

YEN-LING KUO

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RESEARCH VISION & INTERESTS

My research focuses on **enabling generalizations in human-AI/robot interactions** – building machines that can generalize their learned models to robustly interact with humans in novel scenarios. Toward this vision, I develop machine learning models that provide robots with generalizable reasoning skills including **language understanding** and **social interactions**.

EDUCATION

- 2016 – present **Massachusetts Institute of Technology**, Cambridge, MA
Ph.D. in Computer Science, minor in Cognitive Science, expected summer 2022
Thesis: Robotic Planning with Natural Language
Advisors: Boris Katz, Andrei Barbu
- 2009 – 2012 **National Taiwan University**, Taipei, Taiwan
M.S. in Computer Science and Information Engineering
Thesis: A Multiagent Reasoning System for Commonsense Knowledge Integration
Award: Best Master Thesis Award by the Taiwanese Association of Artificial Intelligence
Advisor: Jane Yung-jen Hsu
- 2011 **Massachusetts Institute of Technology**, Cambridge, MA
Visiting Student in Media Arts and Sciences
Advisor: Henry Lieberman
- 2005 – 2009 **National Taiwan University**, Taipei, Taiwan
B.S. in Computer Science and Information Engineering, minor in Physics

RESEARCH & WORK EXPERIENCE

- 09/2016 – present **MIT CSAIL & CBMM**
Research Assistant
 - **Planning with Compositional Language Models:** Designed and implemented planners that leverage models derived from linguistic parse [3, 9] to extend robots' capabilities to follow commands, plan in dynamic environments [10], and generalize in novel scenarios.
 - **Planning with Logics:** Created reinforcement learning agents that plan by incorporating constraints expressed as linear temporal logic in discrete [8] and continuous space [5]. The learned planners are used to learn the meaning of sentences [7].
 - **Modeling Interactions:** Developed experiments and computational models for understanding social interactions [2, 4] and human symbolic communication [13].
- 06/2021 – 08/2021 **Toyota Research Institute** (*host: Guy Rosman*)
Research Intern
 - **Trajectory Prediction with Language:** Developed interpretable machine learning models to predict behaviours of multiple road agents by leveraging linguistic representations [1].
- 09/2011 – 12/2011 **Software Agent Group, MIT Media Lab**
Visiting Student
 - **Language Explorer:** Built a mobile language learning app that adapts to a learner's context and capability by leveraging commonsense knowledge and location-based service to automatically arrange materials and generate dialogues.

- **ConceptNet 5:** Designed and implemented the multilingual knowledge base to integrate data from Chinese ConceptNet, ReVerb, and GoalNet.

10/2012 – 08/2016 **Shopping, Google Inc.**

Software Engineer

- Tech Lead for Shop the Look feature, which integrates outfit search and visually similar items to Google search. (*posts on [Google AdWords blog](#) and [TechCrunch](#)*)
- Developed advanced shopping search features for shopping queries on different platforms.
- Developed machine learning algorithms and crowd-sourcing infrastructure to extract product attributes from image content and product metadata.

06/2008 – 01/2012 **Intelligent Agents Lab, NTU CSIE**

Research Assistant

- **Multi-agent Reasoning System:** Built a multi-agent system to provide commonsense reasoning results from multiple knowledge bases for application developers [11].
- **Crowdsourcing of Chinese Commonsense Knowledge:** Created games and analogical reasoning algorithms to build the largest Chinese commonsense knowledge base (over one million sentences) [12, 16] as part of the MIT Open Mind Common Sense project.

06/2011 – 08/2011 **Comparison Ads, Google Inc.**

Software

Engineering Intern

- Developed algorithms and pipeline to automatically build entity attribute comparison tables for any entity using large-scale crawled web data.

PUBLICATIONS

Published 10 peer-reviewed conference/journal papers, 2 conference papers in review, and 4 peer-reviewed workshop/short papers in venues such as ICRA, IROS, CoRL, IJCAI, Findings of EMNLP, C&C, HCOMP, TiiS, and Frontiers in Robotics and AI. Have 1 pending patent.

Preprints

- [1] **Yen-Ling Kuo**, Xin Huang, Andrei Barbu, Stephen G. McGill, Boris Katz, John J. Leonard, and Guy Rosman. Trajectory Prediction with Linguistic Representations. *Submitted to ICRA 2022, under review.*
- [2] Ravi Tejwani*, **Yen-Ling Kuo***, Tianmin Shu, Bennett Stankovits, Dan Gutfreund, Joshua B. Tenenbaum, Boris Katz, and Andrei Barbu. Incorporating Rich Social Interactions Into MDPs. *Submitted to ICRA 2022, under review.* (*equal contribution)

Conference and Journal Publications

- [3] **Yen-Ling Kuo**, Boris Katz, and Andrei Barbu. Compositional Networks Enable Systematic Generalization for Grounded Language Understanding. In *Findings of Empirical Methods in Natural Language Processing (Findings of EMNLP)*, 2021.
- [4] Ravi Tejwani*, **Yen-Ling Kuo***, Tianmin Shu, Boris Katz, and Andrei Barbu. Social Interactions as Recursive MDPs. In *Proc. of Conference on Robot Learning (CoRL)*, 2021. (*equal contribution)
- [5] **Yen-Ling Kuo**, Boris Katz, and Andrei Barbu. Compositional RL Agents that Follow Language Commands in Temporal Logic. In *Frontiers in Robotics and AI – Robot and Machine Vision*, 2021.
- [6] Yen-Ting Cho, **Yen-Ling Kuo***, Yen-Ting Yeh*, Yen-Yi Huang, Po-Lun Huang. IntuModels: Enabling Interactive Modeling for the Novice through Idea Generation and Selection. In *Proc. of Creativity and Cognition (C&C)*, 2021. (*equal contribution) [**Best Paper Honorable Mention**]
- [7] Christopher Wang, Candace Ross, **Yen-Ling Kuo**, Boris Katz, and Andrei Barbu. Learning a Natural-language to LTL Executable Semantic Parser for Grounded Robotics. In *Proc. of Conference on Robot Learning (CoRL)*, 2020.

- [8] **Yen-Ling Kuo**, Andrei Barbu, and Boris Katz. Encoding Formulas as Deep Networks: Reinforcement Learning from Zero-shot Execution of LTL Formulas. In *Proc. of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020.
- [9] **Yen-Ling Kuo**, Andrei Barbu, and Boris Katz. Deep Compositional Robotic Planners that Follow Natural Language Commands. In *Proc. of International Conference on Robotics and Automation (ICRA)*, 2020.
- [10] **Yen-Ling Kuo**, Andrei Barbu, and Boris Katz. Deep Sequential Models for Sampling-based planning. In *Proc. of 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, October 2018.
- [11] **Yen-Ling Kuo** and Jane Yung-jen Hsu. Planning for Reasoning with Multiple Common Sense Knowledge Bases. *ACM Transactions on Interactive Intelligent Systems (TiiS)*, Vol. 2, No. 3, Article 17, pp. 1-24, September 2012.
- [12] **Yen-Ling Kuo** and Jane Yung-jen Hsu. Resource-bounded Crowd-sourcing of Commonsense Knowledge. In *Proc. of International Joint Conference on Artificial Intelligence (IJCAI)*, 2011.

Peer-Reviewed Short and Workshop Publications

- [13] Emily Cheng, **Yen-Ling Kuo**, Ignacio Cases, Boris Katz, and Andrei Barbu. Toward Modeling the Emergence of Symbolic Communication. In *Proc. of ICRA Workshop on Social Intelligence in Humans and Robots*, 2021.
- [14] Yen-Ting Cho, **Yen-Ling Kuo**, Yen-Ting Yeh, and Yi-Chin Lee. MovIPrint: Move, Explore and Fabricate. In *Proc. of ACM International Conference on Multimedia (ACM-MM)*, 2019.
- [15] **Yen-Ling Kuo**, Jane Yung-jen Hsu, and Fuming Shih. Contextual Commonsense Knowledge Acquisition from Social Content by Crowd-sourcing Explanations. In *Proc. of AAAI Workshop on Human Computation (HCOMP)*, 2012.
- [16] **Yen-Ling Kuo**, Kai-yang Chiang, Cheng-wei Chan, Jong-Chuan Lee, Rex Wang, Edward Shen, and Jane Yung-jen Hsu. Community-based Game Design: Experiments on Social Games for Commonsense Data Collection. In *Proc. of KDD Workshop on Human Computation (HCOMP)*, 2009.

Patent

- [17] **Yen-Ling Kuo**, Boris Katz, and Andrei Barbu. Deep Compositional Robotic Planners that Follow Natural Language Commands. *US Patent App. 17/112,699*. In review.

HONORS & AWARDS

2021	Best Paper Honorable Mention , <i>ACM Conference on Creativity & Cognition</i> Top 5% of the submissions.
2019	Top 10% , <i>ICFP Programming Contest 2019 (with Eric Stansifer, MIT)</i>
2018 – 2022	CBMM Siemens Graduate Fellowship , <i>Siemens Healthineers</i> Awarded to one graduate student at MIT CBMM (announcement on the CBMM website).
2018 – 2020	MIT Sandbox Innovation Fund , <i>Massachusetts Institute of Technology</i> Developed physics simulations in VR for STEM science experiments.
2016 – 2017	MIT Greater China Computer Science Fellowship , <i>Massachusetts Institute of Technology</i> Awarded annually to one graduate student from the Greater China area.
2012	Best Master Thesis Award , <i>Taiwanese Association of Artificial Intelligence</i> Awarded annually to three master students in AI research among all universities in Taiwan.
2011	Irving T. Ho Memorial Scholarship , <i>Irving T. Ho Memorial Foundation</i> Awarded annually to one EE/CSIE graduate student with exceptional research performance.

- 2011 **Google Anita Borg Memorial Scholarship**, *Google Inc.*
Awarded to female students with outstanding academic performance and leadership demonstration.
- 2010 **Outstanding Teaching Assistant Award**, *Department of CSIE, NTU*
Awarded to CSIE Teaching Assistants with highest ratings from students.

TEACHING EXPERIENCE

- 08/2017, 08/2018, 08/2019 **Teaching Assistant**, *Marine Biology Lab* Woods Hole, MA
- Course: *Brains, Minds, and Machines Summer Course*
 - Led and taught Deep Learning and Reinforcement Learning tutorials.
 - Supervised projects of graduate students and postdocs from computer science, cognitive science and neuroscience. Topics include human plan understanding, multi-agent communication and coordination, modeling pursuit and evasion behaviors of birds, social interaction recognition, and composition of policies to form complex behaviors.
- 09/2018 – 12/2018 **Teaching Assistant**, *Massachusetts Institute of Technology* Cambridge, MA
- Course: *Aspects of a Computational Theory of Intelligence*
 - Reviewed, provided feedback, and graded student projects. Held weekly office hours to discuss and answer students' questions.
 - Receive overall score 6.5 in a 7 point-scale course evaluation
– Stimulated interest: 6.5, Displayed thorough knowledge 6.5, Help me learn: 6.8
- 02/2010 – 05/2011 **Teaching Assistant**, *National Taiwan University* Taipei, Taiwan
- Courses: *Artificial Intelligence, Advanced Artificial Intelligence*
 - Held weekly office hours to discuss class, homework, and term projects with students.
 - In charge of both written and programming assignments for over 100 students.

MENTORING

Master Research

- present Patrice Gobat, Master in Computer Science, ETH Zürich (*with Xi Wang*)
Unsupervised Learning and Segmentation of Atomic Actions from First Person Perspective
- present Razvan-George Pasca, Master in Computer Science, ETH Zürich (*with Xi Wang*)
INTENT - Interaction TENDency towards Targets
- 2021 Emily Cheng, MEng, MIT (*with Ignacio Cases*)
Modeling the Emergence of Symbolic Communication
- 2020 Bert Chen, Master in Computer Science, National Taiwan University
Drug-Drug Interaction Discovery using Entity-based Embeddings from BERT
- 2020 Sabrina Chen, Master in Data Science, HTW Berlin
Aspect-based Sentiment Analysis: an Unsupervised Approach to Expand Sentiment Lexicon
- 2019 Yu-Siang Wang, Master in Applied Computing, University of Toronto
Look-ahead Decoders for Maximum-likelihood Sequence Models

Undergraduate Research

- 2019 Daniel Sun, UROP, MIT
- 2019 Summer Victor Turbiner, Undergrad Intern, now at Stanford
- 2018 Summer Michael Saterson, MIT Summer Research Program, City University of New York
- 2018 Justin Yu, UROP, MIT

SERVICE & LEADERSHIP

- 10/2012 – present **Reviewer**
- Robotics: RA-L (2019-2021), ICRA (2020-2022), IROS (2019)
 - Artificial Intelligence & Machine Learning: IJCAI (2019), AAAI (2016, 2022), NeurIPS (2021), ICLR (2022)
 - Human-Computer Interaction: IUI (2013, 2019), CHI (2021), C&C (2021), Frontiers Social Physics (2021)
- 09/2021 – present **Student Representative**, *MIT CSAIL Postdoc and Graduate Student Council*
- 09/2018 – 06/2021 **Organizer**, *MIT Discussion Group on Language and Computation*
- 06/2018 – 08/2018 **Mentor**, *MIT Summer Research Program for Brain and Cognitive Science*
- 2018 **Mentor**, *MIT Undergraduate Women in EECS Buddy Program*
- 10/2015 **Participant & Google Interviewer**, *Grace Hopper Celebration of Women in Computing*
- 01/2013 – 09/2016 **Tech Intern Mentor & Interviewer**, *Google Inc.*
- Weekly career discussion with mentees; hosted 1 PhD and 6 undergraduate interns.
 - Conducted 80+ technical interviews to hire qualified engineers.
- 07/2007 – 07/2008 **President**, *AIESEC (International Association of Students in Economics and Management, <http://aiesec.org>) National Taiwan University Local Committee*
- Initiated an overseas internship program based on social issues for NTU students.
 - Organized a leadership development conference for 14 universities in Taiwan in 2008.
 - Led more than 100 members to win the 2007-2008 Best Local Committee Award.

SELECTED PRESS

- 2021 **Giving robots social skills.** *MIT News*
<https://news.mit.edu/2021/robots-social-skills-1105>
- 2020 **A robotic planner that responds to natural language commands.** *Tech Xplore*
<https://techxplore.com/news/2020-03-robotic-planner-natural-language.html>
- 2019 **Combining artificial intelligence with their passions – Robots that understand language.** *MIT News*
<https://cbmm.mit.edu/news-events/news/combining-artificial-intelligence-their-passions-mit-news>
- 2018 **Model helps robots navigate more like humans do.** *MIT News*
<https://news.mit.edu/2018/model-helps-robots-navigate-like-humans-1004>