Benjamin Kane

585-748-7994 | bkane2@ur.rochester.edu | https://cs.rochester.edu/u/bkane2

EDUCATION

University of Rochester Rochester, NY
PhD Student in Computer Science **June 2019 – Present**
- Advisor: Lenhart Schubert
- Co-Advisor: Ehsan Hoque, Aaron Steven White

University of Rochester Rochester, NY
BSc (Highest Distinction) in Computer Science, BA (Distinction) in Economics **Aug 2015 – May 2019**
- Honors: *magna cum laude*, Dean's List (GPA: 3.92/4.00)
- Education Abroad: *University of Bristol* Jan 2018 – Jun 2018

RESEARCH EXPERIENCE

Department of Computer Science, University of Rochester Rochester, NY
Graduate Research Assistant **June 2019 – Present**
- **SOPHIE (end-of-life communication dialogue system):**
  - Creation of a dialogue system and virtual human capable of acting as a cancer patient in simulated patient-physician conversations.
  - Exploration of both symbolic and neural approaches for
  - Developed in conjunction with collaborators in the ROC HCI lab and the UR Medical Center (URMC), with the goal of helping doctors to improve communication in end-of-life dialogue scenarios.
- **Blocks World dialogue system:**
  - Creation of a dialogue system capable of holding a spatial question-answering dialogue with a human about physical blocks which can be freely arranged on a table.
  - Designed a semantic parser capable of processing a wide range of spatial questions into unscoped logical form (ULF) representations using hierarchical pattern transduction trees.
  - Improved dialogue context and episodic memory in dialogue system to enable the system to answer questions about historical actions and relations.
- **Belief, Desire, Intention, and Fine-Grained Inference:**
  - Collection of lexical-scale human annotations targeting the belief, desire, and intension inferences licensed by different English verbs. Empirical analysis of the relations between these lexical semantic properties and the syntactic distributions of these verbs.
  - Creation of mixed-effects models that can be used with statistical NLI systems to model annotator differences.

Openstream AI Franklin, NJ
Summer Research Intern (Virtual) **May 2022 – September 2022**
- Created an intuitive graphical interface based on Business Process Modeling Notation (BPMN) that allows domain experts to design dialogue flows for task-oriented chatbots in a 'low-code or no-code' environment.
- Developed a tool for parsing graphical BPMN representations into a hierarchical planning definition language that allows a plan-based dialogue manager to solve the developer-defined task through interaction with a user.
- Conducted extensive literature review on hierarchical planning and Belief-Desire-Intention (BDI) dialogue systems, and proposed a method for enriching a BDI dialogue system with domain-specific hierarchical planning capabilities.

Content Understanding Branch, Army Research Lab (ARL) Adelphi, MD
Summer Research Intern (Virtual) **May 2021 – August 2021**
- Enabled a situated robot to learn novel concepts in unexplored environments through interactive back-and-forth dialogue with a human operator, by extending DIARC cognitive robotic architecture with a decision network model for adaptive question generation. Resulted in a paper presented at SIGDIAL 2022.
- Created robot actions and natural language capabilities necessary to support robot learning in a novel spacecraft domain.
- Worked with Unity3D to connect cognitive robotic architecture to PR2 robot situated in the simulated spacecraft domain.
- Presented work to ARL branch as well as panel of ARL researchers from multiple directorates.

Department of Computer Science, University of Rochester Rochester, NY
Undergraduate Research Assistant **May 2017 – May 2019**

- Assisted in development of LISSA Virtual Human, a schema-based dialogue agent used in studies on improving social interaction. Created Lisp code to extract context-independent "gist clauses" from user speech recognizer output, using feature-based pattern matching and transduction trees.
- Worked on training a turn-taking model for LISSA dialogues using various prosodic and linguistic features from annotated Wizard-of-Oz transcripts, using a mixture-of-experts classifier.
- Annotated varied database of sentences with unscoped logical form (ULF) representations.
- Created Lisp code to generate natural inferences from the ULF-coded sentences for various implicative and factive verbs.

PUBLICATIONS & PRESENTATIONS

Conference
- Haut K.; Wohn C.; Kane B.; Carroll T.; Guigno C.; Kumar V.; Epstein R.; Schubert L.; Hoque E. Validating a virtual human and automated feedback system for training doctor-patient communication skills. *Affective Computing and Intelligent Interaction (ACII)* (to appear), September 10-13, 2023, Boston, USA.
- Kane B.; Gervits F.; Scheutz M.; Marge M. A System For Robot Concept Learning Through Situated Dialogue. *SIGDIAL*, September 7-9, 2022, Edinburgh, UK.
- Platonov G.; Kane B.; Schubert L. K. Generating Justifications in a Spatial Question-Answering Dialogue System for a Blocks World. *Reasoning and Interaction (ReInAct 2021)*. October 4-6, 2021, Virtual.
- Kane B.*; Gantt W.*; White A. S. Intensional Gaps: Relating veridicality, factivity, doxasticity, bouleticity, and neg-raising. *Semantics and Linguistic Theory (SALT) 31*. May 7-9, 2021, Virtual.
- Gantt W.*; Kane B.*; White A. S. Natural Language Inference with Mixed Effects. *The 9th Joint Conference on Lexical and Computational Semantics (*SEM 2020)*. December 12-13, 2020, Virtual.
- Kane B.; Platonov G.; Schubert L. K. Registering Historical Context for Question Answering in a Blocks World Dialogue System. *Text, Speech, and Dialogue*, September 8-11, 2020, Virtual.
- Platonov G.; Kane B.; Gindi A.; Schubert L. K. A Spoken Dialogue System for Spatial Question Answering in a Physical Blocks World. *SIGDIAL*, July 1-3, 2020, Virtual.
- Razavi S. Z.; Kane B.; Schubert L. K. Investigating Linguistic and Semantic Features for Turn-Taking Prediction in Open-Domain Human-Computer Conversation. *Interspeech*, September 15-19, 2019, Graz, Austria.

Journal
- Rafayet Ali M.; Sen T.; Kane B.; Bose S.; Carroll T. M.; Epstein R.; Schubert L.; Hoque E. Novel Computational Linguistic Measures, Dialogue System, and the Development of SOPHIE: Standardized Online Patient for Healthcare Interaction Education. *IEEE Transactions on Affective Computing,* January 2021.

Workshop
- Kane B. Schema-Guided Dialogue Management for Virtual Conversational Agents. *Young Researchers' Roundtable on Spoken Dialog Systems (YRRSDS), at the Special Interest Group on Discourse and Dialogue (SIGDIAL)*. September 5-6, 2022, Edinburgh, UK.
- Kim G. L.; Kane B.; Duong V.; Mendiratta M.; McGuire G.; Sackstein S.; Platonov G.; Schubert L. K. Generating Discourse Inferences from Unscoped Episodic Logical Formulas. *1st Int. Workshop on Designing Meaning Representations (DMR), at the 57th Annual Meeting of the Association for Computational Linguistics (ACL 2019)*, Aug 1, 2019, Florence, Italy.
- Razavi S. Z.; Schubert L. K.; Kane B.; Rafayet Ali M.; Van Orden K. A.; Ma T. Dialogue Design and Management for Multi-Session Casual Conversation with Older Adults. *Workshop on User-Aware Conversational Agents (User2Agent), at the 24th Int. Conf. on Intelligent User Interfaces (ACM IUI 2019)*. March 17-20, 2019, Los Angeles, USA.
- Kane B.; Luo, J. Do the Communities We Choose Shape our Political Beliefs? A Study of the Politicization of Topics in Online Social Groups. *Workshop on Big Social Media Data Management and Analysis (BSMDMA), at the IEEE International Conference on Big Data.* December 10-13, 2018, Seattle, USA.

Preprint
- Kane B.; Giugno C.; Schubert L. K.; Haut K.; Wohn C.; Hoque E. A Flexible Schema-Guided Dialogue Management Framework: From Friendly Peer to Virtual Standardized Cancer Patient. *arXiv:2207.07276*
- Kane B.; Platonov G.; Schubert L. K. History-Aware Question Answering in a Blocks World Dialogue System. *arXiv:2005.12501*

* indicates equal contribution.

HONORS AND AWARDS

- Awarded by the University of Rochester to one graduate student in each engineering or natural science discipline to recognize outstanding achievement in coursework and dissertation research work.

NSF Research Traineeship **Aug 2019 – May 2021**
- Receive training and financial support for data-enabled research into human behavior and its cognitive and neural mechanisms (e.g. machine learning, data mining, statistics, cognitive modelling, computational neuroscience).

SELECTED COURSES

Computer Science: Statistical Speech & Language Processing, Sampling Algorithms, Machine Learning, Natural Language Processing, Knowledge Representation & Reasoning in AI, Machine Vision, Computational Neuroscience, Data Mining, Artificial Intelligence, Advanced Algorithms, Computer Networking, Computer Organization, Programming Language Design & Implementation, Theory of Computation, Web Technologies, Databases, Data Structures and Algorithms.
Linguistics: Lexical Semantics, Formal Semantics, Pragmatics
Economics, Physics, Mathematics: Game Theory, Behavioral Economics, Industrial Economics, Econometrics, Intermediate Microeconomics / Macroeconomics, Mechanics, Modern Physics, Statistics, Multidimensional Calculus, Linear Algebra.

ACADEMIC PROJECTS

- **Interpreting DNNs (Python):** experimented with using methods from computational neuroscience (orientation tuning curves and spike-triggered average/covariance analysis) to interpret various layers of a deep neural network (AlexNet).
- **Adversarial Visual Question Answering (Python):** investigated the robustness of state-of-the-art neural visual question answering (VQA) models to various adversarial attacks, and the impact on performance of training on adversarial data.
- **DVCS System (Haskell):** designed a detailed module specification for a distributed version control system based on Mercurial with a small team, and successfully implemented the system in Haskell.
- **Word2Vec Lisp Library (Lisp):** created a small Lisp library for learning word embeddings using a skip-gram architecture implemented natively, as well as for interfacing with Python Word2Vec libraries, to help with KRR in Lisp.
- **POS Tagger & Parser (Python):** implemented a part-of-speech tagger and a statistical parser from scratch using Hidden Markov Model (HMM) decoding and CYK decoding, respectively. Used perceptron algorithm to train both using data from Penn Treebank.
- **Planning Agent (Lisp):** created a simple planning agent for standard "blocks world" domain. Given a (virtual) table with blocks and a description of a goal structure, the agent stacks blocks on table to achieve the structure at the lowest cost.

TEACHING EXPERIENCE

Department of Physics, University of Rochester Rochester, NY
Undergraduate Teaching Intern for Physics Mechanics **Aug 2016 – Dec 2016**
- Led weekly workshop in Classical Mechanics, teaching important physics concepts and essential problem-solving skills to group of 14 students. Provided feedback on homework assignments and held weekly office hours.

Undergraduate Teaching Assistant for Knowledge Representation & Reasoning in AI **Aug 2018 – Dec 2018**
- Supported students with complex topics in upper-level knowledge representation course, graded written homework assignments and Lisp programming assignments.

Undergraduate Teaching Assistant for Introduction to Artificial Intelligence **Jan 2019 – May 2019**
- Supported students in learning introductory concepts in AI. Graded exams and open-ended projects. Led workshop for unit on knowledge representation, reasoning, and inference.

Teaching Assistant for Knowledge Representation & Reasoning in AI **Aug 2019 – Dec 2019**
- Designed and lead workshops covering topics within first-order logic, formal semantics and proof theory. Held biweekly office hours. Graded written homework assignments and Lisp programming assignments.

Teaching Assistant for Natural Language Processing **Jan 2020 – May 2020**
- Designed and graded exam questions and created programming assignments related to various topics in natural language understanding. Held weekly office hours.

Teaching Assistant for Knowledge Representation & Reasoning in AI **Aug 2020 – Dec 2020**
- Held virtual biweekly office hours; graded written homework assignments and Lisp programming assignments.

SKILLS AND INTERESTS

Computer Languages: Python, Common Lisp, Java, JavaScript, C#, Haskell
Web: Node.js, Heroku, PostgreSQL, HTML, CSS
Data Analysis: PyTorch, Pyro, Matplotlib, Jupyter, Numpy, Pandas, Scikit-learn
Computer Tools: LaTeX, Photoshop, Git
Natural Languages: Spanish (limited working proficiency)

Interests: Isshin-ryū karate, Brazilian Jiu Jitsu, Music (flute, synthesizers), WesterosCraft (administration team & developer)