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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
◦ 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 C++ code for object detection and the front-end (in Qt); Independently wrote a tutorial for the LIDAR SDK.

SKILLS

Machine Learning. Supervised & Reinforcement Learning, Tensorflow (Keras), Scikit-Learn, NLP (Word2Vec, NLTK)
Symbolic AI. Knowledge Representation & Reasoning, Model Building, Hierarchical Planning (using Pyhop)
Languages. Python, C++, C, Java, Agda, Lisp (Racket), miniKanren, Lean, Prolog, SQL (Postgres)
Other Tools. Numpy, Matplotlib, Pandas, Git, LaTeX, 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.