Robin Walters

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Employment

○ **Northeastern University, Khoury College of Computer Sciences** **Boston, MA**
Assistant Professor *2022–present*

○ **Northeastern University, Khoury College of Computer Sciences** **Boston, MA**
Postdoctoral Reseach Fellow, Institute for Experiential AI, Roux Institute *2020–2022*

○ **Northeastern University, Department of Mathematics** **Boston, MA**
Zelevinksy Research Instructor, NSF Postdoctoral Teaching Associate, and Visting Lecturer *2015–2020*

○ **Pixar Animation Studios** **Emeryville, CA**
Technical Director, Resident, 3D Rendering for Toy Story 1 and 2. *2008–2009*

Education

○ **University of Chicago** **Chicago, IL**
Ph.D. in mathematics *2009–2015*

○ **Harvard University** **Cambridge, MA**
A.B. in mathematics with high honors *2004–2008*

Publications

Rui Wang, **Walters, Robin**, and Rose Yu. Physics-guided deep learning for spatiotemporal forecasting. In *Knowledge-Guided Machine Learning*, pages 179–210. Chapman and Hall/CRC, 2023.

Dian Wang, Jung Yeon Park, Neel Sortur, Lawson L. S. Wong, Robert Platt[†], and **Walters**[†]**, Robin**. The surprising effectiveness of equivariant models in domains with latent symmetry. In *International Conference on Learning Representations (ICLR)*, 2023. **notable top 25%**.

David Klee, Ondrej Biza, Robert Platt, and **Walters, Robin**. Image to sphere: Learning equivariant features for efficient pose prediction. In *International Conference on Learning Representations (ICLR)*, 2023. notable top 5%.

Linfeng Zhao, Xupeng Zhu, Lingzhi Kong, **Walters, Robin**, and Lawson L. S. Wong. Integrating symmetry into differentiable planning with steerable convolutions. In *International Conference on Learning Representations (ICLR)*, 2023.

Bo Zhao, Iordan Ganev, **Walters, Robin**, Rose Yu, and Nima Dehmamy. Symmetries, flat minima,

and the conserved quantities of gradient flow. In *International Conference on Learning Representations* (*ICLR*), 2023.

Mingxi Jia, Dian Wang, Guanang Su, David Klee, Xupeng Zhu, **Walters, Robin**, and Robert Platt. Seil: Simulation-augmented equivariant imitation learning. In *International Conference on Robotics and Automation* (*ICRA*), 2023.

Haojie Huang, Dian Wang, Xupeng Zhu, **Walters, Robin**, and Robert Platt. Edge grasp network: A graph-based SE(3)-invariant approach to grasp detection. In *International Conference on Robotics and Automation* (*ICRA*), 2023.

Rui Wang, **Walters, Robin**, and Rose Yu. Meta-learning dynamics forecasting using task inference. In *Neural Information Processing Systems* (*NeurIPS*), 2022.

Bo Zhao, Nima Dehmamy, **Walters, Robin**, and Rose Yu. Symmetry teleportation for accelerated optimization. In *Neural Information Processing Systems* (*NeurIPS*), 2022.

David Klee, Ondrej Biza, Robert Platt, and **Walters, Robin**. Image to icosahedral projection for $SO(3)$ object reasoning from single-view images. In *Proceedings of Machine Learning Research* (*PMLR*) *Volume on Symmetry and Geometry in Neural Representations*, 2022.

Dian Wang, Mingxi Jia, Xupeng Zhu, **Walters, Robin**, and Robert Platt. On-robot learning with equivariant models. In *Conference on Robot Learning* (*CoRL*), 2022.

Niklas Smedemark-Margulies[*], **Walters**[*]**, Robin**, Heiko Zimmermann, Lucas Laird, Christian van der Loo, Neela Kaushik, Rajmonda Caceres, and Jan-Willem van de Meent. Probabilistic program inference in network-based epidemiological simulations. *PLOS Computational Biology*, 18(11):e1010591, 2022.

Ayan Chatterjee, Omair Shafi Ahmed, **Walters, Robin**, Zohair Shafi, Deisy Gysi, Rose Yu, Tina Eliassi-Rad, Albert-László Barabási, and Giulia Menichetti. Ai-bind: Improving binding predictions for novel protein targets and ligands. *Nature Communications*. *To Appear*.

Babak Esmaeili[*], **Walters, Robin**[*], Heiko Zimmermann, and Jan-Willem van de Meent. Understanding optimization challenges when encoding to geometric structures. In *NeurReps Workshop at Neural Information Processing Systems*, 2022.

Rui Wang, Robin Walters, and Rose Yu. Approximately equivariant networks for imperfectly symmetric dynamics. In *International Conference on Machine Learning*, 2022.

Jung Yeon Park[*], Ondrej Biza[*], Linfeng Zhao, Jan Willem van de Meent, and Robin Walters. Learning symmetric embeddings for equivariant world models. In *International Conference on Machine Learning*, 2022.

Linfeng Zhao, Lingzhi Kong, Robin Walters, and Lawson LS Wong. Toward compositional generalization in object-oriented world modeling. In *International Conference on Machine Learning*, 2022.

Haojie Huang, Dian Wang, Robin Walters, and Robert Platt. Equivariant transporter network. In *Robotics: Science and Systems*, 2022.

Xupeng Zhu, Dian Wang, Ondrej Biza, Guanang Su, Robin Walters, and Robert Platt. Sample efficient grasp learning using equivariant models. In *Robotics: Science and Systems*, 2022.

Dian Wang, Robin Walters, and Robert Platt. So (2) equivariant reinforcement learning. In *International Conference on Learning Representations*, 2022.

Nima Dehmamy, Robin Walters, Liu Yanchen, Dashun Wang, and Rose Qi Yu. Automatic symmetry discovery with lie algebra convolutional network. In *Neural Information Processing Systems (NeurIPS)*, 2021.

Dian Wang, Robin Walters, Xupeng Zhu, and Robert Platt. Equivariant Q learning in spatial action spaces. *Conference on Robotics Learning (CoRL)*, 2021.

Iordan Ganev* and Robin Walters*. The QR decomposition for radial neural networks. *arXiv preprint arXiv:2107.02550*, 2021.

Steven Wong, Robin Walters, Lejun Jiang, Tamas Molnar, Gabor Orosz, and Rose Yu. Physics-guided deep learning for traffic forecasting using vehicle-to-vehicle communication. *Learning for Dynamics and Control (L4DC)*, 2021.

Robin Walters*, Jinxi Li*, and Rose Yu. Trajectory prediction using equivariant continuous convolution. *International Conference on Learning Representations (ICLR)*, 2021.

Rui Wang*, Robin Walters*, and Rose Yu. Incorporating symmetry into deep dynamics models for improved generalization. *International Conference on Learning Representations (ICLR)*, 2021.

Xingyu Su, Robin Walters, Denis Aslangil, and Rose Yu. Forecasting variable-density 3D turbulent flow. *Deep Learning for Simulation (SimDL), ICLR Workshop*, 2021.

Valerio Toledano Laredo* and Robin Walters*. Monodromy of the mirabolic Harish-Chandra *D*-module. *arXiv preprint*, 2023.

Karthik Kashinath, Mustafa Mustafa, Adrian Albert, Jin Long Wu, Chiyu Jiang, Soheil Esmaeilzadeh, Kamyar Azizzadenesheli, Rui Wang, Alok Singh, Ashray Manepalli, Dragos Chirila, Rose Yu, Walters Robin, Blánaid White, Heng Xiao, Hamdi Tchelepi, Philip Marcus, Anima Anandkumar, and Prabhat. Physics-informed machine learning, case studies for weather and climate modelling. *Journal of Philosophical Transactions of the Royal Society A*, 2020.

Laure Flapan*, Robin Walters*, and Xiaolei Zhao*. Period integrals and Hodge modules. *arXiv preprint arXiv:1910.00035*, 2019.

Asilata Bapat* and Robin Walters*. The strong topological monodromy conjecture for Weyl hyperplane arrangements. *Mathematical Research Letters*, 24(4):947–954, 2017.

Asilata Bapat* and Robin Walters*. The Bernstein-Sato *b*-function of the Vandermonde determinant. *arXiv preprint arXiv:1503.01055*, 2015.

Robin Walters. The Bernstein-Sato b-function of the space of cyclic pairs. *Publications of the Research Institute for Mathematical Sciences*, 51(2):273–288, 2015.

Colin Carroll*, Adam Jacob*, Coner Quinn*, and Robin Walters*. The isoperimetric problem on planes with density. *Bulletin of the Australian Mathematical Society*, 78(2):177–197, 2008.

Hang Yin, Joanna Slusky, Bryan Berger, Robin Walters, Gaston Vilaire, Rustem Litvinov, James Lear, Gregory Caputo, Joel Bennett, and William DeGrado. Computational design of peptides that target transmembrane helices. *Science*, 315(5820):1817–1822, 2007.

Alessandro Senes, Deborah Chadi, Peter Law, Robin Walters, Vikas Nanda, and William DeGrado. $e(z)$, a depth-dependent potential for assessing the energies of insertion of amino acid side-chains into membranes: derivation and applications to determining the orientation of transmembrane and interfacial helices. *Journal of molecular biology*, 366(2):436–448, 2007.

Robin Walters and William DeGrado. Helix-packing motifs in membrane proteins. *Proceedings of the National Academy of Sciences*, 103(37):13658–13663, 2006.

* Authors contributed equally. † equal advising. Note: Mathematics publications usually list authors alphabetically.

Awards and Fellowships

- **Deep Equivariant Radar Models (DERM) Program with the Information, Computation and Exploitation (ICE) Line** Funded by United States Department of the Air Force through MIT Lincoln Labs PI. $100000.
- **NSF Grant: SCALE MoDL: Representation Theoretic Foundations of Deep Learning**
  Awarded NSF grant as lead PI to study the foundational role of representation theory in deep learning as part of the SCALE MoDL program. With Jan-Willem van de Meent (Co-PI, Northeastern) and Rose Yu (PI, UCSD). This award is $661238 at Northeastern and $300000 at UCSD over 3 years.
- **NSF Grant: RI: Medium: Learning MDP abstractions for Autonomous Systems using Variational Methods and Symmetry Groups**
  Awarded NSF grant as co-PI to the role of symmetry in learning MDP abstractions. With Lawson Wong (PI), Jan-Willem van de Meent (Co-PI) and Robert Platt (Co-PI). This award is $1.2M at Northeastern over 4 years.
- **NSF Mathematical Sciences Postdoctoral Research Fellowship**
  Fellowship to study representation theory with Valerio Toledano Laredo at Northeastern University including $150,000 (15-19).
- **NSF Graduate Research Fellowship**
  (10-14).
- **Wayne C. Booth Graduate Student Prize for Excellence in Teaching**
  Awarded to four graduate students across the entire University of Chicago each year for excellence in teaching.
- **Robert Fletcher Rogers First Prize**
  For best talk at the Harvard Undergraduate Mathematics Colloquium in the year (06-07).

- **John Harvard Scholarship**
  For having a GPA in top 5% of class at Harvard (05-06).

Teaching

- **Assistant Professor, Northeastern University** *2022-*
  - CS 3180: Theory of Computation (Fall 22), Instructor.
  - CS 7180: Special Topics in AI – Geometric Deep Learning (Spring 23), Instructor.
- **Zelevinsky Research Instructor, Northeastern University** *2016-2020*
  - Math 3081: Probability and Statistics (Fall 19), Instructor.
  - Math 1342: Calculus 2 for Sci/Engr (Spring 17, Spring 18), Instructor.
  - Math 1341: Calculus 1 for Sci/Engr (Fall 16), Instructor.
  - Math 1365: Intro to Math Reasoning (Fall 16, Fall 17, Fall 19, Spring 20), Instructor.
  - Putnam Exam Training (Fall 18, Fall 19, Spring 20, Fall 20, Spring 21), Instructor.
- **REU Co-organizer, Northeastern University** *2019, 2020*
  - Co-organized an REU program for 7 undergraduate students and 5 graduate mentors. Organized admissions and pairings. Met with students and their mentors, edited papers, and organized colloquia and presentations.
- **Instructor, The University of Chicago** *2011-2015*
  - Math 161,162,163: Honors Calculus IBL (Fall 11, Winter 12, Spring 12), Co-instructor.
  - Math 131,132,133: Introduction to Calculus (Fall 14, Winter 15, Spring 15), Instructor.
- **Visiting Teacher, Polk Brothers Program** *2012-2014*
  - Taught mathematical enrichment lessons and tutored once per week in the Chicago Public Schools as part of outreach program operated by Robert Fefferman. Scott Joplin Elementary (12-13), Anna R. Langford Community Academy (13-14).
- **REU Mentor, The University of Chicago**
  - Summers 2010, 2011, 2012
- **College Fellow, The University of Chicago**
  - Math 268: Commutative Algebra (Winter 11).
    Math 270: Complex Analysis (Fall 10, Spring 11)
- **Course Assistant, Harvard University**
  - E21-a: Multivariate Calculus for Extension School (Fall 07).
    Math 101: Sets, Groups, and Topology (Fall 06)

Service

- **Northeastern-O'Bryant School of Math and Science Machine Learning Program,** *Organizer.* Organized 4-session outreach program for 60 students at Boston public school.
- **Reviewer**, ICLR 2023, KDD 2022, ICML 2022, Neurips 2022, ICLR 2021 ICML 2021, ICLR 2020, JMLR, Transportation Research Part C, Journal of Singularities, Compositio Mathematica, Foundation of Computational Mathematics, Pure and Applied Mathematics Quarterly.
- **Bridge to Calculus**, *Problem writer.* Boston high school outreach program (17-19).
- **Geometry, Physics, and Representation Theory Seminar, Northeastern**, *Co-organizer.* (Fall 17–Spring 20).

- **Graduate Seminar on Hodge Modules, Northeastern and MIT**, *Co-organizer.* (Fall 16).
- **Postdoctoral Research Seminar, Northeastern**, *Co-organizer, Founder.* (Spring 15–Spring 16),
- **Pick My Brain Seminar, Northeastern**, *Co-organizer, Co-founder.* (16-20).
- **Student Chapter of Association for Women in Mathematics, University of Chicago** *Treasurer.* (13-14).

Talks

- *Simulating Radar using Equivariant Graph Neural Networks*
  - Graph Exploitation Symposium. Dedham, MA. August 2023.
- *Incorporating Symmetry into Deep Dynamics Models*
  - IAFAI Summer School Tutorial. August 2023.
- *The Strengths and Limitations of Equivariant Neural Networks*
  - IAIFI Summer Workshop. Northeastern University. August 2023.
  - Machine Learning Seminar at UMass Math and Stats department. Amherst, Massachusetts. March 2023.
- *Symmetry in Deep Neural Networks*
  - Colloquium, Michigan State University Math Department. Lansing, Michigan. March 2023.
- *Approximately Equivariant Neural Netwokrs*
  - NSF Workshop: Foundations of Machine Learning and Its Applications for Scientific Discovery in Physical and Biological Systems. Tyson's Corner, VA. June 2022.
  - Physics-informed Machine Learning Series, CNLS, LANL, Los Alamos, NM. July 2022.
  - Seminar Talk as MIT-IBM Watson AI Lab, Cambridge, MA. November, 2022.
- *Incorporating Symmetry into Deep Dynamics Model for Improved Generalization*
  - Roux Institute. May 2022.
- *Quiver neural networks and the QR decomposition*
  - Geometry and Physics Seminar. Boston University. March 2022.
- *Symmetry in Deep Learning*
  - Hiring Talk. Northeastern University. February 2022.
- *Equivariant Neural Networks for Learning Spatiotemporal Dynamics.*
  - RL Reading Group. Northeastern University. December 2021.
  - Computational Methods and Data Science Journal Club. Flatiron Institute. November 2021.
  - AMLab Seminar. University of Amsterdam. November 2021.
  - AI Seminar. ECE. University of California, San Diego. November 2021.
  - SciML Webinar. Carnegie Mellon University. October 2021.
  - Session on Spatiotemporal Data. INFORMS 2021. October 2021.
  - DATAlab Seminar. Northeastern University. October 2021.
  - Machine Learning lunch seminar. PPPL Computational Sciences Department. Princeton. September 2021.
  - Special Technical Seminar. MIT Lincoln Lab. September 2021.
  - Deep Learning Reading Group. Duke Math Department. February 2021.
- *Equivariant Neural Networks for Trajectory Prediction.*
  - EAI Seminar. Northeastern University. October 2021.
- *Equivariant Neural Networks for Dynamics.*

- · Mathematics in Imaging, Data, and Optimization Seminar, Math Department. Rensselaer Polytechnic Institute. February 2022.
  - · Pick My Brain seminar. Northeastern University. November 2021.
  - · SPIRAL seminar. Northeastern University. December 2020.
- ○ *The Bernstein-Sato polynomial of a Weyl arrangement.*
  - · Special Session on Arrangements of Hypersurfaces, Spring Eastern AMS Sectional Meeting, Northeastern University. April 2018.
- ○ *The Finkelberg-Ginzburg Mirabolic Monodromy Conjecture*
  - · Representations and Lie Theory Seminar at Ohio State University. November 2017.
- ○ *The Bernstein-Sato polynomial of the Vandermonde determinant and the Strong Monodromy Conjecture.*
  - · Lie Seminar at UC Riverside. October 2015.
  - · Postdoctoral Research Seminar at Northeastern University. November 2015.
  - · Geometry, Physics, and Representation Theory Seminar at Northeastern University. October 2015.
  - · Algebraic Geometry Seminar at Purdue University. March 2015.
  - · Algebra and Geometry Seminar at University of Rome, Sapienza. October 2016.
- ○ *The Monodromy Conjecture: The Bernstein-Sato polynomial and Zeta Functions.*
  - · Géométrie Algébrique en Liberté XXIV, Nesin Mathematics Village, Selçuk, Turkey, June 2016
- ○ *Two related Bernstein-Sato polynomial computations.*
  - · Géométrie Algébrique en Liberté XXIII; Leuven, Belgium. June 2015
- ○ *Surfaces with Density and Their Isoperimetric Regions.*
  - · MAA/AMS Joint Mathematics Meeting; New Orleans, LA. January 2007.
- ○ *Generalizations of the Hexagonal Honeycomb Theorem.*
  - · Harvard Mathematics Department Undergraduate Mathematics Colloquium; Cambridge, MA. October 2006.
- ○ *Spherical and Hyperbolic Honeycombs.*
  - · Invited Paper Session: Isoperimetric Problems; MAA Mathfest;Knoxville, TN. August 2006.
- ○ *Objects which Associate but not Commute.*
  - · Math Club at Northeastern University. October 2018.

Technical and Personal skills

- ○ **Computers:** Many years experience programming in Mathematica, Python, C++, SML, PHP, Perl, and MIPS (assembly). Some experience with Macaulay2, Java, C#, Lisp, Pascal, Basic, HTML, and SQL, including using Macaulay2 to aid $\mathcal{D}$-module and b-function computations. Proficient with LaTeX.

- ○ **Language:** Conversational in Hungarian (Level 21 of 30 at Debreceni Nyári Egyetem). College-level German (Passed Ph.D. language exam at University of Chicago).

References

Rose Yu
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