Benjamin Kane

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EDUCATION

University of Rochester — Rochester, NY
PhD Student in Computer Science — **June 2019 – Present**
- Advisor: Lenhart Schubert
- Co-Advisor: 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)
- Robotics Club, Undergraduate Finance & Economics Council
- 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**
- **Blocks World dialogue system:** Creation of an end-to-end 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.
- **SOPHIE (end-of-life communication dialogue system):** Creation of a dialogue system and virtual human capable of acting as a cancer patient in practice doctor-patient dialogues. 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.
- **Veridicality, Negation-Raising, and Fine-Grained Inference:** Collection of lexical-scale human annotations targeting the belief & desire properties of different English verbs. Empirical analysis of the relations between these lexical semantic properties and the veridicality and negation-raising inferences that are licensed, using a neural LSTM-based NLI model with RoBERTa embeddings.

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
- 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.

Workshop
- 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.; Platonov G.; Schubert L. K. History-Aware Question Answering in a Blocks World Dialogue System. *arXiv:2005.12501*

HONORS AND AWARDS

NSF Research Traineeship **Aug 2019 – May 2020**

- 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, Machine Learning, Natural Language Processing, Knowledge Representation & Reasoning in AI, Data Mining, Artificial Intelligence, Advanced Algorithms, Computer Networking, Computer Organization, Programming Language Design & Implementation, Theory of Computation, Web Technologies, Databases & Cloud Concepts, Data Structures and Algorithms.
Linguistics: 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

- **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.
- **Machine Learning Implementation (Python):** implemented multilayer neural network backpropagation, EM algorithm for an aspect model, and a Hidden Markov Model. Analyzed performance and results of algorithms across various real-world datasets.
- **Visulinga (Node.js):** developed prototype flashcard website aimed at helping individuals learn foreign languages through forming visual-semantic connections. Videos related to a word are generated automatically through web mining.

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.

SKILLS AND INTERESTS

Computer Languages: Python, Common Lisp, Java, C, JavaScript/Node.js, SQL
Data Analysis: PyTorch, Numpy, Pandas, Scikit-learn, Matplotlib

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)