

# MAXWELL CROUSE

Email: [mvcrouse@u.northwestern.edu](mailto:mvcrouse@u.northwestern.edu)

Chicago, IL 60657

## RESEARCH STATEMENT

---

My recent work has centered around the development of neuro-symbolic methods that combine graph neural networks with symbolic reasoning techniques. My thesis will describe a question-answering system that can be applied to reasoning-intensive domains with very little in the way of training data.

## EDUCATION

---

- (2021) **Northwestern University**, Evanston, IL  
Pursuing PhD in Artificial Intelligence, supervised by Kenneth Forbus. GPA of 4.0 / 4.0.
- (2015) **Indiana University**, Bloomington, IN  
Received BS in Computer Science with a minor in Mathematics. GPA of 3.8 / 4.0.

## PUBLICATIONS

---

### Conference Papers

- (2021) A Deep Reinforcement Learning Based Approach to First-Order Logic Theorem Proving.  
**Crouse, M.**, Abdelaziz, I., Makni, B., Whitehead, S., Cornelio, C., Kapanipathi, P., Pell, E., Srinivas, K., Thost, V., Witbrock, M., and Fokoue, A.  
*AAAI Conference on Artificial Intelligence (2021)*
- (2021) Neural Analogical Matching.  
**Crouse, M.**, Nakos, C., Abdelaziz, I., and Forbus, K.  
*AAAI Conference on Artificial Intelligence (2021)*
- (2020) Analogy versus Rules in Cognitive Architecture.  
Forbus, K., Hinrichs, T., **Crouse, M.**, and Blass, J.  
*Advances in Cognitive Systems (2020)*
- (2019) Predicting State Changes in Procedural Text using Analogical Question Answering.  
Ribeiro, D., Hinrichs, T., **Crouse, M.**, Forbus, K., Chang, M., and Witbrock, M.  
*Advances in Cognitive Systems (2019)*
- (2019) Analogical Question Answering in a Multimodal Information Kiosk.  
Wilson, J., Chen, K., **Crouse, M.**, Nakos, C., Ribeiro, D., Rabkina, I., and Forbus, K.  
*Advances in Cognitive Systems (2019)*

- (2018) Learning from Unannotated QA Pairs to Analogically Disambiguate and Answer Questions.  
**Crouse, M.**, McFate, C., and Forbus, K.  
*AAAI Conference on Artificial Intelligence (2018)*
- (2016) Elementary School Science as a Cognitive System Domain: How Much Qualitative Reasoning is Required?  
**Crouse, M.** and Forbus, K.  
*Advances in Cognitive Systems (2016)*

### **Workshop Papers**

- (2020) Improving Graph Neural Network Representations of Logical Formulae with Subgraph Pooling.  
**Crouse, M.**, Abdelaziz, I., Cornelio, C., Thost, V., Wu, L., Forbus, K., and Fokoue, A.  
*KDD Workshop on Deep Learning on Graphs: Methods and Applications (2020)*
- (2020) Towards High-Precision Understanding of Comparative Analysis Problems Expressed in Natural Language.  
**Crouse, M.** and Forbus, K.  
*International Workshop on Qualitative Reasoning (2020)*
- (2019) Step Semantics: Representations for State Changes in Natural Language.  
Forbus, K., Chang, M., Neves, D., Hinrichs, T., **Crouse, M.**, and Witbrock, M.  
*AAAI Reasoning for Complex QA Workshop (2019)*
- (2018) Learning to Build Qualitative Scenario Models from Natural Language.  
**Crouse, M.**, McFate, C., and Forbus, K.  
*International Workshop on Qualitative Reasoning (2018)*

### **INDUSTRY EXPERIENCE**

---

- (2019) **IBM Research, Research Intern - AI Reasoning Group**, Yorktown Heights, NY  
Developed a method for embedding logical formulae with DAG LSTMs for the task of premise selection and proof step relevance classification.
- (2018) **IBM Research, Research Intern - AI Reasoning Group**, Yorktown Heights, NY  
Developed a Superposition theorem prover guided by deep reinforcement learning techniques. Developed a method for producing decodable vector-space representations of structured data to be used as inputs to machine learning systems.
- (2014) **Epic Systems, Software Engineering Intern**, Verona, WI  
Used natural language processing techniques to detect plagiarism between documents.  
Created a Windows Forms interface for users to interact with the program.  
Performed extensive unit-testing for the application.

- (2013) **Caterpillar Inc., Software Engineering Intern**, Peoria, IL  
Developed various web applications to interface with internal databases.  
Designed, coordinated, and coded a solution to streamline grief report handling.

## **PATENTS**

---

### **Application Filed**

- (2019) Encoding and Decoding Tree Data Structures as Vector Data Structures.  
**Crouse, M.**, Fokoue, A., Musa, R., Chang, M., and Witbrock, M.
- (2019) Capturing the Global Structure of Logical Formulae with Graph LSTMs.  
**Crouse, M.**, Abdelaziz, I., Cornelio, C., Thost, V., Wu, L., Makni, B.,  
Srinivas, K., and Fokoue, A.

## **TEACHING EXPERIENCE**

---

- (2019) **Northwestern University**, Evanston, IL  
Teaching Assistant for EECS-344 - Building Problem Solvers. Graded assignments and projects. Held office hours to further assist students.
- (2018) **Northwestern University**, Evanston, IL  
Teaching Assistant for EECS-371 - Knowledge Representation and Reasoning. Graded assignments and projects. Assisted and provided additional support for students on a weekly basis.
- (2014) **Indiana University**, Bloomington, IN.  
Teaching Assistant for CSCI B-351 – Introduction to Artificial Intelligence. Created homeworks, quizzes, and tests (wrote entirety of final exam). Supervised 3 Master’s students. Graded assignments and projects.
- (2013) **Indiana University**, Bloomington, IN.  
Teaching Assistant for CSCI C-343 - Data Structures. Assisted and provided additional support for students on a weekly basis. Co-ran a lab instructing 30+ students.

## **PROFESSIONAL SERVICE**

---

- (2020) **Program Committee**, Reasoning and Complex QA Workshop, AAAI, 2020.
- (2019) **Program Committee**, Reasoning and Complex QA Workshop, AAAI, 2019.

## **HONORS AND AWARDS**

---

- (2020) **Terminal Year Fellowship**, Northwestern University

(2015) **Cognitive Science Fellowship**, Northwestern University

(2014) **Dean's Advisory Council Senior Student Award**, Indiana University

(2011-2014) **Dean's List**, Indiana University

(2011-2015) **Prestige Scholarship**, Indiana University

#### **ADDITIONAL SKILLS**

---

**Programming:** Python, Lisp, Java

**Expertise:** Machine Learning, Natural Language Understanding, Natural Language Processing, Symbolic Reasoning, Neuro Symbolic Methods, Graph Neural Networks