Email: cckisby@iu.edu
Phone: +1 609 455 0673

Caleb Schultz Kisby

Neuro-Symbolic AI Researcher

GitHub: ais-climber
LinkedIn: [Link]

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

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 verifying and building neural networks via 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 (AlphaZero alone fails to learn a winning strategy for this game — 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 Qt front-end application & object detection code in C++; Independently wrote a tutorial for the LIDAR SDK.

SKILLS

Machine Learning. Deep Neural Networks, Reinforcement Learning, Tensorflow, SciKit-Learn, NLP (Word2Vec, NLTK)
Symbolic AI. Knowledge Representation & Reasoning, Model Building, First-Order & Modal Logics, Natural Language Semantics
Languages. Python, C++, C, Java, Agda, SQL (Postgres), Lisp (Racket), Haskell, Prolog, Lean
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.