Taylor Olson

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Research Interests

Constructing moral and epistemological theories, deontic logics, and machine learning formalisms in hopes to better understand our moral nature and progress the moral competence of AI systems.

Education

Northwestern University, Evanston, IL

PhD Computer Science, Anticipated Spring 2025
Thesis Title: *A Formal Theory of Norms*
Advisor: Professor Ken Forbus
Honors: IBM PhD Fellowship, 2023-24; Northwestern Cognitive Science Fellowship, 2018-19

Cognitive Science Certificate, 2023

University of Northern Iowa, Cedar Falls, IA

B.S., Computer Science, 2018

B.A., Mathematics, 2018

Minor in Philosophy

Kirkwood Community College, Cedar Rapids, IA

Mechanical Engineering Transfer Program, 2014

Research Experience

Thesis Research, Computer Science, Northwestern University, Evanston, IL, 2018-Present
Advisor: Professor Ken Forbus
Project: *A Formal Theory of Norms*

- Investigating the theoretical possibility of creating moral AI systems
- Developing predicate calculus knowledge representation and reasoning schemes for norms
- Developing machine learning models of norm learning and grounding them in reasoning
- Exploring defeasible logics for resolving normative conflicts

Research Assistant (with Prof. Ken Forbus), Computer Science, Qualitative Reasoning Group, Northwestern University, Evanston, IL, 2018-Present
Project: *Social Reasoning for AI Systems*

- Implementing and testing normative reasoning in the Companions cognitive architecture
- Improving semantic parsing for learning norms via natural language

Undergraduate Research Intern, School of Engineering and Applied Sciences, Harvard University, Cambridge, MA, Summer 2017
Advisors: Professor Dustin Tingley, Dr. Margot Levine
Project: *Clustering and Recommending Course Offerings from Syllabi*

- Built and tested an academic course recommender model trained on syllabi
- Developed a pipeline and interface for rapid development of ensemble machine learning models including LSA, LDA, K-nearest neighbors, and Doc2Vec/Word2Vec

Research Assistant, Computer Science, University of Northern Iowa, Cedar Falls, IA, 2016-17
Advisor: Professor Aleksandar Poleksić
Project: *Predicting Adverse Drug Reactions via Unified Medical Language System (UMLS)*

- Automated the translation of compound IDs to their standard IDs
- Analyzed coverage of compound IDs and their adverse reactions for prediction

Publications

Olson, T., Salas-Damian R., & Forbus, K.D. (Under Review 2024). Reasoning and Planning with Dynamic Social Norms.

Olson, T., & Forbus, K. D. (2024). Normative Testimony and Belief Functions: A Formal Theory of Norm Learning. In *Proceedings of the 33rd International Joint Conference on Artificial Intelligence.* Jeju, South Korea.

Olson, T., Salas-Damian R., & Forbus, K.D. (2024). A Defeasible Deontic Calculus for Resolving Norm Conflicts. Proceedings of the 11th Annual Conference on Advances in Cognitive Systems 2021. Palermo, Sicily, Italy.

Olson, T. (2024). Towards Unifying the Descriptive and Prescriptive for Machine Ethics. In P. Wu , M. Salpukas, H. Wu, S. Ellsworth (Eds.), *Trolley Crash: Approaching Key Metrics for Ethical AI Practitioners, Researchers, and Policy Makers*, (Chapter 5). Cambridge: Academic Press.

Olson, T., & Forbus, K. D. (2023). Mitigating Adversarial Norm Training with Moral Axioms. In *Proceedings of the AAAI Conference on Artificial Intelligence* (Vol. 37, No. 10, pp. 11882-11889).

Olson, T. (2022). Towards Unifying the Descriptive and Prescriptive for Machine Ethics. In *Proceedings of the AAAI 2022 Spring Symposium on "Approaches to Ethical Computing Metrics for Measuring AI's Proficiency and Competency for Ethical Reasoning"*.

Olson, T. & Forbus, K. (2021). Learning Norms via Natural Language Teachings. In *Proceedings of the 9th Annual Conference on Advances in Cognitive Systems 2021*.

Invited Talks

Normative Testimony and Belief Functions: A Formal Theory of Norm Learning, IJCAI-24, Jeju, South Korea, 2024.

A Defeasible Deontic Calculus for Resolving Norm Conflicts, the 11th Annual Conference on Advances in Cognitive Systems 2024, Palermo, Sicily, Italy, 2024.

Mitigating Adversarial Norm Training with Moral Axioms, Second International Workshop on Computational Machine Ethics, 20th International Conference on Principles of Knowledge Representation and Reasoning (KR2023), 2023. (Virtual).

Mitigating Adversarial Norm Training with Moral Axioms, AAAI-23, Washington D.C., 2023.

Towards Unifying the Prescriptive and Descriptive for Machine Ethics, AAAI-22 Spring Symposium on "Approaches to Ethical Computing Metrics for Measuring AI's Proficiency and Competency for Ethical Reasoning", Spring 2022.

Learning Norms via Natural Language Teachings, The Ninth Advances in Cognitive Systems (ACS) Conference, 2021.

Artificial Intelligence in Curriculum Design, National Conference for McNair Scholars and Undergraduate Research, University of Maryland, March 2018

Artificial Intelligence and Recommender Systems, McNair Seminar Series, University of Northern Iowa, September 2017.

Recommendation System Developer, Joint Research Experience for Undergraduates Summer Symposium, Harvard University, August 2017.

Honors & Awards

IBM PhD Fellowship, Northwestern University, 2023-2024

Cognitive Science Travel Grant, Northwestern University, 2023

Cognitive Science Fellowship, Northwestern University, 2018-2019

4th Place, Midwest Instruction and Computing Symposium Programming Contest, 2017

1st Place at site, ACM Programming Contest, 2016

Ronald E. McNair Postbaccalaureate Achievement Program, 2016 -

Student of the Month, Kirkwood Community College, 2014

NSF Engineering Scholarship, Kirkwood Community College, 2012-2014

Engineering project featured in local newspaper, 2012

All-Region Basketball, Kirkwood Community College, 2012-2014

Teaching

Instructor, Introduction to Cognitive Modeling, Northwestern University, Fall 2024

Guest lecturer, *Deontic Logic,* Knowledge Representation and Reasoning (KRR), Northwestern University, Winter 2024

TA, Introduction to Cognitive Modeling, Northwestern University, Fall 2020 – 2023

Guest lecturer, *Knowledge Representation,* Introduction to Cognitive Modeling, Northwestern University, Fall 2023

Guest lecturer, *Intelligent Tutoring Systems,* Introduction to Cognitive Modeling, Northwestern University, Fall 2022

Guest lecturer, *Deontic Logic,* Knowledge Representation and Reasoning (KRR), Northwestern University, Winter 2022

Guest lecturer, *Intelligent Tutoring Systems,* Introduction to Cognitive Modeling, Northwestern University, Fall 2021

Guest lecturer, *Philosophy and KRR - Deontic Logic,* Knowledge Representation and Reasoning (KRR), Northwestern University, Winter 2021

Guest lecturer, *Statistical Modeling - Introduction to Neural Networks,* Introduction to Cognitive Modeling, Northwestern University, Fall 2020

TA, AI and Experimental Narrative, Northwestern University, Spring 2020

Guest lecturer, *Philosophy and KRR,* Knowledge Representation and Reasoning (KRR), Northwestern University, Winter 2020

Guest lecturer, *Philosophy and KRR,* Knowledge Representation and Reasoning (KRR), Northwestern University, Winter 2019

URM Stem Tutor, University of Northern Iowa, 2016-2018

Service & Outreach

Mentor, High School Independent Study - Parsing and Knowledge Representation, Summer 2024

Mentor, Undergraduate Independent Study - Machine Ethics, Northwestern University, 2022

Grad Cohort for URMD, CRA-WP, Austin, TX, 2020

STEM Mentor, Morning Mentors, Nichols Middle School, Evanston, IL, 2019-2020

Reading Mentor, America Reads, Lincoln Elementary School, Cedar Falls, IA, 2016-2018

Software

Norms Reasoner: https://github.com/TeeOhh/Norms-Reasoner

An application and web interface for running our model of Moral Intuition and Construction on the Moral Conventional Transgression (MCT) Task experiment.

tRECS: https://github.com/TeeOhh/tRECS

Python NLP package and graphical interface capable of cleaning text data, building various statistical and vector space models, and creating recommender systems. With Janie Neal, Christiana Prater-Lee, and Eshita Nandini.

UMLS-Similarity-Viewer

Python package for graphical user interface to UMLS-Similarity, a similarity querying package built on top of the UMLS database of medicines, chemical compounds, and adverse drug reactions.