Carl N. Edwards

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Education

University of Illinois Urbana-Champaign   PhD Student in Computer Science   Fall 2020 — Present
Advisor: Professor Heng Ji
RA Experience – NSF Molecule Maker Lab Institute
- Integrating molecular and natural language information.

TA Experience – CS 125 – Introduction to Computer Science
CS 412 – Introduction to Data Mining

University of Tennessee-Knoxville   Honors Computer Science BS   Graduated May 2020
Honors Math Double Major
STEM GPA: 4.0/4.0   Overall GPA: 3.99/4.0
Summa Cum Laude   Chancellor's Honors Program
Mathematics Honors Program   Engineering Honors Program

University of Zürich: EuroScholars Research Study Abroad   Fall Semester 2018
Dynamic and Distributed Information Systems Group

Project: Linking Knowledge Graphs and Images Using Embeddings
- Crafted two linked datasets between knowledge graphs and image datasets.
- Incorporated embedding models based on InceptionNet and TransE into a joint embedding model.

Experience

PhD Candidate & Research Assistant –MMLI   University of Illinois Urbana-Champaign   Fall 2020-Present
- Researched integrating molecular and natural language information. Work enables novel downstream tasks such as cross-modal retrieval of molecules from natural language queries, generation of molecules from textual descriptions, and molecule captioning.
- Conducted research to enable the *AlphaSynthesis* platform, which allows AI-assisted synthesis planning for molecular discovery and manufacturing based on large-scale analysis of scientific literature.
- Aided in construction of large information extraction systems with a focus on new event type induction.

Research Intern–Semantic Scholar   Allen Institute for Artificial Intelligence (AI2)   Summer 2022
- Researched applications of language models and semi-parametric language models to augment drug synergy prediction and dataset design.
- Extended collaboration externally to wrap-up project for conference submission (in progress).

Robotics Institute Summer Scholar (NSF REU)–Auton Lab   Carnegie Mellon University   Summer 2019
- Detected organizations in multimodal human trafficking dataset consisting of over 40 million data points.
- Integrated multiple similarity measures using face detection, word embeddings, and regex-extracted features to detect organizations in tens of millions of escort advertisements scraped from online sources.

ORNL – DOE SULI Internship – CISR   Oak Ridge National Laboratory   Summer 2018
- Researched global optimization algorithms for subarrayed phase-only radar beam synthesis.

Undergraduate Research Assistant – MRAIL   University of Tennessee, Knoxville   Fall 2016- Spring 2018
- Performed Brownian dynamics simulations of flowing polymer solutions.
- Created visualizations from resulting data and computed solution physical properties.
- Prepared manuscript for publication in Journal of Molecular Graphics and Modelling.

ORNL – HERE Internship – CISR   Oak Ridge National Laboratory   Summer 2017

- Developed radar simulations using proprietary technology.
- Designed phased array radar beam width optimization algorithms (GA, particle swarm, simulated annealing).

Software Engineering Intern – [Nanomechanics, Inc.](#) Oak Ridge, TN.   Summer 2016
- Programmed proprietary software to interpret high speed data using C++ .
- Developed programs for Linux, Raspberry Pi, and ALSA libraries.

Relevant Coursework

- Knowledge-Driven Natural Language Generation
- Data Mining Principles
- Natural Language Processing
- Biologically-Inspired Computation
- Deep Generative and Dynamical Models

- Advanced Information Retrieval
- Text Mining: A New Paradigm
- Transfer Learning
- Reinforcement Learning
- Introduction to Pattern Recognition

Activities and Skills

- **Programming**: Proficient in C++, Matlab, Python (2.7 and 3), and Java; Experience with C, Fortran, LaTeX, HTML, and CSS. Experienced with Windows and Linux.
  - **Skills**: Representation learning (image, knowledge graph, word, document, molecule, etc), Keras, TensorFlow, PyTorch, pandas, NLP, information retrieval, information extraction, text mining, deep learning, knowledge graphs, multimodal data, computer vision, face recognition, reinforcement learning, scientific computing, statistical decision theory, Bayesian learning, cheminformatics
- **UTK Machine Learning Club:** 2017-2020, Executive Board Member
- **HackUTK**: 2016-2020, UTK cybersecurity organization, VolHacks Hackathon 2016, 2017, 2019
- **Taekwondo**: 2007-2016, martial art, black belt
- **Classical Singing**: 2015-2020
- **FIRST Robotics**: 2011-2016
  Senior year: Programming leader and team coleader; participated in playoffs at Smoky Mountain Regional
  Junior year: Co-programmer; Industrial design award, Georgia Southern Classic: 4th, Smoky Mountain: 5th

Service

- **Reviewer:** ACL-IJCNLP Demo Track 2021**,** ACL Demo Track 2022, 2023, NAACL Demo Track 2022, EACL Demo Track 2023
- **NSF Molecule Maker Laboratory Institute –** Student and Postdoc Council Educational & Outreach Activities Chair
- **Presentations to High School Students:**
  - **Summer 2019:** Presentation on "Detecting Human Trafficking Organizations" with AI4All@CMU
  - **April 2021, 2022:** Illinois CS Sail course on "Learning Word Representations"

Honor Societies
- Tau Beta Pi   • Phi Kappa Phi   • Phi Beta Kapa   • Pi Mu Epsilon

Awards
- Saburo Muroga Endowed Fellowship, UIUC (2020) – awarded to outstanding computer science graduate students
- **Goldwater Scholarship** (2019) – "the most prestigious undergraduate scholarship given in the natural sciences, engineering and mathematics" [(Wikipedia)](#) in the United States
- UTK Outstanding Computer Science Junior (2018) – awarded to a single junior in computer science based on academic merit
- Min H. Kao Scholar (2018, 2019) – roughly six students selected from EE, CS, and CE majors based on academic merit
- Schmitt Memorial Scholarship (Math) (2019)
- Thomas & Kathryn Shelton Award (2017, 2018, 2019)

- Volunteer Scholarship (2016-2020)
- UT Provost Scholarship (2016-2020)
- National Merit Scholar (2016)
- National AP Scholar (2016)
- State of Tennessee Governor's School for Computational Physics Attendee (2015)

Conference Papers

Edwards, C.*, Lai, T.*, Ros, K., Honke, G., Cho, K. & Ji, H. (2022) "Translation between Molecules and Natural Language." In *Proceedings of the 2022 Conference on Empirical Methods in Natural Language Processing* (EMNLP2022). (Oral presentation)

Edwards, C., Zhai, CX., & Ji, H. (2021). "Text2Mol: Cross-modal Molecule Retrieval with Natural Language Queries." In *Proceedings of the 2021 Conference on Empirical Methods in Natural Language Processing* (EMNLP2021).

Ros, K.*, Edwards, C.*, Ji, H., & Zhai, C. (2021). "Team Skeletor at Touché 2021: Argument Retrieval and Visualization for Controversial Questions." *CEUR Workshop Proceedings*. Vol. 2936. CEUR-WS, 2021.[1]
[1]Ranked 2nd/22 teams for retrieval quality.

Du, X., […], Edwards, C., […] & Ji, H. (2022). Resin-11: Schema-guided event prediction for 11 newsworthy scenarios. In *Proceedings of the 2022 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies: System Demonstrations* (pp. 54-63).

Preprints

Edwards, C., and Ji, H. "Semi-supervised New Event Type Induction and Description via Contrastive Loss-Enforced Batch Attention." arXiv preprint *arXiv:2202.05943* (2022).

Journal Articles

In-plane and out-of-plane rotational motion of individual chain molecules in steady shear flow of polymer melts and solutions, C.N. Edwards, M.H. Nafar Sefiddashti, B.J. Edwards, and B. Khomami, *J. Mol. Graph. Model.*, *81*, 184-196 (2018).

Using Similarity Measures to Detect Organizations in Online Escort Advertisements, C. Edwards, A. Wertz, and A. Dubrawski, *Robotics Institute Summer Scholar' Working Papers Journal*, 7, 43-49 (2019).

Presentations

Out-of-plane rotational motion in shear flow of polymer melts and solutions, M.H. Nafar Sefiddashti, C.N. Edwards, B.J. Edwards, and B. Khomami, The Society of Rheology 89th Annual Meeting, Denver, CO, October 8-12, 2017.

Posters

Edwards C.N., Zhai CX., and Ji H., Text2Mol: Cross-modal Molecular Retrieval with Natural Language Queries. Poster presented at: Molecule Maker Lab Institute Retreat 2021; 2021 August 2; Champaign-Urbana, IL

Edwards C.N., Wertz A., Dubrawski A.W., Using Similarity Measures to Detect Organizations in Online Escort Advertisements. Poster presented at: RISS 2019 Poster Session; 2019 August 14; Pittsburgh, PA.

Edwards C.N., Daniel B., Beam Broadening of Subarrayed Radar Arrays Utilizing Various Global Optimization Techniques. Poster presented at: ORNL 2018 Undergraduate Research Poster Session; 2018 August 1; Oak Ridge, TN

Other

Daniel, Barry, Carl Edwards, and Adam Anderson. "Phase-Only Beam Broadening of Contiguous Uniform Subarrayed Arrays Utilizing Three Metaheuristic Global Optimization Techniques." *arXiv preprint arXiv:2009.06123 (2020).*

* indicates equal contribution