Mengye Ren

PERSONAL INFORMATION

Mengye Ren
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RESEARCH INTERESTS

Areas: Machine learning, computer vision, meta learning, representation learning, few-shot learning, brain & cognitively inspired learning, robot learning, self-driving vehicles

My key research question is: how do we enable human-like, agent-based machine intelligence to continually learn, adapt, and reason in naturalistic environments? Towards this goal of building a more general and flexible AI, my research has centered on developing *meta-learning* and *representation learning* algorithms.

EDUCATION

University of Toronto

Department of Computer Science 2017/01 – 2021/10
PhD, Supervisors: Richard Zemel and Raquel Urtasun
Thesis: "Open World Machine Learning with Limited Labeled Data"
Committee: Roger Grosse, Geoffrey Hinton, Yee Whye Teh

Department of Computer Science 2015/09 – 2017/01
MSc, Supervisor: Richard Zemel

Department of Engineering Science, ECE Option 2011/09 – 2015/06
BASc, CGPA 3.90/4.00, with high honours

PROFESSIONAL EXPERIENCE

New York University, New York, NY, USA
Assistant Professor in Computer Science and Data Science 2022/09 – Present
Google, Toronto, ON, Canada
Visiting Researcher in Google Brain 2022/01 – Present
Waabi Innovation, Toronto, ON, Canada
Senior Researcher II 2021/03 – 2021/12
Uber ATG, Toronto, ON, Canada
Senior Research Scientist I 2018/09 – 2021/02
Research Scientist II 2017/05 – 2018/09
Twitter, Cambridge, MA, USA
Research Intern 2016/06 – 2016/08
Google, Mountain View, CA, USA
Research Intern in Google Brain and Image Understanding 2015/06 – 2015/08
SWE Intern in StreetView 2014/06 – 2014/08
Microsoft, Redmond, WA, USA
SDET Intern in Visual Studio 2013/06 – 2013/08
SDET Intern in Visual Studio 2012/06 – 2012/08

TEACHING

Vector Institute
- Deep Learning II 2020 Fall

University of Toronto

- CSC 411: Machine Learning and Data Mining 2019 Winter

Peer-Reviewed Conference Publications

(*=equal contribution)

2022

C1 Chris Zhang, Runsheng Guo, Wenyuan Zeng, Yuwen Xiong, Binbin Dai, Rui Hu, **Mengye Ren**, Raquel Urtasun. Rethinking Closed-loop Training for Autonomous Driving. In *18th European Conference on Computer Vision (ECCV)*, Tel-Aviv, Israel, 2022.

2021

C2 Yuwen Xiong, **Mengye Ren**, Wenyuan Zeng, Raquel Urtasun. Self-supervised representation learning from flow equivariance. In *International Conference on Computer Vision (ICCV)*, 2021.

C3 James Tu*, Tsun-Hsuan Wang*, Jingkang Wang, Sivabalan Manivasagam, **Mengye Ren**, Raquel Urtasun. Adversarial attacks on multi-agent communication. In *International Conference on Computer Vision (ICCV)*, 2021.

C4 Sean Segal*, Nishanth Kumar*, Sergio Casas, Wenyuan Zeng, **Mengye Ren**, Jingkang Wang, Raquel Urtasun. Just label what you need: Fine-grained active selection for perception and prediction through partially labeled scenes. In *Conference on Robot Learning (CoRL)*, London, United Kingdom, 2021.

C5 James Tu, Huichen Li, Xinchen Yan, **Mengye Ren**, Yun Chen, Ming Liang, Eilyan Bitar, Ersin Yumer, Raquel Urtasun. Exploring adversarial robustness of multi-sensor perception systems in self driving. In *Conference on Robot Learning (CoRL)*, London, United Kingdom, 2021.

C6 Alexander Wang*, **Mengye Ren***, Richard S. Zemel. SketchEmbedNet: Learning novel concepts by imitating drawings. In *38th International Conference on Machine Learning (ICML)*, 2021.

C7 **Mengye Ren**, Michael L. Iuzzolino, Michael C. Mozer, Richard S. Zemel. Wandering within a world: Online contextualized few-shot learning. In *9th International Conference on Learning Representations (ICLR)*, 2021.

C8 James Lucas, **Mengye Ren**, Irene Kameni, Toniann Pitassi, Richard S. Zemel. Theoretical bounds on estimation error for meta learning. In *9th International Conference on Learning Representations (ICLR)*, 2021.

C9 Bob Wei*, **Mengye Ren***, Wenyuan Zeng, Ming Liang, Bin Yang, Raquel Urtasun. Perceive, attend and drive: Learning spatial attention for safe self-driving. In *IEEE International Conference on Robotics and Automation (ICRA)*, Xi'an, China, 2021. (**oral**)

C10 Shuhan Tan*, Kelvin Wong*, Shenlong Wang, Sivabalan Manivasagam, **Mengye Ren**, Raquel Urtasun. SceneGen: Learning to simulate realistic traffic scenes. *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2021.

C11 Jingkang Wang, Ava Pun, James Tu, Abbas Sadat, Sergio Casas, Sivabalan Manivasagam, **Mengye Ren**, Raquel Urtasun. AdvSim: Generating safety-critical scenarios for self-driving vehicles. *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2021.

2020

C12 Yuwen Xiong, **Mengye Ren**, Raquel Urtasun. LoCo: Local contrastive representation learning. In *Advances in Neural Information Processing Systems 33 (NeurIPS)*, Vancouver, British Columbia, Canada, 2020.

C13 Nicholas Vadivelu, **Mengye Ren**, James Tu, Jingkang Wang, Raquel Urtasun. Learning to communicate and correct pose errors. In *Conference on Robot Learning (CoRL)*, Cambridge, Massachusetts, USA, 2020.

C14 Lingyun (Luke) Li, Bin Yang, Ming Liang, Wenyuan Zeng, **Mengye Ren**, Sean Segal, Raquel Urtasun. End-to-end contextual perception and prediction with interaction transformer. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Las Vegas, Nevada, USA, 2020. (**oral**)

C15 Abbas Sadat*, Sergio Casas Romero*, **Mengye Ren**, Xinyu Wu, Pranaab Dhawan, Raquel Urtasun. Perceive, predict, and plan: Safe motion planning through interpretable semantic representations. In *16th European Conference on Computer Vision (ECCV)*, Glasgow, United Kingdom, 2020.

C16 Quinlan Sykora*, **Mengye Ren***, Raquel Urtasun. Multi-agent routing value iteration network. In *37th International Conference on Machine Learning (ICML)*, Vienna, Austria, 2020.

C17 James Tu, **Mengye Ren**, Sivabalan Manivasagam, Ming Liang, Bin Yang, Richard Du, Frank Cheng, Raquel Urtasun. Physically realizable adversarial examples for LiDAR object detection. In *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, Seattle, Washington, USA, 2020.

2019

C18 **Mengye Ren**, Renjie Liao, Ethan Fetaya, Richard S. Zemel. Incremental few-shot learning with attention attractor networks. In *Advances in Neural Information Processing Systems 32 (NeurIPS)*, Vancouver, British Columbia, Canada, 2019.

C19 Kelvin Wong, Shenlong Wang, **Mengye Ren**, Ming Liang, Raquel Urtasun. Identifying unknown instances for autonomous driving. In *Conference on Robot Learning (CoRL)*, Osaka, Japan, 2019. (**spotlight**)

C20 Abbas Sadat*, **Mengye Ren***, Andrei Pokrovsky, Yen-Chen Lin, Ersin Yumer, Raquel Urtasun. Jointly learnable behavior and trajectory planner for self-driving vehicles. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Macau, China, 2019. (**oral**)

C21 Chris Zhang, **Mengye Ren**, Raquel Urtasun. Graph hypernetworks for neural architecture search. In *7th International Conference on Learning Representations (ICLR)*, New Orleans, Louisiana, USA, 2019.

2018

C22 **Mengye Ren**, Wenyuan Zeng, Bin Yang, Raquel Urtasun. Learning to reweight examples for robust deep learning. In *35th International Conference on Machine Learning (ICML)*, Stockholm, Sweden, 2018.

C23 **Mengye Ren***, Andrei Pokrovsky*, Bin Yang*, Raquel Urtasun. SBNet: Sparse blocks network for fast inference. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, Salt Lake City, Utah, USA, 2018. (**spotlight**)

C24 **Mengye Ren**, Eleni Triantafillou*, Sachin Ravi*, Jake Snell, Kevin Swersky, Joshua B. Tenenbaum, Hugo Larochelle, Richard S. Zemel. Meta-learning for semi-supervised few-shot classification. In *6th International Conference on Learning Representations (ICLR)*, Vancouver, British Columbia, Canada, 2018.

C25 Yuhuai Wu*, **Mengye Ren***, Renjie Liao, Roger B. Grosse. Understanding short-horizon bias in meta optimization. In *6th International Conference on Learning Representations (ICLR)*, Vancouver, British Columbia, Canada, 2018.

2017

C26 Aidan N. Gomez*, **Mengye Ren***, Raquel Urtasun, Roger B. Grosse. The reversible residual network: Backpropagation without storing activations. In *Advances in Neural Information Processing Systems 30 (NIPS)*, Long Beach, California, USA, 2017.

C27 **Mengye Ren**, Richard S. Zemel. End-to-end instance segmentation with recurrent attention. In *IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, Honolulu, Hawaii, USA, 2017. (**spotlight**)

C28 **Mengye Ren***, Renjie Liao*, Raquel Urtasun, Fabian H. Sinz, Richard S. Zemel. Normalizing the normalizers: Comparing and extending network normalization schemes. In *5th International Conference on Learning Representations (ICLR)*, Toulon, France, 2017.

2015

C29 **Mengye Ren**, Ryan Kiros, Richard S. Zemel. Exploring models and data for image question answering. In *Advances in Neural Information Processing Systems 28 (NIPS)*, Montréal, Québec, Canada, 2015.

Peer-Reviewed Workshop Papers

2020

W1 **Mengye Ren***, Eleni Triantafillou*, Kuan-Chieh Wang*, James Lucas*, Jake Snell, Xaq Pitkow, Andreas S. Tolias, Richard S. Zemel. Flexible few-shot learning of contextual similarity. In *NeurIPS Meta-Learning Workshop*, Vancouver, BC, Canada, 2020.

W2 Laleh Seyyed-Kalantari, Karsten Roth, **Mengye Ren**, Parsa Torabian, Joseph P. Cohen, Marzyeh Ghassemi. Multi-label incremental few-shot learning for medical image pathology classifiers. In *Medical Imaging Meets NeurIPS Workshop*, Vancouver, BC, Canada, 2020.

W3 **Mengye Ren**, Michael L. Iuzzolino, Michael C. Mozer, Richard S. Zemel. Wandering within a world: Online contextualized few-shot learning. In *ICML Continual Learning Workshop & Lifelong Learning Workshop & Workshop on Learning in Artificial Open Worlds*, Vienna, Austria, 2020. (**oral**)

W4 Jingkang Wang*, **Mengye Ren***, Ilija Bogunovic, Yuwen Xiong, Raquel Urtasun. Cost-efficient online hyperparameter optimization. In *ICML RealML Workshop*, Vienna, Austria, 2020.

2019

W5 James Lucas, **Mengye Ren**, Richard S. Zemel. Information-theoretic limitations on novel task generalization. In *NeurIPS Workshop on Machine Learning with Guarantees*, Vancouver British Columbia, Canada, 2019. (**oral**)

W6 Yuwen Xiong*, **Mengye Ren***, Renjie Liao, Kelvin Wong, Raquel Urtasun. Deformable filter convolution for point cloud reasoning. *arXiv preprint arXiv:1907.13079*. In *NeurIPS Workshop on Sets & Partitions*, Vancouver, British Columbia, Canada, 2019.

2018

W7 **Mengye Ren**, Renjie Liao, Ethan Fetaya, Richard S. Zemel. Incremental few-shot learning with attention attractor networks. In *NeurIPS Meta-Learning Workshop*, Montréal, Québec, Canada, 2018.

W8 Chris Zhang, **Mengye Ren**, Raquel Urtasun. Graph hypernetworks for neural architecture search. In *NeurIPS Meta-Learning Workshop*, Montréal, Québec, Canada, 2018.

2017

W9 **Mengye Ren**, Eleni Triantafillou*, Sachin Ravi*, Jake Snell, Kevin Swersky, Joshua B. Tenenbaum, Hugo Larochelle, Richard S. Zemel. Meta-learning for semi-supervised few-shot classification. In *NIPS Meta-Learning Workshop & Learning with Limited Data Workshop*, Long Beach, California, USA, 2017.

W10 Yuhuai Wu*, **Mengye Ren***, Renjie Liao, Roger B. Grosse. Understanding short-horizon bias in meta optimization. In *NIPS Meta-Learning Workshop*, Long Beach, California, USA, 2017.

2015

W11 **Mengye Ren**, Ryan Kiros, Richard Zemel. Exploring models and data for image question answering. In *ICML Deep Learning Workshop*, Lille, France, 2015. (**oral**)

Preprints & Tech Reports

R1 **Mengye Ren**, Simon Kornblith, Renjie Liao, Geoffrey Hinton. Scaling forward gradient with local losses. *arXiv preprint arXiv:2210.03310*, 2022.

R2 Andrew J. Nam*, **Mengye Ren***, Chelsea Finn, James L. McClelland. Learning to reason with relational abstractions. *arXiv preprint arXiv:2210.02615*, 2022.

R3 **Mengye Ren**, Tyler R. Scott, Michael L. Iuzzolino, Michael C. Mozer, Richard Zemel. Online unsupervised learning of visual representations and categories. *arXiv preprint arXiv:2109.05675*, 2021.

R4 **Mengye Ren***, Eleni Triantafillou*, Kuan-Chieh Wang*, James Lucas*, Jake Snell, Xaq Pitkow, Andreas S. Tolias, Richard S. Zemel. Flexible few-shot learning of contextual similarity. *arXiv preprint arXiv:2012.05895*, 2020.

R5 Yuwen Xiong*, **Mengye Ren***, Raquel Urtasun. Learning to remember from a multi-task teacher. *arXiv preprint arXiv:1910.04650*, 2019.

Patents

P1 Raquel Urtasun, **Mengye Ren**, Andrei Pokrovsky, Bin Yang. Sparse convolutional neural networks, US 11,061,402 B2, *US Patent*, 2021.

Awards & Honors

- NSERC Postdoctoral Fellowship, $90,000 CAD (declined) 2021 – 2023
- Facebook Fellowship Finalist (91 out of 1876 PhD applicants worldwide) 2020
- NSERC Alexander Graham Bell Scholarship, $105,000 CAD 2018 – 2021
- NVIDIA Research Pioneer Award 2018
- NVIDIA Research Pioneer Award 2017
- NIPS 2017 Travel Award $800 USD 2017
- ICLR 2017 Travel Award $1,250 USD 2017
- MLSS 2015 Kyoto Travel Support ¥140,000 JPY 2015
- U of T Quantathon 2nd Place $5,000 CAD 2015
- U of T Undergraduate Mathematics Competition, Honourable Mention 2015
- Wallberg Undergraduate Scholarship $1,500 CAD 2014
- International 5th place in Windward AI Challenge, 1st in U of T 2014
- Dean's List for all semesters in undergraduate studies 2011 – 2015
- Entrance Scholarship from the University of Toronto $5,000 CAD 2011
- Meritorious Award in Mathematical Contest of Modeling (MCM) 2011

Professional Service

Area Chair:

- NeurIPS Workshop on Meta-Learning (MetaLearn) 2020 - 2021
- AutoML 2022

Journal Reviewer:

- Journal of Machine Learning Research (JMLR)
- International Journal of Computer Vision (IJCV)
- IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- IEEE Transactions on Image Processing (TIP)
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- IEEE Transactions on Computational Imaging (TCI)
- Neural Networks
- Machine Learning
- Optimization Methods and Software

Conference Reviewer:

- Conference on Neural Information Processing Systems (NeurIPS) 2016 – 2022
- International Conference on Machine Learning (ICML) 2017 – 2022
- International Conference on Learning Representations (ICLR) 2018 – 2022

- Conference on Computer Vision and Pattern Recognition (CVPR) 2018 – 2022
- International Conference on Computer Vision (ICCV) 2019 – 2021
- European Conference on Computer Vision (ECCV) 2020
- International Conference on Robotics and Automation (ICRA) 2021
- Conference on Lifelong Learning Agents (CoLLAs) 2022
- International Conference on Intelligent Robots and Systems (IROS) 2020
- Association for the Advancement of Artificial Intelligence Conference (AAAI) 2018
- Uncertainty in Artificial Intelligence (UAI) 2018

Seminar Organizer:

- Self-Supervised Learning Weekly Seminars (with E. Triantafillou) 2021 – 2022
- Meta-Learning Weekly Seminars (with E. Triantafillou) 2019 – 2021
- Uber ATG R&D Weekly Paper Reading Seminars 2018 – 2019

Open Source Softwares

- Forward-mode automatic differentiation for TensorFlow.
  GitHub: `https://github.com/renmengye/tensorflow-forward-ad`
- DeepDashboard: Real-time web-based training visualizer.
  GitHub: `https://github.com/renmengye/deep-dashboard`

Invited Talks

2022

T1 Biologically plausible learning using local activity perturbation. NYU CDS Lunch Seminar. New York, New York, USA. Oct, 2022.

T2 Visual learning in the open world. 19th Conference on Vision and Robotics (CRV) Symposium. Toronto, Ontario, Canada. Jun 2022.

2021

T3 Visual learning in the open world. University of Oxford. Oxford, UK. Nov 2021.

T4 Visual learning in the open world. Google Brain. Toronto, Ontario, Canada. Nov 2021.

T5 Visual learning in the open world. Stanford University. Stanford, California, USA. Oct 2021.

T6 Steps towards making machine learning more natural. École Polytechnique Fédérale de Lausanne. Lausanne, Switzerland. Apr 2021.

T7 Steps towards making machine learning more natural. University of Michigan. Ann Arbor, Michigan, USA. Mar 2021.

T8 Steps towards making machine learning more natural. Université de Montréal. Montréal, Québec, Canada. Mar 2021.

T9 Steps towards making machine learning more natural. University of North Carolina, Chapel Hill. Chapel Hill, North Carolina, USA. Mar 2021.

T10 Steps towards making machine learning more natural. University of Chicago. Chicago, Illinois, USA. Mar 2021.

T11 Steps towards making machine learning more natural. University of British Columbia. Vancouver, British Columbia, Canada. Mar 2021.

T12 Steps towards making machine learning more natural. University of Waterloo. Waterloo, Ontario, Canada. Mar 2021.

T13 Steps towards making machine learning more natural. New York University. New York, New York, USA. Mar 2021.

T14 Steps towards making machine learning more natural. University of Edinburgh. Edinburgh, UK. Mar 2021.

T15 Steps towards making machine learning more natural. University of Maryland, College Park. College Park, Maryland, USA. Feb 2021.

T16 A tutorial on few-shot learning and unsupervised representation learning. Vector Institute. Toronto, Ontario, Canada. Jan 2021.

2020

T17 How can we apply few-shot learning? Vector Institute. Toronto, Ontario, Canada. Oct 2020.

T18 Towards continual and compositional few-shot learning. Stanford University. Stanford, California, USA. Oct 2020.

T19 Towards continual and compositional few-shot learning. Brown University. Providence, Rhode Island, USA. Sept 2020.

T20 Towards continual and compositional few-shot learning. MIT. Cambridge, Massachusetts, USA. Sept 2020.

T21 Towards continual and compositional few-shot learning. Mila. Montréal, Québec, Canada. Aug 2020.

T22 Towards continual and compositional few-shot learning. Uber ATG. Toronto, Ontario, Canada. Aug 2020.

T23 Wandering within a world: Online contextualized few-shot learning. Google Brain. Montréal, Québec, Canada. Aug 2020.

T24 Wandering within a world: Online contextualized few-shot learning. ICML 2020 Lifelong Learning Workshop. July 2020.

T25 Wandering within a world: Online contextualized few-shot learning. ICML 2020 Continual Learning Workshop. July 2020.

2019

T26 Jointly learnable behavior and trajectory planner for autonomous driving. IROS 2019. Macau, China. Nov 2019.

T27 Meta-learning for more human-like learning algorithms. Columbia University. New York, New York, USA. Oct 2019.

2018

T28 Learning to reweight examples for robust deep learning. CIFAR deep learning and reinforcement learning summer school. Toronto, Ontario, Canada. Aug 2018.

T29 Meta-learning for weakly supervised learning. INRIA Grenoble - Rhône-Alpes. Grenoble, France. July 2018.

T30 Learning to reweight examples for robust deep learning. ICML 2018. Stockholm, Sweden. July 2018.

T31 Meta-learning and learning to reweight examples. Max Planck Institute for Intelligent Systems. Tübingen, Germany. June 2018.

T32 SBNet: Sparse blocks network for fast inference. CVPR 2018. Salt Lake City, Utah, USA. June 2018.

T33 Meta-learning for weakly supervised learning. NEC Laboratories America. Princeton, New Jersey, USA. June 2018.

T34 SBNet: Sparse blocks network for fast inference. Borealis AI Lab (RBC Research). Toronto, Ontario, Canada. Feb 2018.

2017

T35 Meta-learning for semi-supervised few-shot classification. Vector Institute. Toronto, Ontario, Canada. Nov 2017.

T36 End-to-end instance segmentation with recurrent attention. CVPR 2017. Honolulu, Hawaii, USA. July 2017.

T37 Sequence-to-sequence deep learning with recurrent attention. Queen's University. Kingston, Ontario, Canada. May 2017.

T38 Recurrent neural networks. CSC 2541: Sport Analytics Guest Lecture. University of Toronto. Toronto, Ontario, Canada. Jan 2017.

2016

T39 Deep dashboard tutorial. University of Guelph. Guelph, Ontario, Canada. Mar 2016.

T40 Deep dashboard tutorial. University of Toronto. Toronto, Ontario, Canada. Feb 2016.

2015

T41 Exploring data and models for image question answering. ICML 2015 Deep Learning Workshop. Lille, France. July 2015.

STUDENT SUPERVISION

PhD Students:

- Nikhil Bhattasali
- Ryan Teehan
- Alexander Wang
- Yanlai Yang

Undergraduate Students:

- Alexander Li
- Jason Sun
- Alexander Wang
- Yatu Zhang

Interns (Uber ATG & Waabi):

- Richard Du
- Alexander Li
- Yen-chen Lin
- Mengfei Liu
- Stephen Liu
- Ava Pun
- Quinlan Sykora
- James Tu
- Nicholas Vadivelu
- Jingkang Wang
- Bob Wei
- Xinkai Wei
- Chris Zhang
- Lunjun Zhang

MEDIA COVERAGE

- Researchers from University of Toronto proposed attention attractor networks and implemented incremental few-shot learning. Synced. `[link]`. 2019/11/03.
- Autonomous vehicles: U of T researchers make advances with new algorithm. Nina Haikara. U of T News. `[link]`. 2018/06/21.
- Industry — Uber proposed SBNet: Leveraging activation block sparsity for speeding up convolutional neural networks. Synced. `[link]`. 2018/01/18.
- SBNet: Leveraging activation block sparsity for speeding up convolutional neural networks. Uber Engineering Blog. `[link]`. 2018/01/16.