Jiayuan Mao

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Website : https ://jiayuanm.com

Research Interest

I aim to build machines that can continually learn new knowledge from their experiences and reason across tasks, modalities, and environments : answer queries, infer human intentions, and make long-horizon plans spanning hours to days. As an AI scientist, I primarily use *robots* as my testbed. My work spans multiple fields in AI, including *robotics*, *machine learning*, *computer vision*, and *natural language processing*.

Education

2019-Present | **Massachusetts Institute of Technology**

Ph.D. Student in the Department of Electrical Engineering and Computer Science

Advisors : Joshua B. Tenenbaum and Leslie Pack Kaelbling
Thesis : Learning, Reasoning, and Planning with Neuro-Symbolic Concepts
Expected Graduation : September 15, 2025

2014-2019 | **Tsinghua University**

B.Eng. in Computer Science (Yao Class), Institute for Interdisciplinary Information Sciences

Thesis : Learning Sememe-based Dependency Structures

Awards and Honors

2024	Best Paper, SoCal NLP 2024 (top 0.4%)
2024	Best Paper, CoRL 2024 Workshop on Language and Robot Learning
2024	Rising Star in EECS
2024	Rising Star in Generative AI
2024	Best Undergraduate Student Paper, Annual Meeting of the Cognitive Science Society
2021	Qualcomm Fellowship Finalist
2020	Facebook Fellowship Finalist
2019	Best Paper Nomination, Annual Meeting of the Association for Computational Linguistics
2019	MIT Presidential Graduate Fellowship

Publication

Agent Workflow Memory **ICML 2025**
Zora Zhiruo Wang, Jiayuan Mao, Daniel Fried, Graham Neubig

Infer Human's Intentions Before Following Natural Language Instructions **AAAI 2025**
Yanming Wan, Yue Wu, Yiping Wang, Jiayuan Mao*, Natasha Jaques*

One-Shot Manipulation Strategy Learning by Making Contact Analogies **ICRA 2025**
CoRL 2024 Workshop on Learning Effective Abstractions for Planning
Yuyao Liu*, Jiayuan Mao*, Joshua Tenenbaum, Tomás Lozano-Pérez, Leslie Pack Kaelbling

Keypoint Abstraction using Large Models for Object-Relative Imitation Learning **ICRA 2025**
CoRL 2024 Workshop on Language and Robot Learning (Best Paper)

Xiaolin Fang*, Bo-Ruei Huang*, Jiayuan Mao*, Jasmine Shone, Joshua B. Tenenbaum, Tomás Lozano-Pérez, Leslie Pack Kaelbling

What Makes a Maze Look Like a Maze ? **ICLR 2025**
ECCV Human-Inspired Computer Vision Workshop 2024

Joy Hsu, Jiayuan Mao, Joshua B. Tenenbaum, Noah D. Goodman, Jiajun Wu

Learning Linear Attention in Polynomial Time **ArXiv 2024**

Morris Yau, Eykin Akyurek, Jiayuan Mao, Joshua B. Tenenbaum, Stefanie Jegelka, Jacob Andreas

BLADE : Learning Compositional Behaviors from Demonstration and Language **CoRL 2024**

Weiyu Liu*, Neil Nie*, Ruohan Zhang, Jiayuan Mao†, Jiajun Wu†

Embodied Agent Interface : A Single Line to Evaluate LLMs **NeurIPS 2024 (Oral)**
for Embodied Decision Making **SoCal NLP 2024 (Best Paper)**

Manling Li*, Shiyu Zhao*, Qineng Wang*, Kangrui Wang*, Yu Zhou*, Sanjana Srivastava, Cem Gokmen, Tony Lee, Li Erran Li, Ruohan Zhang, Weiyu Liu, Percy Liang, Li Fei-Fei, Jiayuan Mao, Jiajun Wu

Hybrid Declarative-Imperative Representations for Hybrid **WAFR 2024**
Discrete-Continuous Decision-Making

Jiayuan Mao, Joshua B. Tenenbaum, Tomás Lozano-Pérez, Leslie Pack Kaelbling

Learning Iterative Reasoning through Energy Diffusion **ICML 2024**

Yilun Du*, Jiayuan Mao*, Joshua B. Tenenbaum

Finding Structure in Logographic Writing with Library Learning **CogSci 2024**

Guangyuan Jiang, Matthias Hofer, Jiayuan Mao, Lionel Wong, **(Best Undergraduate Student Paper)**
Joshua B. Tenenbaum, Roger P. Levy

"Set It Up !" : Functional Object Arrangement with Compositional Generative Models **RSS 2024**

Yiqing Xu, Jiayuan Mao, Yilun Du, Tomas Lozáno-Pérez, Leslie Pack Kaebling, David Hsu

Grounding Language Plans in Demonstrations through **ICLR 2024 (Spotlight)**
Counter-Factual Perturbations

Yanwei Wang, Tsun-Hsuan Wang, Jiayuan Mao, Michael Hagenow, Julie Shah

Learning to Act from Actionless Videos through Dense Correspondences **ICLR 2024 (Spotlight)**

Po-Chen Ko, Jiayuan Mao, Yilun Du, Shao-Hua Sun, Joshua B. Tenenbaum

Learning Adaptive Planning Representations with Natural Language Guidance **ICLR 2024**

Lionel Wong*, Jiayuan Mao*, Pratyusha Sharma*, Zachary S. Siegel, Jiahai Feng, Noa Korneev, Joshua B. Tenenbaum, Jacob Andreas

Learning Planning Abstractions from Language **ICLR 2024**

Weiyu Liu, Geng Chen, Joy Hsu, Jiajun Wu*, Jiayuan Mao*

What Planning Problem Can A Relational Neural Network Solve **NeurIPS 2023 (Spotlight)**

Jiayuan Mao, Tomás Lozano-Pérez, Joshua B. Tenenbaum, Leslie Pack Kaelbling

What's Left ? Concept Grounding with Logic-Enhanced Foundation Models **NeurIPS 2023**

Joy Hsu*, Jiayuan Mao*, Joshua B. Tenenbaum, Jiajun Wu

Learning Reusable Manipulation Strategies **CoRL 2023**

Jiayuan Mao, Tomás Lozano-Pérez, Joshua B. Tenenbaum, Leslie Pack Kaelbling

Compositional Diffusion-Based Continuous Constraint Solvers **CoRL 2023**

Zhutian Yang, Jiayuan Mao, Yilun Du, Jiajun Wu, Joshua B. Tenenbaum, Tomás Lozano-Pérez, Leslie Pack Kaelbling

Composable Part-Based Manipulation **CoRL 2023**
Weiyu Liu, Jiayuan Mao, Joy Hsu, Tucker Hermans, Animesh Garg, Jiajun Wu

NS3D : Neuro-Symbolic Grounding of 3D Objects and Relations **CVPR 2023**
Joy Hsu, Jiayuan Mao, Jiajun Wu

Programmatically Grounded, Compositionally Generalizable Robotic Manipulation **ICLR 2023 (Spotlight)**
Renhao Wang*, Jiayuan Mao*, Joy Hsu, Hang Zhao, Jiajun Wu, Yang Gao

Learning Rational Subgoals from Demonstrations and Instructions **AAAI 2023**
Zhezheng Luo*, Jiayuan Mao*, Jiajun Wu, Tomás Lozano-Pérez, Joshua B. Tenenbaum, Leslie Pack Kaelbling

DisCo : Improving Compositional Generalization in Visual Reasoning through Distribution Coverage **TMLR 2023**
Joy Hsu, Jiayuan Mao, Jiajun Wu

On the Expressiveness and Generalization of Hypergraph Neural Networks **LoG 2022**
Zhezheng Luo, Jiayuan Mao, Joshua B. Tenenbaum, Leslie Pack Kaelbling

Sparse and Local Hypergraph Reasoning Networks **LoG 2022**
Guangxuan Xiao, Leslie Pack Kaelbling, Jiajun Wu, Jiayuan Mao

PDSketch : Integrated Domain Programming, Learning, and Planning **NeurIPS 2022**
Jiayuan Mao, Tomás Lozano-Pérez, Joshua B. Tenenbaum, Leslie Pack Kaelbling

HandMeThat : Human-Robot Communication in Physical and Social Environments **NeurIPS 2022**
Yanming Wan*, Jiayuan Mao*, Joshua B. Tenenbaum

CLEVRER-Humans : Describing Physical and Causal Events the Human Way **NeurIPS 2022**
Jiayuan Mao*, Xuelin Yang*, Xikun Zhang, Noah D. Goodman, Jiajun Wu

IKEA-Manual : Seeing Shape Assembly Step by Step **NeurIPS 2022**
Ruocheng Wang, Yunzhi Zhang, Jiayuan Mao, Ran Zhang, Chin-Yi Cheng, Jiajun Wu

Translating a Visual LEGO Manual to a Machine-Executable Plan **ECCV 2022**
Ruocheng Wang, Yunzhi Zhang, Jiayuan Mao, Chin-Yi Cheng, Jiajun Wu

Programmatic Concept Learning for Human Motion Description and Synthesis **CVPR2022**
Sumith Kulal*, Jiayuan Mao*, Alex Aiken†, Jiajun Wu†

FALCON : Fast Visual Concept Learning by Integrating Images, Linguistic descriptions, and Conceptual Relations **ICLR 2022**
Lingjie Mei*, Jiayuan Mao*, Ziqi Wang, Chuang Gan, Joshua B. Tenenbaum

Grammar-Based Grounded Lexicon Learning **NeurIPS 2021**
Jiayuan Mao, Haoyue Shi, Jiajun Wu, Roger P. Levy, Joshua B. Tenenbaum

Temporal and Object Quantification Networks **IJCAI 2021**
Jiayuan Mao*, Zhezheng Luo*, Chuang Gan, Joshua B. Tenenbaum, Jiajun Wu, Leslie Pack Kaelbling, Tomer D. Ullman

Language-Mediated, Object-Centric Representation Learning **ACL 2021 (Findings)**
Ruocheng Wang*, Jiayuan Mao*, Samuel J. Gershman, Jiajun Wu

Hierarchical Motion Understanding via Motion Programs **CVPR 2021**
Sumith Kulal*, Jiayuan Mao*, Alex Aiken, Jiajun Wu

Grounding Physical Concepts of Objects and Events Through Dynamic Visual Reasoning **ICLR 2021**
Zhenfang Chen, Jiayuan Mao, Jiajun Wu, Kwan-Yee K. Wong, Joshua B. Tenenbaum, Chuang Gan

Object-Centric Diagnosis of Visual Reasoning **ArXiv 2020**
Jianwei Yang, Jiayuan Mao, Jiajun Wu, Devi Parikh, David D. Cox, Joshua B. Tenenbaum, Chuang Gan

Multi-Plane Program Induction with 3D Box Priors **NeurIPS 2020**
Yikai Li*, Jiayuan Mao*, Xiuming Zhang, William T. Freeman, Joshua B. Tenenbaum, Noah Snavely, Jiajun Wu

Perspective Plane Program Induction from a Single Image **CVPR 2020**
Yikai Li*, Jiayuan Mao*, Xiuming Zhang, William T. Freeman, Joshua B. Tenenbaum, Jiajun Wu

Visual Concept-Metaconcept Learning **NeurIPS 2019**
Chi Han*, Jiayuan Mao*, Chuang Gan, Joshua B. Tenenbaum, Jiajun Wu

Program-Guided Image Manipulators **ICCV 2019**
Jiayuan Mao*, Xiuming Zhang*, Yikai Li, William T. Freeman, Joshua B. Tenenbaum, Jiajun Wu

Visually Grounded Neural Syntax Acquisition **ACL 2019 (Best Paper Nominee)**
Haoyue Shi*, Jiayuan Mao*, Kevin Gimpel, Karen Livescu

Neurally-Guided Structure Inference **ICML 2019**
Sidi Lu*, Jiayuan Mao*, Joshua B. Tenenbaum, Jiajun Wu

The Neuro-Symbolic Concept Learner : Interpreting Scenes, Words, and Sentences from Natural Supervision **ICLR 2019 (Oral)**
Jiayuan Mao, Chuang Gan, Pushmeet Kohli, Joshua B. Tenenbaum, Jiajun Wu

Neural Logic Machines **ICLR 2019**
Honghua Dong*, Jiayuan Mao*, Tian Lin, Chong Wang, Lihong Li, Denny Zhou

Unified Visual-Semantic Embeddings : Bridging Vision and Language with Structured Meaning Representations **CVPR 2019 (Oral)**
Hao Wu*, Jiayuan Mao*, Yufeng Zhang, Yuning Jiang, Lei Li, Wei-Ying Ma

Neural Phrase-to-Phrase Machine Translation **ArXiv 2018**
Jiangtao Feng, Lingpeng Kong, Po-Sen Huang, Chong Wang, Da Huang, Jiayuan Mao, Kan Qiao, Denny Zhou

Acquisition of Localization Confidence for Accurate Object Detection **ECCV 2018 (Oral)**
Borui Jiang*, Ruixuan Luo*, Jiayuan Mao*, Tete Xiao, Yuning Jiang

Learning Visually-Grounded Semantics from Contrastive Adversarial Samples **COLING 2018**
Haoyue Shi*, Jiayuan Mao*, Tete Xiao*, Yuning Jiang, Jian Sun

Universal Agent for Disentangling Environments and Tasks **ICLR 2018**
Jiayuan Mao, Honghua Dong, Joseph J. Lim

What Can Help Pedestrian Detection ? **CVPR 2017**
Jiayuan Mao*, Tete Xiao*, Yuning Jiang, Zhimin Cao

Invited Talks

2024	Workshop on Rising Stars in Generative AI Title : *Learning, Reasoning and Planning with Neuro-Symbolic Concepts*
2024	Workshop on Visual Concepts at ECCV 2024 Title : *Representation and Computation Aspects of Visual Concepts*
2024	Bimanual Manipulation : On Kitchen Challenges workshop at ICRA 2024 Title : *Building General-Purpose Robots with Neuro-Symbolic Action Abstractions*
2024	Brown Robotics Talks at Brown University

	Title : *Compositional Action Representations*
2024	NSF Workshop on Hardware-Software Co-design for Neuro-Symbolic Computation Title : *Learning and Planning with Neuro-Symbolic Actions*
2024	The Manipulation Reading Group at the Robotics Institute at Carnegie Mellon University Title : *Building General-Purpose Robots with Integrated Learning and Planning*
2024	Coordinated Science Laboratory Student Conference (CSLSC 2024) at the University of Illinois at Urbana-Champaign Title : *Integrated Learning and Planning*
2023	Guest Lecture of Course "Reinforcement Learning" at National Taiwan University Title : *Integrated Robotic Programming, Learning and Planning*
2023	Workshop on Robot Representations For Scene Understanding, Reasoning and Planning at RSS 2023 Title : *Neuro-Symbolic Concepts for Robotic Manipulation*
2021	CLVR Lab at University of Southern California Title : *Neuro-Symbolic Frameworks for Visual Concept Learning and Language Acquisition*
2020	Tutorial on Neuro-Symbolic Reasoning and Program Synthesis Title : *Neuro-Symbolic Frameworks for Visual Concept Learning and Language Acquisition*
2020	Computational Cognitive Neuroscience Lab at Harvard University Title : *Neuro-Symbolic Frameworks for Visual Concept Learning and Language Acquisition*
2020	MIT Vision Seminar Title : *Neuro-Symbolic Frameworks for Visual Concept Learning and Language Acquisition*
2019	Workshop on Visually Grounded Interaction and Language at NeurIPS 2019 Title : *Neuro-Symbolic Frameworks for Visually Grounded Reasoning and Language Acquisition*

Mentored Students

Undergraduates and Master Students

2024	Peiqi Liu
2024	Bo-Ruei Huang Next : Ph.D. student at University of Southern California
2024	Yuyao Liu Next : Ph.D. student at Massachusetts Institute of Technology
2023-2024	Po-Chen Ko
2023-2024	Neil Nie Next : Ph.D. student at University of California, Berkeley
2023-2024	Zachary S. Siegel Next : Ph.D. student at Massachusetts Institute of Technology
2023-2024	Guangyuan Jiang Next : Ph.D. student at Massachusetts Institute of Technology
2023-2024	Zachary Zhang Next : Stripe
2023	Xingjian Bai Next : Ph.D. student at Massachusetts Institute of Technology
2023	Jiahai Feng Next : Ph.D. student at University of California, Berkeley
2023	Jung-Chun Liu Next : Ph.D. student at University of Michigan

2022	Renhao Wang Next : Ph.D. student at University of California, Berkeley
2022	Guangxuan Xiao Next : Ph.D. student at Massachusetts Institute of Technology
2021-2022	Yanming Wan Next : Ph.D. student at University of Washington
2021-2022	Xuelin Yang Next : Ph.D. student at University of California, Berkeley
2020-2022	Zhezheng Luo Next : Citadel
2020-2021	Ruocheng Wang Next : Ph.D. student at Stanford University
2020-2021	Lingjie Mei Next : Ph.D. student at Princeton University
2019-2021	Yikai Li Next : Ph.D. student at Stanford University
2020	Ruidong Wu Next : Ph.D. student at University of Illinois Urbana-Champaign
2019	Chi Han Next : Ph.D. student at University of Illinois Urbana-Champaign

Ph.D. Students

2023-2024	Weiyu Liu Postdoc at Stanford University. Co-mentored with Prof. Jiajun Wu
2022-2024	Joy Hsu Ph.D. student at Stanford University. Co-mentored with Prof. Jiajun Wu
2020-2022	Sumith Kulal Ph.D. student at Stanford University. Co-mentored with Prof. Jiajun Wu and Prof. Alex Aiken

Teaching

2021 Fall	Teaching Assistant : Representation, Inference and Reasoning in AI (Graduate), MIT
2017 Spring	Teaching Assistant : Object-Oriented Programming (Undergraduate), Tsinghua University

Professional Service : Workshop and Tutorial Organization

ICRA 2025	Workshop on Learning Meets Model-Based Methods for Contact-Rich Manipulation
CVPR 2025	Workshop on Visual Concepts
CVPR 2025	Foundation Models for Embodied Agents
NAACL 2025	Tutorial on Learning Language through Grounding
NAACL 2025	Tutorial on Foundation Models Meet Embodied Agents
AAAI 2025	Tutorial on Foundation Models Meet Embodied Agents
AAAI 2025	Workshop on Planning in the Era of LLMs
CoRL 2024	Workshop on Learning Effective Abstractions for Planning
ECCV 2024	Workshop on Visual Concepts
NAACL 2021	Workshop on Visually Grounded Interaction and Language
CVPR 2020	Tutorial on Neuro-Symbolic Visual Reasoning and Program Synthesis

Professional Service : Conference Refereeing

2025-Present	International Conference on Automated Planning and Scheduling (ICAPS)
2024-Present	Annual Meeting of the Cognitive Science Society (CogSci)
2024-Present	Conference on Language Models(CoLM)
2024-Present	Robotics : Science and Systems (RSS)
2023-Present	Association for the Advancement of Artificial Intelligence (AAAI)
2023-Present	IEEE International Conference on Robotics and Automation (ICRA)
2023-Present	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
2023-Present	Association for Computational Linguistics Rolling Review (ACL Rolling Review)
2022-Present	European Conference on Computer Vision (ECCV)
2021-Present	International Conference on Computer Vision (ICCV)
2021-Present	International Conference on Machine Learning (ICML)
2021-Present	International Conference on Learning Representations (ICLR)
2020-Present	Conference on Neural Information Processing Systems (NeurIPS)
2019-Present	IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)

Other Research Appointments

2018-2019 | **COCOSCI Group, Massachusetts Institute of Technology**
Visiting Student, Advisor : Joshua B. Tenenbaum
Publication : *The Neuro-Symbolic Concept Learner : Interpreting Scenes, Words, and Sentences from Natural Supervision*

2018 | **Google AI China Center**
Research Intern, Mentor : Denny Zhou, Chong Wang
Publication : *Neural Logic Machines*
Publication : *Neural Phrase-to-Phrase Machine Translation*

2017 | **CLVR Lab, University of Southern California**
Visiting Student, Advisor : Joseph J. Lim
Publication : *Universal Agent for Disentangling Environments and Tasks*