

Email: [cckisby@iu.edu](mailto:cckisby@iu.edu)  
Phone: +1 609 455 0673

# Caleb Schultz Kisby

Neuro-Symbolic AI Researcher

GitHub: [ais-climber](#)  
LinkedIn: [caleb-kisby](#)

## EDUCATION

### Ph.D. Candidate, Computer Science (in progress)

Fall 2018 – Present

Indiana University

GPA: 3.75

Concentration: Neuro-Symbolic AI

### B.S. Computer Science and Mathematics

Spring 2018

University of South Carolina

GPA: 3.97

## EXPERIENCE

### Research Assistant

Spring 2022 – Present

Indiana University

Fall 2018 – Spring 2019

- See Projects below. Supported by a DoD Trusted AI grant for which I co-wrote the grant proposal.

### Teaching Assistant

Summer 2019 – Fall 2021

Indiana University

- Planned and taught recitations for Theory of Computation, Honors Discrete Math, and Intro to Programming

## PROJECTS

### à la Mode: Neural Network Model Checking & Building

[GitHub]

- Independently developed a suite for checking and building neural networks from symbolic constraints (using Tensorflow).
- Proved that the neuro-symbolic translation at the heart of the program is formally sound (see FLAIRS paper below).

### Notakto Player

[GitHub][Report]

- Supplemented the [AlphaZero CNN](#) with light knowledge-based features to better play [Thane Plambeck's Notakto](#) (a game for which AlphaZero fails to learn a winning strategy — see the linked [Report](#)).
- Wrote testbed code (using Tensorflow) to compare the supplemented net against the original AlphaZero net.

### An Efficient & Light Cardinality Reasoner

[Github]

- Proved completeness for a computationally light logic that reasons about cardinalities with intersection in polynomial time.
- Collaborated with co-authors on proof (see AAAI paper below); Independently implemented model-building in Python.

### COBB: Case-Based Confidence for Black Box Predictions

[Github]

- Co-developed a hybrid neuro-symbolic system that uses a case-based reasoner to assess confidence and explain a neural network's predictions (using Scikit-Learn). Larry Gates and I divided all work evenly. (See ICCBR paper below.)

### Sense-Able: Obstacle Sensor for Visually Impaired

[GitHub][Tutorial]

- Collaborated with a team to develop a proof-of-concept LIDAR sensor for our clients at [P. B. Mumola, Ph.D., LLC](#).
- Wrote core C++ code for object detection and the GUI (in Qt); Independently wrote a tutorial for the LIDAR SDK.

## SKILLS

**AI & ML.** Deep Learning (CNNs, LSTMs), Tensorflow (Keras), Scikit-Learn, Knowledge Representation, Symbolic Reasoning

**Formal Methods.** Model-Building, First-Order & Modal Logics, Proof Assistants, Functional Programming, Interpreters

**Languages.** Python, Agda, Lisp (Racket), miniKanren, Lean, Prolog, C++, C, Java

**Other Tools.** Git, LaTeX, TexMacs, Jupyter Notebook (Google Colab), Visual Studio Code, Emacs, Linux

## PUBLICATIONS

### FLAIRS 2022 The Logic of Hebbian Learning

[pdf]

with Saúl A. Blanco and Lawrence Moss. Presented at FLAIRS 2022, Jensen Beach FL.  
*Nominated for Best Student Paper.*

### AAAI 2020 Logics for Sizes with Union or Intersection

[pdf]

with Saúl A. Blanco, Alex Kruckman, and Lawrence Moss. Presented at AAAI'20, New York NY

### ICCBR 2019 CBR Confidence as a Basis for Confidence in Black Box Systems

[pdf]

with Lawrence Gates and David Leake. Presented at ICCBR 2019, Otzenhausen Germany.