

Kyle Roth

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INTRODUCTION

Kyle Roth is a third-year PhD candidate in the Département d'informatique et de recherche opérationnelle (DIRO) at the Université de Montréal. He is advised by Bang Liu. His research focuses on the structured use of LLMs within larger pipelines and agent systems, both from robustness and sociotechnical perspectives. His main research project focuses on augmenting these systems with structures for procedural knowledge understanding and adaptation for planning.

EDUCATION

Doctor of Philosophy (Ph.D.)

DIRO, Université de Montréal & Mila

Sep 2021 -
Montréal, Canada

- **3.7 GPA**; accelerated admission in fall 2022 from M.Sc. (**4.3 GPA**)

Bachelor of Science (B.S.)

Department of Mathematics, Brigham Young University

Aug 2014 - Dec 2019
Provo, USA

- Applied and Computational Mathematics Emphasis (ACME)
 - **3.9 GPA** (Cum Laude); minor in computer science; concentration in linguistics
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RESEARCH EXPERIENCE

Mitacs Accelerate

30,000 CAD. Principal research intern.

Aug 2022 - May 2024

- *Project title:* Technical and procedural knowledge extraction with question answering.
- *Partner organization:* Thales Canada Inc.
- *Project description:* We sought to build an LLM-enabled system to handle procedural knowledge (how-to instructions). Retrieval-augmented generation (RAG) is widely used to improve the factuality of LLMs' outputs, but can struggle to collect information from the wide set of documents and combine them coherently to produce novel procedures. To address this we developed a method called analogy-augmented generation (AAG) to address this, and tested it on datasets in several procedural knowledge domains, including a dataset of LangChain tutorials we constructed.

BYU ORCA undergraduate research grant

1,500 USD. Individual mentored research project.

Jan 2018 - Dec 2018

- *Project title:* Morphological parsing and segmentation.
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PROFESSIONAL EXPERIENCE

Cobalt Speech and Language

speech scientist (full time)

Jan 2020 - Aug 2021
(remote) Provo, USA

- Built an online training service in Go to manage parallel training of Kaldi models on sensitive live data
- Implemented state-of-the-art hyperparameter selection algorithms (learning rate range test; adaptive filtering) for online training
- Implemented MFCC extraction in Go while avoiding allocs and array bound checks

CamachoLab, Brigham Young University

research assistant (part time)

Jan 2019 - Dec 2019
Provo, USA

- Simulated field profiles of photonic chip components in TensorFlow using neural networks with resize convolutions
- Built SLURM_gen, a tool to automatically generate and manage simulated datasets in a high-performance computing environment
- Wrote custom resize-convolution layer to improve performance

Emergent Trading

software developer (intern)

May 2019 - Aug 2019

Chicago, USA

- Wrote fast market analysis code in C++ to track competitors on currency markets at the Chicago Mercantile Exchange
- Created an interactive tool to observe currency market behavior using Bokeh

Cobalt Speech and Language

speech scientist (intern)

Apr 2018 - Nov 2018

(remote) Provo, USA

- Improved model accuracy from 76% to 94% for autonomous drone recognition of air traffic control speech, using class-based (Thrax) language models

PUBLICATIONS

K Roth, Rushil Gupta, Simon Halle, Bang Liu. "Pairing Analogy-Augmented Generation with Procedural Memory for Procedural Q&A." *Under review at ACL ARR*. <https://arxiv.org/abs/2409.01344>

Kyle Roth, Deryle Lonsdale. "Morphological Parsing and Segmentation." *BYU Journal of Undergraduate Research* (2019): 24280. <http://jur.byu.edu/?p=24280>

HONORS & AWARDS

- Université de Montréal bourse d'exemption, 3e cycle (42,076.26 CAD) *Aug 2022 - Aug 2024*
- Université de Montréal bourse d'exemption, 2e cycle (9,789.06 CAD) *Aug 2021 - Aug 2022*
- Brigham Young University Mathematics Department certificate of excellence *Apr 2018*
- Brigham Young University full-tuition academic scholarship (13,500 USD) *May 2017 - Dec 2019*
- North Idaho College mathematics student of the year *May 2014*

TEACHING & SERVICE

teaching assistant

Université de Montréal; IFT 6759: advanced machine learning projects

Jan - May (2023, 2024)

- Advised student groups weekly to help design their experiments
- Taught introductory lectures on Linux, Git, SLURM, and other development tooling

reviewer

- 2024 - KDD, TOMM, NeurIPS, CIKM, COLM, ECCV, IJCAI, TNNLS, SIGIR, NAACL, SoLaR
- 2023 - Coling, TNNLS, ICKG, AACL, CVPR, WSDM, CIKM, WWW, ACL ARR, Elsevier Pattern Recognition
- 2022 - Elsevier Knowledge-Based Systems

volunteer

Refugee4Refugees; Mitilini, Greece

Jul 2017 - Aug 2017

- Stood night watch to spot and land refugee boats as they arrived from Turkey
- Taught swimming; cleaned up around Moria camp; organized donated materials

math lab tutor

North Idaho College; calculus I, II, III, & differential equations

Aug 2013 - May 2014

SKILLS

- **natural languages:** native English, fluent Spanish, functional French
- **programming languages:** Python, Go, C++, Java, Dart, Bash, \LaTeX
- **tools:** PyTorch, LangChain, Weaviate, SLURM, Git, Docker, Flutter, scikit-learn, TensorFlow, AWS, SQL