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Jennifer J. Sun

Education | **California Institute of Technology**, Pasadena, CA. **09/2017–06/2023**
Doctor of Philosophy in Computing and Mathematical Sciences
Advisors: Pietro Perona, Yisong Yue
Expected 09/2023

Univeristy of Toronto, Toronto, Canada. **09/2012–06/2017**
Bachelor of Science in Engineering Science (Electrical and Computer Engineering)
Minor in Robotics and Mechatronics

Research Interests | My research centers on developing general expert-in-the-loop frameworks to accelerate scientific discovery. I build machine learning and computer vision methods that learn from both symbolic domain knowledge and experimental data. I collaborate closely with scientists across domains, such as behavioral neuroscientists and medical doctors, to integrate my methods in practice.

Honors and Awards | Ben P.C. Chou Doctoral Prize (Caltech). **2023**
Rising Star in EECS (University of Texas at Austin). **2022**
Caltech Chen Institute Diversity and Inclusion Award. **2022**
Amazon AI4Science Fellowship. **2022**
Rising Star in Data Science (University of Chicago). **2021**
Best Student Paper Award, Conference on Computer Vision and Pattern Recognition (CVPR). **2021**
Natural Sciences and Engineering Research Council of Canada (NSERC) Postgraduate Scholarships. **2019**
Caltech Kortschak Scholar Program. **2017**
University of Toronto W. S. Wilson Medal for top graduating student in engineering science. **2017**
University of Toronto merit-based scholarships. **2012–2016**
John M. Empey Scholarship
Shaw Design Scholarship
Andrew Alexander Kinghorn Scholarship
Avie Bennett Scholarship

(* denotes equal contribution)

Peer-Reviewed Conference and Journal Publications

J. J. Sun*, M. Marks*, A. Ulmer, D. Chakraborty, B. Geuther, E. Hayes, H. Jia, V. Kumar, S. Oleszko, Z. Partridge, M. Peelman, A. Robie, C. E. Schretter, K. Sheppard, C. Sun, P. Uttarwar, J. M. Wagner, E. Werner, J. Parker, P. Perona, Y. Yue, K. Branson, A. Kennedy. MABe22: A Multi-Species Multi-Task Benchmark for Learned Representations of Behavior. *International Conference on Machine Learning (ICML)*. 2023.

J. J. Sun*, P. Karashchuk*, A. Dravid*, S. Ryou, S. Fereidooni, J. Tuthill, A. Katsaggelos, B. Brunton, G. Gkioxari, A. Kennedy, Y. Yue, P. Perona. Self-Supervised 3D Keypoint Discovery in Multi-View Videos. *In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*. 2023.

K. Luxem*, **J. J. Sun***, S. P. Bradley, K. Krishnan, T. D. Pereira, E. A. Yttri, J. Zimmermann, M. Laubach, Open-Source Tools for Behavioral Video Analysis: Setup, Methods, and Development. *eLife*. 2023.

E. Zhan*, **J. J. Sun***, A. Kennedy, Y. Yue, S. Chaudhuri. Unsupervised Learning of Neurosymbolic Encoders. *Transactions on Machine Learning Research (TMLR)*. 2022.

J. J. Sun*, S. Ryou*, R. Goldshmid, B. Weissbourd, J. Dabiri, D. J. Anderson, A. Kennedy, Y. Yue, P. Perona. Self-Supervised Keypoint Discovery in Behavioral Videos. *In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*. 2022.

A. Tseng, **J. J. Sun**, Y. Yue. Automatic Synthesis of Diverse Weak Supervision Sources for Behavior Analysis. *In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*. 2022.

J. J. Sun, T. Karigo, D. Chakraborty, S. P. Mohanty, B. Wild, Q. Sun, C. Chen, D. J. Anderson, P. Perona, Y. Yue, A. Kennedy. The Multi-Agent Behavior Dataset: Mouse Dyadic Social Interactions. *In Neural Information Processing Systems (NeurIPS), Datasets and Benchmarks Track*. 2021.

J. J. Sun, A. Kennedy, E. Zhan, D. J. Anderson, Y. Yue, P. Perona. Task Programming: Learning Data Efficient Behavior Representations. *In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*. 2021. **(Oral) Best Student Paper Award**.

L. Zhao, Y. Wang, J. Zhao, L. Yuan, **J. J. Sun**, F. Schroff, H. Adam, X. Peng, D. Metaxas, T. Liu. Learning View-Disentangled Human Pose Representation by Contrastive Cross-View Mutual Information Maximization. *In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*. 2021. **(Oral)**

T. Liu*, **J. J. Sun***, L. Zhao, J. Zhao, L. Yuan, Y. Wang, L.C. Chen, F. Schroff, H. Adam. View-Invariant, Occlusion-Robust Probabilistic Embedding for Human Pose. *International Journal of Computer Vision (IJCV)*. 2021.

C. Segalin, J. Williams, T. Karigo, M. Hui, M. Zelikowsky, **J. J. Sun**, P. Perona, D. J. Anderson, A. Kennedy. The Mouse Action Recognition System (MARS): a software pipeline for automated analysis of social behaviors in mice. *eLife*. 2021.

A. Shah*, E. Zhan*, **J. J. Sun**, A. Verma, Y. Yue, S. Chaudhuri. Learning Differentiable Programs with Admissible Neural Heuristics. *In Neural Information Processing Systems (NeurIPS)*. 2020.

J. J. Sun, J. Zhao, L.C. Chen, F. Schroff, H. Adam, T. Liu. View-Invariant Probabilistic Embedding for Human Pose. *In Proceedings of the European Conference on Computer Vision (ECCV)*. 2020. **(Spotlight)**

Peer-Reviewed Workshop Publications

J. J. Sun*, M. Tjandrasuwita*, A. Sehgal*, A. Solar-Lezama, S. Chaudhuri, Y. Yue, O. Costilla-Reyes. Neurosymbolic Programming for Science. *AI for Science Workshop at NeurIPS*. 2022.

S. Talukder*, **J. J. Sun***, M. Leonard, B. Brunton, Y. Yue. Deep Neural Imputation: A Framework for Recovering Incomplete Brain Recordings. *Learning from Time Series for Health Workshop at NeurIPS*. 2022.

M. Tjandrasuwita, **J. J. Sun**, A. Kennedy, S. Chaudhuri, Y. Yue. Interpreting Expert Annotation Differences in Animal Behavior. *CV4Animals Workshop at CVPR*. 2021.

J. J. Sun, T. Liu, G. Prasad. GLA in MediaEval 2018 Emotional Impact of Movies Task. *MediaEval Workshop*. 2018.

Patents

J. Lam, A. Huda, **J. J. Sun**, Image processing method for generating training data. US Patent Number: US10672143B2.

A. M. Rotenstein, A. Bachoo, C. Sutanto, **J. J. Sun**, A. Kelman, Three-dimensional detection and tracking pipeline recommendation using performance prediction. US Patent Number: US20200105001A1

Invited Talks & Panels

AI for Scientists: Accelerating Discovery through Knowledge, Data & Learning

- Cornell University Computer Science Seminar, 2023
- Microsoft Research Machine Learning Seminar, 2023
- University of Waterloo Computer Science Seminar, 2023
- MIT EECS / Broad Institute Seminar, 2023
- UCSD Cognitive Science Seminar, 2023
- Emory University Computer Science Seminar, 2023
- Georgia Tech Computational Science and Engineering Seminar, 2023
- UCI Computer Science Seminar, 2023
- UCSB Computer Science Seminar, 2023
- Duke Biostatistics and Bioinformatics Seminar, 2023
- Rice Computer Science Seminar, 2023
- University of Toronto Computer Science Seminar, 2023
- Symposium on Frontiers of ML and AI at USC, 2022
- UCSD Halicioğlu Data Science Institute Seminar, 2022
- Rising Stars in EECS at UT Austin, 2022
- Neurosym Webinar Series at MIT, 2022
- ML Reading Group at the University of Arizona, 2022
- AI4Life Group at Harvard, 2022

AI for Science: Learning from Experts and Data

- Janelia Computing and Theory Seminar, 2022
- Rising Stars in Data Science at UChicago, 2021
- Vision & ML groups at UChicago/TTIC, 2021
- Cognitive Science Talk Series at MIT, 2021

Self-Supervised Learning for Behavioral Neuroscience

- CAJAL Training Course on Machine Learning in Neuroscience, 2023

Perception and Modeling of Human and Animal Behavior

- Disney Research, 2022

Machine Learning for Behavior: Methods and Datasets

- Chicago Sensorimotor Consortium, 2022
- Caltech Chen Building Seminar Series, 2022

Measuring Social Behavior from Video and Trajectory Data of Interacting Animals

- Automatic Behavior Recognition in Rodents Symposium at Measuring Behavior Conference, 2022

Behavior Quantification: Pose to Actions

- Behavior Quantification Symposium at the 8th Annual BRAIN Meeting, 2022

Neurosymbolic Programming Tutorial Series

- Summer school on Neurosymbolic Programming, 2022

Deep Learning Careers in Academia

- Neuromatch Professional Development Session Panel, 2022

Academic Services

Workshop & Tutorial Organization

The 3rd Workshop on Multi-Agent Behavior: Properties, Computation, and Emergence (MABe). Workshop at CVPR 2023.

Workshop Co-organizer

Neurosymbolic Programming. Tutorial at NeurIPS 2022.

Co-organizer

The 2nd Workshop on Multi-Agent Behavior: Representation, Modeling, Measurement, and Applications (MABe). Workshop at CVPR 2022.

Workshop and Competition Co-organizer

The 1st Workshop on Multi-Agent Behavior: Representation, Modeling, Measurement, and Applications (MABe). Workshop at CVPR 2021.

Workshop and Competition Co-organizer

The 1st Workshop on Affective Understanding in Video (AUVi). Workshop at CVPR 2021.

Workshop and Competition Co-organizer

Reviewing

ICLR (*highlighted reviewer in 2022*)

NeurIPS

NeurIPS Datasets and Benchmarks

CVPR

ICML

ECCV

Artificial Intelligence Journal

IEEE Transactions on Geoscience and Remote Sensing

Nature Communications

International Journal of Computer Vision

Teaching Experience

Summer School on Machine Learning in Neuroscience, **07/2023–07/2023**
Instructor.

Designed a lecture and hands-on notebook for unsupervised and self-supervised learning for a group of students at the CAJAL Machine Learning in Neuroscience course.

Summer School on Neurosymbolic Programming, **07/2022–07/2022**
Co-Instructor.

Designed a tutorial on neurosymbolic programming for behavior analysis and led hands-on exercises for a group of graduate students in computer science.

Caltech CS159 Representation Learning for Science, **03/2022–06/2022**
Head Teaching Assistant.

Co-designed a machine learning course with a focus on representation learning in real-world scientific applications, and mentored multiple student projects end-to-end.

Computing and Mathematical Sciences Department, **09/2019–06/2021**
Teaching Fellow.

Mentored teaching assistants (TAs) in the department on effective and inclusive teaching, managed feedback between department and TAs, and designed teaching workshops.

Caltech CMS144 Networks: Structures and Economics, **01/2019–04/2019**
Head Teaching Assistant.

Coordinated a group of teaching assistants to support students in the course, designed assignments, and hosted office hours.

Computing and Mathematical Sciences Department, **09/2018–04/2019**
Preliminary Exam Prep Lead.

Mentored students on the preliminary exam process at Caltech and organized practice problems and discussions.

Leadership Activities

Caltech International Student Program, *Orientation Leader.* **2021**

Future Ignited, *Graduate Student Panelist.* **2021**

Building Effective Research Collaborations Workshop (Whitney Workshop Series), *Co-organizer.* **2021**

Future Ignited, *Graduate Student Panelist.* **2020**

Graduate Women in CMS Steering Committee, *Member.* **2020–2023**

Caltech Canadian Club, *President.* **2018–2023**

Research Mentorship

Patrick Rim, <i>undergraduate student at Caltech.</i> Causal learning for behavior analysis.	09/2022–present
Amil Dravid, <i>now graduate student at Berkeley.</i> 3D structural discovery from multi-view video.	06/2022–present
Joshua Flashner, <i>undergraduate student at Caltech.</i> Neurosymbolic learning for electrocardiogram data analysis.	06/2022–09/2023
Shir Goldfinger, <i>undergraduate student at Caltech.</i> Senior thesis on safety-critical neurosymbolic learning for robotics.	09/2022–06/2023
Pablo Backer Peral, <i>undergraduate student at Caltech.</i> Methods and tools for behavioral representation learning.	06/2022–09/2022
Megan Tjandrasuwita, <i>now graduate student at MIT.</i> Learning human interpretable programs for behavior analysis.	09/2020–08/2022
Arushi Gupta, <i>undergraduate student at Caltech.</i> Automatic toad behavior quantification for ecology.	03/2022–06/2022
Albert Tseng, <i>now graduate student at Cornell.</i> Automatically generating weak supervision using program synthesis.	01/2021–01/2022
Jason Yang, <i>graduate student at Caltech.</i> Self-supervised representation learning for sequential data.	09/2021–12/2021
Eric Ma, <i>now undergraduate student at Caltech.</i> Improving pose estimation for the Mouse Action Recognition System.	06/2021–09/2021
Jonathan Beltran, <i>undergraduate student at UCLA.</i> Introduction to visual re-identification.	06/2021–09/2021
Eric Han, <i>now graduate student at Stanford.</i> Learning a shared representation space of different human annotators.	01/2021–06/2021
Hongsen Qin, <i>now Software Engineer at Two Sigma.</i> Quantifying uncertainty of behavior classifiers.	03/2021–06/2021
Isabella Zhang, <i>now Technical Staff at Qumulo.</i> Transfer learning across human annotation styles for mice behavior.	06/2020–09/2020
Victor Chen, <i>now Software Engineer at Quora.</i> Generative modeling for trajectories of mouse social behavior.	01/2019–06/2019

Professional Experience

- Google Research, *Venice, CA.* **08/2023–present**
Perception, Research Scientist
Developing methods for video understanding.
- Google Research, *Venice, CA.* **06/2019–12/2019**
Mobile Vision Team, Research Intern
Developed a method for view-invariant probabilistic embedding of 2D poses (ECCV 2020 Spotlight)
- Google Research, *Venice, CA.* **06/2018–09/2018**
Mobile Vision Team, Research Intern
Built a dataset and model for affective video analysis (led to the Affective Understanding in Video workshop at CVPR 2021)
- University of Toronto, *Toronto, Canada.* **09/2016–04/2017**
Institute for Aerospace Studies, Undergraduate Thesis Student
Studied and developed methods to enable human-robot shared control of a mobile manipulator (mentor: Prof. Jonathan Kelly, STARS Lab).
- Epson Research and Development, *Markham, Canada.* **05/2015–08/2016**
Robotics and AR Teams, Algorithm Research Intern
Developed algorithm prototypes for integration into augmented reality systems (led to two US patents).
- ETH Zurich, *Zurich, Switzerland.* **05/2014–08/2014**
Institute for Dynamic Systems and Control, Summer Research Student
Worked on time-of-flight based localization algorithms for ultra-wideband radios.
- University of Hamburg, *Hamburg, Germany.* **05/2013–08/2013**
Center for Free-Electron Laser Science, Summer Research Student
Profiled laser-generated plumes on water using interferometry.