided students in programming generative graphics during labs, met with students during office hours, marked assignments, and supervised final projects where students produced an original interactive artwork.

Teaching and Mentorship (continued)

2012-2014 **Teaching Assistant, CS488: Introduction to Computer Graphics, University of Waterloo**
Assisted students during labs, marked projects, assignments, and exams, met with students during office hours, designed assignments and quizzes.

Awards

2019 CBMM research award $40 000
2018 'Beyond the Ivory Tower' Writing for The Public Workshop, Northwestern University $1500
2017 Doctoral Thesis Award, University of Waterloo, $5000, 3 awarded annually.
2016 Women in Machine Learning Grant $1500
Travel Fellowship, Center for Visual Science University of Rochester, $400
Cheriton Scholarship, University of Waterloo, 9 awarded annually. $20 000
2015 Distinguished Teaching Assistant Award, University of Waterloo, $500
2014 Graduate Excellence Award in Computer Science, University of Waterloo, $5000
2013 QEII-Graduate Scholarship in Science and Technology, University of Waterloo, $5000

Service

Reviewing for Journals PNAS, Cognition, Cognitive Science, PLOS Computational Biology, Computer Aided Design, Journal of Mathematics and the Arts, Engineering Applications of Artificial Intelligence
Reviewing for Conferences: ICRA 2021(2), ICLR 2023(3), 2021(2), NeurIPS 2023(6), 2022(3), 2021(5), 2017(3), Cognitive Sciences Society 2016-2023 (5 each year)
2019 Lecturer, Exhibit designer, MIT Museum
2017 Bicycle mechanic at University of Waterloo Student Bike Centre.
2016 Poster Judge at the Cheriton Computer Science Graduate Symposium, University of Waterloo
2015 Facilitator at the CEMC Workshop in Computer Science for Young Women.
2014 Tutor at the Frontier College, a Canada-wide literacy outreach organisation.

References

Joshua B. Tenenbaum, Massachusetts Institute of Technology jbt.letters@gmail.com
Tomer Ullman, Harvard University tomerullman@gmail.com
Ila Fiete, Massachusetts Institute of Technology lownm@mit.edu

Presonal Information: I am a Canadian and EU citizen.

January 2024