Yudong (Will) Xu

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EDUCATION

University of Toronto
Ph.D. in Mechanical & Industrial Engineering   2024 –Present

University of Toronto
M.ASc. in Mechanical & Industrial Engineering, Grade: A+/A+   2021 –2023

University of Toronto
B.ASc. with Honors in Engineering Science, Machine Intelligence, GPA: 3.66/4.00   2016 –2021

- Certificate in Engineering Business

PUBLICATIONS

[1] W. Li, Y. Xu, S. Sanner, and E. B. Khalil, "Tackling the abstraction and reasoning corpus with vision transformers: The importance of 2d representation, positions, and objects", *arXiv preprint arXiv:2410.06405*, 2024.

[2] Y. Xu, W. Li, P. Vaezipoor, S. Sanner, and E. B. Khalil, "Llms and the abstraction and reasoning corpus: Successes, failures, and the importance of object-based representations", *Transactions on Machine Learning Research*, 2024.

[3] Y. Xu, E. B. Khalil, and S. Sanner, "Graphs, constraints, and search for the abstraction and reasoning corpus", in *Proceedings of the 37th AAAI Conference on Artificial Intelligence (AAAI-23)*, Washington D.C., USA, 2023.

RESEARCH EXPERIENCE

Large Language Models for Abstract Reasoning
Supervisors: Prof. Elias B. Khalil and Prof. Scott Sanner   2023

- Explored the logical reasoning capabilities of large language models, notably **GPT-4**.
- Identified failure modes in models' logical comprehension and consistency via rigorous experimentation.
- Employed **Prompt Engineering** to create alternative representations, thereby doubling the performance of LLMs.

Graphs, Constraints, and Search for the Abstraction and Reasoning Corpus
Supervisors: Prof. Elias B. Khalil and Prof. Scott Sanner   2021–2023

- Devised an innovative abstraction and reasoning framework for an **Artificial General Intelligence (AGI)** challenge, marking the first solution to be published at a top peer-reviewed venue.
- Implemented in **Python**, achieving a 100-fold efficiency improvement over state-of-the-art solutions.

DiscreteNet: A Diverse Integer Programming Dataset for Machine Learning
Supervisor: Prof. Elias B. Khalil   2020–2021

- Developed synthetic data generators for **Integer Programming** problems using CPLEX and SCIP.
- Generated a vast number of real-world problem instances for integrating Machine Learning with Integer Programming, thereby facilitating research in combining these two fields.

PROFESSIONAL EXPERIENCE

Capital One
Software Engineer   2019 –2020

- Developed a data processing pipeline in **Scala** for real-time decision-making machine learning models.

- Integrated pipeline with microservices using **Docker**, achieving 100% unit test coverage.
- Established CI/CD pipelines with **Jenkins** to streamline versioning and deployment processes.
- Significantly enhanced customer onboarding experience for credit card applications.

University of Toronto
Artificial Intelligence Course Developer   Summer 2020

- Developed two comprehensive assignments as core components for an undergraduate-level Artificial Intelligence course.
- Devised a project based on Particle Filter Localization, integrating existing robot odometry and laser sensor data to facilitate Mobile Robot Localization.
- Created an assignment utilizing A* algorithm and OpenStreetMap, culminating in an interactive route-planning application for cyclists.

PROJECTS

Molecular Generation with GPT-4
LLM Drug Discovery Challenge   Spring 2023

- Implemented a novel approach to molecular generation by leveraging the **GPT-4** language model and employing advanced **prompt engineering** techniques.
- Generated unique SMILES strings that represented inhibitor compounds, targeting a vital component in cellular functions. Received the Social Drug Discovery Award.

Stroke Neurologists Demand Prediction
CorHealth Ontario   Fall 2020

- Designed **Deep Neural Network (DNN)** models with TensorFlow and **ARIMA** models to predict the demand for stroke neurologists in Ontario for the next decade, achieving a 70% accuracy rate.
- Developed data visualization tools and user interfaces for clients to analyze the results.

Volunteer Dashboard
Autism Ontario   Fall 2019

- Developed a volunteer portal for a local charity using **React** and **Drupal 8**, integrated with CiviCRM.
- Launched prototype back-end server using **AWS EC2** and **AWS S3** buckets.

AWARDS

- University of Toronto Engineering Research Conference Oral Presentation Second Place (2023)
- MIE Graduate Research Fellowship and Tuition Waiver (2021–2023)
- Faculty of Applied Science and Engineering Dean's Honor List (2016-2021)
- Engineering Alumni Centennial Scholarships (2016)
- Faculty of Applied Science & Engineering Admission Scholarship (2016)

PRESENTATIONS

- NeurIPS-22 nCSI workshop (Virtual, 2022)
- AAAI-23 (Virtual, 2023)
- CPAIOR Extended Abstract (Nice, France, 2023)
- University of Toronto Industrial Engineering (IE) Seminar (Toronto, Canada, 2023)
- University of Toronto Mechanical and Industrial Engineering Research Symposium (Toronto, Canada, 2023)
- University of Toronto Engineering Research Conference (Toronto, Canada, 2023)