

Colin McDonald

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[LinkedIn](#) | [Google Play](#) | [GitHub](#) | [Google Scholar](#) | [Website](#)

Education

University of Notre Dame

Bachelor of Arts, Majors in Computer Science and Philosophy

GPA: 4.00 | Dean's List every semester

Notre Dame, Indiana

Class of 2023

Experience

Compilers Research

Research Assistant

University of Notre Dame

April 2021 - May 2022, August 2022 - Current

- Designed probabilistic programming language *Perpl* based on linear lambda calculus with algebraic datatypes
- Wrote compiler from *Perpl* to a differentiable graph-generating grammar for use in training machine learning models
- Implemented code transformation algorithms from several papers to preprocess and optimize *Perpl* code
- Co-Author: Exact Recursive Probabilistic Programming. *In Submission*. 2022.

Amazon Managed Service for Prometheus

Software Development Engineer Intern

AWS Open Source Observability

May 2022 - August 2022

- Designed and implemented bot to monitor automated trouble tickets, improving efficiency in resolving high-severity issues
- Integrated numerous AWS services and tools, enabling bot to determine the root cause of each ticket, find relevant error logs, plot recent error metrics, and run specialized CloudWatch queries based off that information
- Reduced customer-impacting tickets' average time to resolution by 10 minutes, also saving the on-call engineer 2+ hours/week

Quantum Computing Research

Quantum Computing Lab Intern

Center for Research Computing, University of Notre Dame

December 2020 - April 2021

- Executed quantum circuits on real quantum devices using IBM Quantum Experience with IBM Qiskit
- Developed quantum circuit error estimation algorithm, producing more accurate error estimates than Qiskit's noisy simulator
- Assisted implementation of parameterized quantum circuits, enabling accelerated machine learning

Natural Language Processing Research

Research Assistant

University of Notre Dame

August 2019 - November 2020

- Adapted custom Transformer implementation for tree-to-sequence translation tasks, with novel self-attention mechanism
- Designed model to automatically generate javadocs/docstrings for functions by parsing source code
- Optimized model for GPU use in high-performance computing environment, training models 2x-6x faster
- Created data processing tools to parse and standardize millions of Java and Python functions along with their javadocs/docstrings
- Lead Author: Syntax-Based Attention Masking for Neural Machine Translation. *NAACL: SRW*. 2021.

Type Theory Research

Research Assistant

University of Iowa

May 2017 - August 2019

- Developed dependently-typed functional programming language *Cedille* with lab of grad students, post-docs, and profs
- Primary contributor to *Cedille*'s 15,000-line code base, also writing compact core type checker in fewer than 1000 lines
- Implemented an elaborating transpiler from full language to core language, eliminating algebraic datatypes
- Co-Author: Strong Functional Pearl: Harper's Regular-Expression Matcher in *Cedille*. *ICFP*. 2020.
- Co-Author: Elaborating Inductive Definitions and Course-of-Values Induction in *Cedille*. *Unpublished*. 2019.

Clubs, Activities, and Other Involvement

- Boxed in Bengal Bouts (Men's Boxing Club), led dorm workouts and individually raised several thousand dollars for charity
- Led weekly faith-based Compass small groups and as part of ND Vision, facilitating faith sharing and intentionality
- Dorm Resident Assistant, responsible for 35 residents and leading several weekly section activities
- Worked on the CSE Undergraduate Leadership Team, organizing events and competitions for the department

Technical Skills

- Programming Languages: Haskell, Python, Java, C, C++, C#, Unix shell, JavaScript/TypeScript, Lisp, MATLAB, ...
- Tool proficiency: \LaTeX , git/svn, Microsoft Excel, Unity, WordPress, Emacs

Awards and Honors

- 2019 U.S. Presidential Scholar
- 2020 Gilman Scholar (declined for covid)
- Third-Degree Black Belt, Taekwondo