

Toby Jia-Jun Li

Curriculum Vitae

Department of Computer Science and Engineering
College of Engineering
University of Notre Dame
Notre Dame, IN 46556 USA

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Research Interests

Human-Computer Interaction (HCI), Human-AI Interaction, End-User Development, Programming by Demonstration, Multi-Modal Interface, Interactive Task Learning, Natural Language Programming, Instructable Agents, Developer Tools.

Professional Experience

Assistant Professor

2021–Present

University of Notre Dame, *Notre Dame, IN*
Department of Computer Science and Engineering

Education

Ph.D. in Human-Computer Interaction

2015–2021

Carnegie Mellon University, *Pittsburgh, PA*
Human Computer Interaction Institute, School of Computer Science
Advisor: Brad A. Myers
Committee: Tom M. Mitchell, Jeffery P. Bigham, John Zimmerman, and Philip J. Guo

B.S. with Distinction in Computer Science

2012–2015

University of Minnesota, *Minneapolis, MN*
Department of Computer Science and Engineering
Advisor: Brent J. Hecht

Selected Honors and Awards

CHI 2021 Best Paper Honorable Mention Award [C.14]	2021
UIST 2020 Best Paper Award [C.13]	2020
Yahoo! InMind Fellowship (<i>Full support for 4 years</i>)	2016–2019
NSF Travel Award for ACM IUI 2019 (\$450)	2019
NSF Travel Award for ACM MobiSys 2018 (\$1,500)	2018
Rethinking Interaction CHI 2018 Workshop Travel Award (\$1,000)	2018
IS-EUD 2017 Best Paper Award [C.6]	2017
CHI 2017 Best Paper Honorable Mention Award [C.5]	2017
VL/HCC 2017 Doctoral Consortium Grant (\$1,200)	2017
2016 Bosch Internet of Things Hackathon – 1st place (\$1,000)	2016
University of Minnesota Gold Global Excellence Scholarship (\$33,680 over 4 years)	2012–2015

UROP Undergraduate Research Opportunity Program Award (\$1,400)	2013–2014
NSF Travel Award for ACM SIGSPATIAL 2014 (\$720)	2014
ESRI Scholarship (\$2,000)	2014
University of Minnesota Cultural Corps Award (\$150)	2014
University of Minnesota College of Science and Engineering: Dean's List	2012–2015
ACM/ICPC International Collegiate Programming Contest Word Final Qualifier	2013

Major Peer-Reviewed Conference and Journal Papers

(Underlines indicate students I supervised)

- [C.14]  **Screen2Vec: Semantic Embedding of GUI Screens and GUI Components**
Toby Jia-Jun Li, Lindsay Popowski, Tom M. Mitchell, and Brad A. Myers
Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI 2021)
Best Paper Honorable Mention Award
- [C.13]  **Multi-Modal Repairs of Conversational Breakdowns in Task-Oriented Dialogs**
Toby Jia-Jun Li, Jingya Chen, Haijun Xia, Tom M. Mitchell, and Brad A. Myers
Proceedings of the ACM Symposium on User Interface Software and Technology (UIST 2020)
Best Paper Award
- [C.12] **Geno: A Developer Tool for Authoring Multimodal Interaction on Existing Web Applications**
Ritam Sarmah, Yunpeng Ding, Di Wang, Cheuk Yin Phipson Lee, **Toby Jia-Jun Li**, and Xiang ‘Anthony’ Chen
Proceedings of the ACM Symposium on User Interface Software and Technology (UIST 2020)
- [C.11] **Interactive Task Learning from GUI-Grounded Natural Language Instructions and Demonstrations**
Toby Jia-Jun Li, Tom M. Mitchell, and Brad A. Myers
Proceedings of the Annual Meeting of the Association for Computational Linguistics (ACL 2020): System Demonstrations
- [C.10] **Privacy-Preserving Script Sharing in GUI-based Programming-by-Demonstration Systems**
Toby Jia-Jun Li, Jingya Chen, Brandon Canfield, and Brad A. Myers
Proceedings of the ACM on Human-Computer Interaction (CSCW 2020)
- [C.9] **PUMICE: A Multi-Modal Agent that Learns Concepts and Conditionals from Natural Language and Demonstrations**
Toby Jia-Jun Li, Marissa Radensky, Justin Jia, Kirielle Singarajah, Tom M. Mitchell, and Brad A. Myers
Proceedings of the ACM Symposium on User Interface Software and Technology (UIST 2019)
- [C.8] **A Multi-Modal Interface for Specifying Data Descriptions in Programming by Demonstration Using Verbal Instructions**
Toby Jia-Jun Li, Igor Labutov, Xiaohan Nancy Li, Xiaoyi Zhang, Wenze Shi, Wanling Ding, Tom M. Mitchell, and Brad A. Myers
Proceedings of the IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC 2018)
- [C.7] **KITE: Building conversational bots from mobile apps**
Toby Jia-Jun Li and Oriana Riva
Proceedings of the the ACM Conference on Mobile Systems, Applications, and Services (MobiSys 2018)
- [C.6]  **Programming IoT Devices by Demonstration Using Mobile Apps**
Toby Jia-Jun Li, Yuanchun Li, Fanglin Chen, and Brad A. Myers
International Symposium on End User Development (IS-EUD 2017). LNCS, vol. 10303
Best Paper Award

- [C.5] **SUGILITE: Creating Multimodal Smartphone Automation by Demonstration**
 **Toby Jia-Jun Li**, Amos Azaria, and Brad A. Myers
Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI 2017)
Best Paper Honorable Mention Award
- [C.4] **PrivacyStreams: Enabling Transparency in Personal Data Processing for Mobile Apps**
 Yuanchun Li, Fanglin Chen, **Toby Jia-jun Li**, Yao Guo, Gang Huang, Matthew Fredrikson, Yuvraj Agarwal, and Jason I. Hong
Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (PACM IMWUT / UbiComp 2017)
- [C.3] **Not at Home on the Range: Peer Production and the Urban/Rural Divide**
 Isaac Johnson, Yilun Lin, **Toby Jia-Jun Li**, Andrew Hall, Aaron Halfaker, Johannes Schöning, and Brent Hecht
Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI 2016)
- [C.2] **Leveraging Advances in Natural Language Processing to Better Understand Tobler's First Law of Geography**
Toby Jia-Jun Li, Shilad Sen, and Brent Hecht
Proceedings of the ACM Conference on Advances in Geographic Information Systems (SIGSPATIAL 2014)
- [C.1] **WikiBrain: Democratizing Computation on Wikipedia**
 Shilad Sen, **Toby Jia-Jun Li**, WikiBrain Team, and Brent Hecht
Proceedings of the International Symposium on Open Collaboration (OpenSym / WikiSym 2014)

Minor Lightly-Reviewed Posters, Extended Abstracts and Workshop Papers

- [W.9] **Building an Interactive Storytelling Conversational Agent through Parent-AI Collaboration**
Zheng Zhang, Ying Xu, Yanhao Wang, Bingsheng Yao, Daniel Ritchie, Tongshuang Wu, Mo Yu, Dakuo Wang, and **Toby Jia-Jun Li**
CSCW 2021 Workshop on Inclusive and Collaborative Child-facing Voice Technologies (CUI@CSCW)
- [W.8] **Towards Effective Human-AI Collaboration in GUI-Based Interactive Task Learning Agents**
Toby Jia-Jun Li, Jingya Chen, Tom M. Mitchell, and Brad A. Myers
CHI 2020 Workshop on Artificial Intelligence for HCI: A Modern Approach (AI4HCI)
- [W.7] **Interactive Task and Concept Learning from Natural Language Instructions and GUI Demonstrations**
Toby Jia-Jun Li, Marissa Radensky, Justin Jia, Kirielle Singarajah, Tom M. Mitchell, and Brad A. Myers
AAAI 2020 Workshop on Intelligent Process Automation (IPA-20)
- [W.6] **A Multi-Modal Approach to Concept Learning in Task Oriented Conversational Agents**
Toby Jia-Jun Li, Marissa Radensky, Tom M. Mitchell, and Brad A. Myers
CHI 2019 Workshop on Conversational Agents: Acting on the Wave of Research and Development
- [W.5] **How End Users Express Conditionals in Programming by Demonstration for Mobile Apps**
Marissa Radensky, **Toby Jia-Jun Li**, and Brad A. Myers
IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC 2018) Poster Track
- [W.4] **Supporting Co-Adaptive Human-Agent Relationship through Programming by Demonstration using Existing GUIs**
Toby Jia-Jun Li, Igor Labutov, Xiaohan Nancy Li, Tom M. Mitchell, and Brad A. Myers
CHI 2018 Workshop on Rethinking Interaction

- [W.3] **End User Mobile Task Automation using Multimodal Programming by Demonstration**
Toby Jia-Jun Li
IEEE Symposium on Visual Languages and Human-Centric Computing (VL/HCC 2017) Graduate Consortium
- [W.2] **Designing a Conversational Interface for a Multimodal Smartphone Programming by Demonstration Agent**
Toby Jia-Jun Li, Brad A. Myers, Amos Azaria, Igor Labutov, Alexander Rudnicky, and Tom M. Mitchell
CHI 2017 Workshop on Conversational UX Design
- [W.1] **Smartphone Text Entry in Cross-Application Tasks**
Toby Jia-Jun Li and Brad A. Myers
CHI 2016 Workshop on Inviscid Text Entry and Beyond

Book Sections

- [B.3] **Demonstration + Natural Language: Multimodal Interfaces for GUI-based Interactive Task Learning Agents**
Toby Jia-Jun Li, Tom M. Mitchell, and Brad A. Myers
 Chapter of *Artificial Intelligence for Human Computer Interaction: A Modern Approach*. Springer. *To appear*.
- [B.2] **Teaching Agents When They Fail: End User Development in Goal-Oriented Conversational Agents**
Toby Jia-Jun Li, Igor Labutov, Brad A. Myers, Amos Azaria, Alexander Rudnicky, and Tom M. Mitchell
 Chapter of *Studies in Conversational UX Design*. Springer. 2018.
- [B.1] **Making End User Development More Natural**
 Brad A. Myers, Amy Ko, Chris Scaffidi, Stephen Oney, YoungSeok Yoon, Kerry Chang, Mary Beth Kery, and **Toby Jia-Jun Li**
 Chapter of *New Perspectives in End-User Development*. Springer. 2017.

Patents

- [P.1] **Automatically generating conversational services from a computing application**
 Oriana Riva, Jason Kace, Doug Burger, and **Toby Jia-Jun Li**
 U.S. Patent 10,705,892. Granted July 7, 2020; Filed June 7, 2018.

Research Grants

Google Cloud Research Credit Grant: Procedure Generalization in Interactive Task Learning

PI: Toby Jia-Jun Li

\$5,000 in credits (2021)

Google Cloud Research Credit Grant: Screen2Vec: A New Method for Embedding GUI Screens in Vector Spaces

PI: Toby Jia-Jun Li

\$1,000 in credits (2020)

Google Cloud Research Credit Grant: SUGILITE: A Multi-Modal Agent that Learns Tasks from Natural Language and Demonstrations

PI: Toby Jia-Jun Li

\$2,000 in credits (2019-2020)

Yahoo InMind Fellowship: Automating Repetitive and Cross-App Tasks

Recipient: Toby Jia-Jun Li

\$400,000 (2016-2019)

- This grant was directly based on my research in [C.5-6] on automating repetitive and cross-app tasks through programming by demonstration. I helped write the proposal, prepared progress reports, and gave invited talks at Yahoo!.

Relevant Research Experience

Engineering Implementation Consultant

Aug. 2017–Dec. 2017

Research Intern

May. 2017–Aug. 2017

Microsoft Research, Redmond, WA

Mentor: Dr. Oriana Riva

- Designed, developed, and studied a new conversational bot development tool using deep neural network, user task modeling, and mobile app analysis. My work was published [C.7] and patented [P.1].

Research Assistant

Jan. 2013–Aug. 2015

GroupLens Research, University of Minnesota

- Led the development and field deployment of ATLASIFY – a novel interactive spatial visualization and exploratory search system used by over 10,000 unique users [T.2] [T.3].
- Developed major parts of WIKIBRAIN – a popular open-source software framework for knowledge extraction and computation on Wikipedia [C.1] [T.1].
- Designed and conducted spatial and natural language analysis on Wikipedia data for evaluating Tobler's First Law of Geography and measuring the urban/rural bias in Wikipedia [C.2] [C.3].

Teaching Experience

Instructor, CSE 60427: Human-Centered Computing Research

Fall 2021

Department of Computer Science and Engineering, University of Notre Dame

Guest Lecturer, 05-830: Advanced User Interface Software

Fall 2020

Human-Computer Interaction Institute, Carnegie Mellon University

Teaching Assistant, 05-391 / 05-891: Designing Human-Centered Software

Spring 2019

Human-Computer Interaction Institute, Carnegie Mellon University

Teaching Assistant, 05-410 / 05-610: User-Centered Research & Evaluation

Fall 2018

Human-Computer Interaction Institute, Carnegie Mellon University

Teaching Staff, CSCI 5715: From GPS and Google Maps to Spatial Computing

Fall 2014

Coursera MOOC & Dept. of Computer Science and Engineering, Univ. of Minnesota

Teaching Assistant, CSCI 2011: Discrete Structures of Computer Science

Fall 2013, Spring 2014

Department of Computer Science and Engineering, University of Minnesota

Students Advised at Notre Dame

Doctoral Advisees

Yuwen Lu (Ph.D. in Computer Science and Engineering)

2021–Present

Zheng Ning (Ph.D. in Computer Science and Engineering)

2021–Present

Simret Araya (Ph.D. in Computer Science and Engineering)

2021–Present

Undergraduate Advisees

Victor Cox (B.S. in Computer Science)

2021–Present

Students Mentored Prior to Notre Dame

Tiffany Cai (CMU, now at Google X) - <i>Worked on a new mobile keyboard for recording text entries in demonstration.</i>	Spring 2017
Jeremy Wei (CMU, now at Flatiron Health) - <i>Worked on identifying crucial actions in demonstrated scripts.</i>	Spring 2017
Xiaohan Nancy Li (CMU, now at Microsoft) - <i>Worked on representing and querying snapshots of mobile GUIs. [C.8][W.4]</i>	Fall 2017
Wenze Shi (CMU, now at Facebook) - <i>Worked on extracting semantic entities from mobile GUIs. [C.8]</i>	Spring 2018
Wanling Ding (CMU, now at Shopee) - <i>Worked on generating user friendly representations for demonstrated scripts. [C.8]</i>	Spring 2018
Marissa Radensky (Amherst College, REU at CMU, now Ph.D. student at UW) - <i>Worked on supporting conditionals in programming by demonstration. [W.5][W.6][C.9]</i>	Summer 2018
Justin Jia (CMU) - <i>Worked on semantic parsing for concept instructions. [C.9]</i>	Spring 2019
Kirielle Singarajah (CMU) - <i>Worked on semantic parsing for concept instructions. [C.9]</i>	Spring 2019
Brandon Canfield (Yale University, REU at CMU) - <i>Worked on enabling privacy-preserving sharing of end user developed scripts. [C.10]</i>	Summer 2019
William Timkey (Cornell University, REU at CMU, now at Univ. of Cambridge) - <i>Worked crowd-sourced data collection for semantic parsers.</i>	Summer 2019
Jingya Chen (CMU, first position at MIT, now at Microsoft Research) - <i>Worked on multi-modal error handling for speech interfaces. [W.8][C.10][C.13]</i>	Summer 2019–2020
Lindsay Popowski (Harvey Mudd, REU at CMU, now Ph.D. student at Stanford) - <i>Worked on the semantic embedding of GUI screens and components. [C.14]</i>	Summer 2020
 CRA 2021 Outstanding Undergraduate Researcher Award	
Vanessa Hu (Harvard University, REU intern at CMU) - <i>Worked on the fuzzy lexicon matching and time expression parsing in semantic parsers.</i>	Summer 2020

Selected Talks, Seminars, and Invited Demos

- [T.8] **Screen2Vec: Semantic Embedding of GUI Screens and What They are Useful for**
 Invited Talk at HCI Group, Stanford University
 Host: Michael Bernstein
 Virtual Visit, Feb. 22, 2021

- [T.7] **Interactive Systems for Configuring, Extending, and Developing AI Applications**
Invited Talk at Apple Research
Host: Jeff Nichols
Virtual Visit, Mar. 8, 2021
- Invited Talk at HCI Lab, Hasso Plattner Institut
Host: Patrick Baudisch
Virtual Visit, Mar. 4, 2021
- Invited Talk at Sigma Research Seminar Series
Host: Çağatay Demiralp
Virtual Visit, Feb. 24, 2021
- Invited Talk at Microsoft Research Montréal
Host: Adam Trischler
Virtual Visit, Jan. 11, 2021
- Invited Talk at Google People + AI Research (PAIR) Seminar
Host: Carrie Cai
Virtual Visit, Oct. 13, 2020
- Invited Talk at IBM Research Cambridge
Host: Casey Dugan
Virtual Visit, Aug. 12, 2020
- [T.6] **Interactive Task Learning from GUI-Grounded Natural Language Instructions and Demonstrations**
Invited Talk at *the AAAI-20 Workshop on Intelligent Process Automation (IPA-20)*
New York, NY. Feb. 7, 2020
- [T.5] **Machine Learning from Human Instruction: Every Person a Programmer**
Invited Talk at J.P. Morgan (*with Forough Arabshahi*)
Host: Sumitra Ganesh and Denis Kochedykov
New York, NY. May 24, 2019
- [T.4] **Teaching Intelligent Agents New Tricks: Natural Language Instructions plus Programming-by-Demonstration for Teaching Tasks**
Invited Talk at *Human Computer Interaction Consortium (HCIC '18)* (*with Brad Myers*)
Watsonville, CA. Jun. 25, 2018
- [T.3] **SUGILITE: A Multi-Modal Agent that Learns Tasks from Natural Language and Demonstrations**
Invited Demo at *the ACL 2020 Workshop on Natural Language Interfaces*
Seattle, WA. July 10, 2020
- Invited Demo at *the ACM SIGACCESS Conference on Computers and Accessibility (ASSETS 2019)*
Pittsburgh, PA. Oct. 28, 2019
- Invited Lightning Talk at CMU HCII 25th Anniversary
Pittsburgh, PA. Oct. 25, 2019
- Invited Talk at Oath (formerly Yahoo!)
Sunnyvale, CA. May 30, 2018

- [T.2] **Atlasify – The Geography of Everything**
 Invited Demo at *the 3M Science and Engineering Symposium*
 St Paul, MN. Jun. 25, 2015
- Invited Demo at *the Social Media and Business Analytics Collaborative (SOBACO) Research Symposium*
 Minneapolis, MN. May 14, 2015
- [T.1] **WikiBrain: Making Computer Programs Smarter with Knowledge from Wikipedia**
 Invited Demo at *the Social Media and Business Analytics Collaborative (SOBACO) Research Symposium*
 Minneapolis, MN. May 6, 2014.

Professional Service

Academic Service

Organizing Committee

ACM UIST 2021 Web and Design Chair

Associate Chair (AC) of Program Committee

ACM CHI 2022

ACM UIST 2021

ACM CHI 2020 Late Breaking Work Track

ACM CHI 2019 Late Breaking Work Track

Member of Program Committee

EMNLP 2021

KDD 2021 Workshop on Data Science with Human in the Loop (DaSH 2021)

ACL 2021 Workshop on NLP for Programming (NLP4Prog)

AAAI 2020 Workshop on Intelligent Process Automation (IPA 20)

Session Chair

ACM CHI 2019 Session on Conversational Interactions

Conference Reviewer

ACM CHI (2017-2022), **ACM UIST** (2017-2020), **ACM CSCW** (2018-2022), **ACL** (2021), **ACM DIS** (2018-2021), **ACM MobileHCI** (2018-2020), **ACM TEI** (2018), **ACM SIGCSE** (2018), **ACM CHI PLAY** (2019)



Received “special recognitions” for outstanding reviews for ACM UIST 2017, ACM CHI 2018, ACM DIS 2020, ACM CHI 2021 (twice), and ACM CSCW 2022.

Journal Reviewer

ACM IMWUT (2017-2020), **IEEE TMC** (2018), **IEEE TSC** (2020), **IEEE Pervasive** (2018-2019), **IJGIS** (2017), **IEEE Access** (2019-2020)

Departmental and Community Service

Faculty Leader, Notre Dame’s Participation in TAPIA Conference of Diversity in Computing (2021)

Member, Notre Dame CSE Ph.D. Admissions Committee (2021-2022)

Member, CMU HCII Anti-Racism Work Group (2020-2021)

Coordinator, CMU HCII Open House Faculty Research Talks (2020-2021)

Committee Member, CMU HCII Faculty Lunch Organization Committee (2019-2020)

Committee Member, CMU HCII Ph.D. Student Lounge Committee (2019-2020)

Committee Member, CMU HCII Ph.D. Admissions Committee (2018-2019)

Student Volunteer, ACM IUI 2019, ACM SIGSPATIAL 2014

Languages

English – Native or bilingual proficiency, **Chinese (Mandarin)** – Native or bilingual proficiency

Technical Skills

Programming Languages: C/C++, Java, Python, Android, JavaScript, SQL, HTML and others

UX Skills: Qualitative Research, Quantitative Research, Experiment Design, Data Analysis, UX Design

Keywords: Machine Learning, Deep Learning, Natural Language Processing, Dialog Systems, Conversational UX