Toby Jia-Jun Li

Curriculum Vitae

Human-Computer Interaction Institute
School of Computer Science
Carnegie Mellon University
5000 Forbes Avenue
Pittsburgh, PA 15213 USA

Email: tobyli@cs.cmu.edu
Office: Newell-Simon Hall 2620C
Website: http://toby.li/
Tel: (612) 756-8886
Twitter: @TobyJLi

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.

Education

Ph.D. in Human-Computer Interaction **2015–Present**
Carnegie Mellon University, *Pittsburgh, PA* (Expected Fall 2020)
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

Major Peer-Reviewed Conference and Journal Papers

[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.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
The AAAI-20 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.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

[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

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.

Invited Talks and Presentations

[T.10] **SUGILITE: A Multi-Modal Agent that Learns Tasks from Natural Language and Demonstrations**
Presentation at *the ACL 2020 Workshop on Natural Language Interfaces*
Seattle, WA. July 10, 2020

[T.9] **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.8] **SUGILITE: A Multi-Modal Agent that Learns Tasks from Natural Language and Demonstrations**
Demonstration at *the 21st International ACM SIGACCESS Conference on Computers and Accessibility (ASSETS 2019)*
Pittsburgh, PA. Oct. 28, 2019

[T.7] **SUGILITE: A Multi-Modal Agent that Learns Tasks from Natural Language and Demonstrations**
Invited Lightning Talk at CMU HCII 25th Anniversary
Pittsburgh, PA. Oct. 25, 2019

[T.6] **Machine Learning from Human Instruction: Every Person a Programmer**
Invited Talk at J.P. Morgan (*with Forough Arabshahi*)
New York, NY. May 24, 2019

[T.5] **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.4] **SUGILITE: Enabling InMind Agent to Learn New Tasks from User Demonstration**
Invited Talk at Oath (formerly Yahoo!)
Sunnyvale, CA. May 30, 2018

[T.3] **Atlasify – The Geography of Everything**
Invited Demo at *3M Science and Engineering Symposium*
St Paul, MN. Jun 25, 2015

[T.2] **Atlasify – The Geography of Everything**
Invited Demo at *the Social Media and Business Analytics Collaborative (SOBACO) Spring 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) Spring Research Symposium*
Minneapolis, MN. May 6, 2014.

Relevant Research Grants

JP Morgan Research Award: Machine Learning from Human Instruction: Every Person a Programmer
PI: Tom M. Mitchell, Co-PI: Brad A. Myers
$149,207 (2019-2020)

- This grant was directly based on my research in [C.9] on combining natural language task instructions with GUI-grounded demonstrations. I helped write the proposal, prepared the progress reports, and gave invited talks at JP Morgan.

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)

- This grant funded the computational resources used the development of a new method for creating distributed representations of GUI screens and GUI components.

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)

- This grant funded the infrastructure and computational resources used for the development and the field deployment of our SUGILITE system.

NSF IIS-1814472: CHS: Small: Multimodal Conversational Assistant that Learns from Demonstrations
PI: Brad A. Myers and Tom M. Mitchell
$499,019 (2018-2021)

- This grant was directly based on my research in [C.5-11] on enabling conversational assistants to learn from demonstrations. I helped write the proposal and prepared the progress reports.

Yahoo InMind Award: Automating Repetitive and Cross-App Tasks
PI: Brad A. Myers, Co-I: 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!.

Selected Honors and Awards

UIST 2020 Best Paper Award	2020
Yahoo! InMind Fellowship *(Full support for 4 years*)	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	2017
CHI 2017 Best Paper Honorable Mention Award	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

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

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 Mentored

Tiffany Cai (CMU) **Spring 2017**
- Worked on a new mobile keyboard for recording text entries in demonstration.

Jeremy Wei (CMU) **Spring 2017**
- Worked on identifying crucial actions in demonstrated scripts.

Xiaohan Nancy Li (CMU, now at Microsoft) **Fall 2017**
- Worked on representing and querying snapshots of mobile GUIs. [C.8][W.4]

Wenze Shi (CMU) **Spring 2018**
- Worked on extracting semantic entities from mobile GUIs. [C.8]

Wanling Ding (CMU) **Spring 2018**
- Worked on generating user friendly representations for demonstrated scripts. [C.8]

Marissa Radensky (Amherst College, REU intern at CMU, now Ph.D. student at UW) **Summer 2018**

- Worked on supporting conditionals in programming by demonstration. [W.5][W.6][C.9]

Justin Jia (CMU) **Spring 2019**
- Worked on semantic parsing for concept instructions. [C.9]

Kirielle Singarajah (CMU) **Spring 2019**
- Worked on semantic parsing for concept instructions. [C.9]

Brandon Canfield (Yale University, REU intern at CMU) **Summer 2019**
- Worked on enabling privacy-preserving sharing of end user developed scripts. [C.10]

William Timkey (Cornell University, REU intern at CMU, now at Univ. of Cambridge) **Summer 2019**
- Worked crowd-sourced data collection for semantic parsers.

Jingya Chen (CMU) **Summer 2019–2020**
- Worked on multi-modal error handling for speech interfaces. [W.8][C.10][C.13]

Lindsay Popowski (Harvey Mudd College, REU intern at CMU) **Summer 2020**
- Worked on the semantic embedding of GUI screens and components.

Vanessa Hu (Harvard University, REU intern at CMU) **Summer 2020**
- Worked on the fuzzy lexicon matching and time expression parsing in semantic parsers.

Professional Service

Academic Service

Associate Chair, ACM CHI 2020 Late Breaking Work Track
Program Committee, AAAI-20 Workshop on Intelligent Process Automation (IPA 20)
Associate Chair, ACM CHI 2019 Late Breaking Work Track
Session Chair, ACM CHI 2019 Session on *Conversational Interactions*

Paper Reviewing

Conferences: **ACM CHI** (2017-2020), **ACM UIST** (2017-2020), **ACM CSCW** (2018-2020), **ACM DIS** (2018-2020), **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, and ACM DIS 2020.

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

Departmental and Community Service

Member, CMU SCS Anti-Racism Work Group (2020)
Coordinator, CMU HCII Open House Faculty Research Talks (2020)
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, Scheme, 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