Yudong (Will) Xu

Email: wil.xu@mail.utoronto.ca
Website: xuwil.github.io

EDUCATION

University of Toronto
M.ASc. in Mechanical & Industrial Engineering, GPA: 4.00/4.00   2021 –Present

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] 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.

[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", Submitted to *the Thirty-seventh Conference on Neural Information Processing Systems (NeurIPS-23)*, 2023.

RESEARCH EXPERIENCE

Large Language Models for Logical 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.
- − Crafted a second assignment utilizing A* algorithm and OpenStreetMap, culminating in an interactive route-planning application specifically designed 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.
- − Succeeded in generating unique SMILES strings that represented inhibitor compounds, targeting the TKB region of the CBLB protein, a vital component in cellular functions.

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.

SKILLS

- **Programming:** Python, Java, Scala, C, C++, R, Matlab, SQL, JavaScript.

- **Machine Learning:** PyTorch, TensorFlow, Scikit-learn, GPT.

- **Software Engineering:** Jenkins, Docker, GitHub, AWS, Kanban, Agile.

AWARDS

- 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)

CONFERENCE PRESENTATIONS

- NeurIPS-22 nCSI workshop (Virtual, 2022)

- AAAI-23 (Virtual, 2023)

- CPAIOR Extended Abstract (Nice, France, 2023)