

## EDUCATION

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- **Rensselaer Polytechnic Institute (RPI)** Troy, NY  
*Ph.D. in Computer Science - Advised by Deborah L. McGuinness : GPA 4.0/4.0* Aug. 2019 – Present
- **Worcester Polytechnic Institute (WPI)** Worcester, MA  
*B.S. with High Distinction in Computer Science, Minor in Data Science: GPA 3.9/4.0* Aug. 2015 – May 2019

## RESEARCH INTERESTS

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My research interests lie in the areas of knowledge representation and reasoning as well as natural language processing for artificial intelligence applications. My recent work has particularly focused on developing context-aware methods to more effectively utilize semantic web technologies, such as knowledge graphs and ontologies, to produce new knowledge through interpretable and interoperable AI models.

## RESEARCH EXPERIENCE

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- **Rensselaer-IBM AI Research Collaboration Summer Researcher** May 2022 - Aug. 2022  
*IBM Research* Yorktown Heights, NY
  - Research extern at T.J. Watson Research Center, mentored by Debarun Bhattacharjya and Oktie Hassanzadeh.
  - Conducted research project involving the use of causal knowledge graphs to perform forecasting about news events, using reasoning-based methods to predict properties of unseen events based on similar past cause-effect events.
  - Contributed novel forecasting functions to an event forecasting and analysis toolkit.
- **Knowledgebase Intern** May 2021 - Aug. 2021  
*Robert Bosch LLC.* Remote (Sunnyvale, CA)
  - Research intern with Bosch's Human-Machine Interaction research group, mentored by HyeonSik Kim.
  - Proposed and conducted a research project involving flow graph construction and graph embedding methods applied to procedural instruction text, specifically for automatically performing ingredient substitutions in cooking recipes.
- **Research Assistant** Aug. 2019 - Present  
*RPI* Troy, NY
  - Researcher under IBM-RPI's HEALS (Health Empowerment by Analytics, Learning, and Semantics) project.
  - Lead and collaborator in projects that apply resources such as ontologies, knowledge graphs, and NLP tools to support personal health applications, especially surrounding food and eating habits.

## RESEARCH PROJECTS

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- **Integrating Spatial Omics Data with Knowledge Graphs for Cancer Analysis** Sep. 2022 - Present  
*HEALS Research Project* Troy, NY
  - Ongoing project to explore the application of semantic technology-based methods to spatial omics data of cancer images in order to perform prediction and analysis tasks.
  - Investigating methods to incorporate large-scale bioinformatics knowledge bases of proteins and their interactions together with the spatial topology and protein expression data of individual cells.
  - Developing reasoning-based methods to predict patient survival rates using explainable and generalizable models.
- **Event Prediction using Case-Based Reasoning over Knowledge Graphs** May 2022 - Oct. 2022  
*Extern Project with IBM Research* Yorktown Heights, NY
  - Curated and released a dataset of cause-effect events and their surrounding neighborhood, sourced from Wikidata.
  - Developed a case-based reasoning method to perform inductive link prediction, enabling interpretable predictions about unseen events without the need for model training.
  - **Outcomes:** To appear in WWW 2023 Semantics and Knowledge Research Track, "Event Prediction using Case-Based Reasoning over Knowledge Graphs" (Lead). Wikidata Workshop at ISWC 2022, "[Rule-Based Link Prediction over Event-Related Causal Knowledge in Wikidata](#)" (Lead). DL4KG Workshop at ISWC 2022, "[Knowledge Graph Embeddings for Causal Relation Prediction](#)" (Co-author). ISWC 2022 Industry Track, "[Knowledge-Based News Event Analysis Toolkit](#)" (Co-author). Demo under submission to IJCAI 2023.

- Defining and Using “Context” in Knowledge-Driven Systems**

*HEALS Research Project*

  - Ongoing project to explore how the concept of “context” is framed and utilized in knowledge graph research.
  - Investigating methods to identify contextually “interesting” and “useful” information to support explainable AI.
  - Developing methods to unambiguously represent various facets and perspectives of context to enable greater interoperability and communication of scientific results surrounding context-aware methodologies.
  - **Outcomes:** Grand Challenges in Personal Informatics and AI Workshop at CHI 2022, “[Towards Context Clarity in Personal Informatics Applications](#)” (Lead), “[Realizing the Potential of Personal Health Informatics Through A Personal Semantic Health Knowledge Graph](#)” (Co-author)

Oct. 2021 - Present

*Troy, NY*
- Procedural Instruction Modification using Flow Graphs**

*Intern Project with Robert Bosch LLC.*

  - Generated flow graphs from cooking recipe text using dependency parsing tools and domain ontologies.
  - Developed strategy to embed flow graphs to support the use case of automatic ingredient substitution.
  - **Outcomes:** Patent application filed. ISWC 2022 Research Track, “[EaT-PIM: Substituting Entities in Procedural Instructions Using Flow Graphs and Embeddings](#)” (Lead)

May 2021 - Oct. 2021

*Remote (Sunnyvale, CA)*
- Framework for Recommendations with Explanations**

*HEALS Research Project*

  - Developed a lightweight pipeline framework for explainable recommendations using knowledge graphs,<sup>1</sup> demonstrated for a university course-recommendation use case and healthy food recommendation use case.
  - Supports object-oriented programming workflows using data from RDF data sources and ontology modeling
  - **Outcomes:** ISWC 2021 Poster&Demo Session, “[Healthy Food Recommendation and Explanation Generation using a Semantically-Enabled Framework](#)” (Lead)

Jul. 2020 - Mar. 2021

*Troy, NY*
- Ingredient Substitution using a Knowledge Graph of Food**

*HEALS Research Project*

  - Devised a heuristic model to identify good ingredient substitutions to empower patients to make healthier meals.
  - Utilized a knowledge graph of food and word embeddings to capture explicit and latent semantic information.
  - **Outcomes:** Frontiers in Artificial Intelligence Journal 2021, “[Identifying Ingredient Substitutions Using a Knowledge Graph of Food](#)” (Lead). ISWC 2020 Poster&Demo Session, “[Semantics-Driven Ingredient Substitution in the FoodKG](#)” (Lead). Presentation at AI & Food and Nutrition at AMLD EPFL 2021, “[Utilizing a Food Knowledge Graph for Healthy Ingredient Substitutions](#)”

Dec. 2019 - Jun. 2020

*Troy, NY*
- Personal Health Knowledge Graphs (PHKG)**

*HEALS Research Project*

  - Investigated existing literature and identified key challenges to develop PHKGs.
  - Assisted in organizing and presenting at the PHKG workshop at the 2020 Knowledge Graph Conference.
  - **Outcomes:** PHKG Workshop at KGC 2020, “[Applying Personal Knowledge Graphs to Health](#)” (Lead)

Feb. 2020 - Apr. 2020

*Troy, NY*
- Generating Surrogate Facial Images for Crowdsourcing**

*WPI Undergraduate Capstone Project*

  - Developed generative adversarial networks to generate fake facial images that retained facial expressions.
  - Utilized surrogate images with crowdsourcing, enabling annotation while preserving the privacy of the original images.
  - **Outcomes:** CV-COPS Workshop at CVPR 2019, “[Privacy-Preserving Annotation of Face Images Through Attribute-Preserving Face Synthesis](#)” (Lead)

Aug. 2018 - Mar. 2019

*Worcester, MA*
- ASSISTments Open-Response Automatic Grading**

*WPI Undergraduate Research Project*

  - Applied NLP methods for automatic grading of open-response math questions.
  - **Outcomes:** Contributed to a Poster presented at AIED 2019.

May 2018 - Aug. 2018

*Worcester, MA*

## ADDITIONAL EXPERIENCE

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- DBpedia Hackathon - Knowledge-Graph Shiritori Application**

*DBpedia Autumn Hackathon Project*

  - Developed a game of “shiritori” with the goal of making connections between entities and facts.
  - Used Diffbot’s APIs to parse user input, extract entities and facts, and identify connections <sup>2</sup>.

Sep. 2020

*Troy, NY*

<sup>1</sup>FREx github: <https://github.com/solashirai/FREx> – Additional FREx documentation: <https://tetherless-world.github.io/FREx/>

<sup>2</sup>Short demo video available at <https://www.youtube.com/watch?v=BtSgWrNE7M8>

- **Student Software Engineer - ASSISTments** May 2016 - Nov. 2018  
*Student Software Engineer* Worcester, MA
  - Performed various maintenance and improvements for front-end systems and interaction with student data.
  - Contributed to development of ASSISTments SDK for transitioning the system into Java.
  - Lead project to develop new user interfaces for teachers to create course content.
- **Big Data in Denmark's Waste Management Sector** Fall 2017  
*WPI Interdisciplinary Project with Dansk Affaldsforening* Copenhagen, Denmark
  - Assessed big data collection, management, and usage in Denmark's waste management industry.
  - Interviewed field experts and traveled to various municipalities to conduct on-site observations.
  - Project report: "[Preparing for the Use of Big Data in Denmark's Waste Management Sector](#)"
- **edX Internship** Summer 2014  
*Research Science Institute Summer Internship* Cambridge, MA
  - Developed a course component for edX to enable crowdsourcing of hints for student homework questions.

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## SKILLS

- **Programming:** Python > Java > C# > Javascript > C/C++
- **Misc. Tech.:** SPARQL, RDF, Ontologies<sup>3</sup>, SQL, Git, Docker, Prolog, L<sup>A</sup>T<sub>E</sub>X, TensorFlow/Keras, Pytorch
- **Languages:** Native speaker of Japanese and English

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<sup>3</sup>Example ontology for course recommendation: <https://rpi-ontology-engineering.netlify.app/oe2020/course-recommender/ontology>