

Logan Weber

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Education

Massachusetts Institute of Technology

Cambridge, MA

PHD IN COMPUTER SCIENCE

Sep. 2020 - PRESENT

- Advisors: Michael Carbin and Saman Amarasinghe
- Research Focus: Programming Languages and Machine Learning

University of Washington

Seattle, WA

M.S. IN COMPUTER SCIENCE

Jan. 2018 - June 2020

- Advisor: Zachary Tatlock
- Mentors: Jared Roesch and Tianqi Chen
- Research Focus: Programming Languages, Machine Learning, and Systems

University of Washington

Seattle, WA

B.S. IN COMPUTER SCIENCE

Sep. 2014 - Jan. 2018

Research Projects

Neural Surrogate Compilation

Cambridge, MA

NEURAL NETWORKS FOR COMPILING PROGRAMS TO NEURAL NETWORKS

Feb. 2023 - Present

- Created an approach to developing neural surrogates of programs, called *neural surrogate compilation*, wherein a neural network that implements program functionality is generated solely from the source code of the program.
- Implemented a neural surrogate compiler using a BERT model adapted to function as a hypernetwork.
- Developed a dataset of $\approx 23,000$ executable, numeric C programs and corresponding input-output pairs, to train neural surrogate compilers.
- Evaluated our neural surrogate compiler and found it produces neural surrogates that achieve $2.6 - 5.5\times$ lower loss for a fixed data budget and achieve target losses with $1.5 - 3.3\times$ fewer epochs, compared to randomly initialized neural surrogates.

Semantic Program Embeddings

Cambridge, MA

A THEORETICAL AND EMPIRICAL STUDY OF EMBEDDINGS OF PROGRAM SEMANTICS

Sep. 2020 - Jan. 2023

- Developed a theory to characterize the conditions under which one can compute an embedding that preserves semantic equivalences between programs.
- Proved that such an embedding can only be tractably computed when the programming language has a finite number of semantic equivalence classes and an efficient canonicalizer.
- Evaluated the predictive power of the theory on a set of programming languages, showing that a Transformer model is able to learn an embedding of a tractable language, but it is unable to learn an embedding of an intractable language.
- Developed a technique for producing distance-preserving embeddings of numerical programs using orthogonal polynomials.
- Evaluated our embedding technique and found it achieved better distance preservation than a BERT-Tiny that was trained to produce distance-preserving embeddings.

MicroTVM

Seattle, WA

DEEP LEARNING ON BARE-METAL DEVICES

Jan. 2019 - Sep. 2020

- Created infrastructure in Apache TVM to support compilation and automatic optimization of machine learning models on microcontrollers.
- Acted as the core technical contributor before transferring ownership of the technology to OctoML.

Relay

Seattle, WA

FUNCTIONAL AND DIFFERENTIABLE IR FOR MACHINE LEARNING

Feb. 2018 - Sep. 2020

- Aided development of an intermediate representation for machine learning, featuring a tensor-oriented, dependent type system.
- Relay is used every time someone asks Amazon Alexa a question.

Relay Dashboard

Seattle, WA

MACHINE LEARNING BENCHMARKING AND ANALYSIS FRAMEWORK

June 2019 - Sep. 2019

- Aided design and development of a system for performing scalable and reproducible machine learning experiments in a language-agnostic fashion.

Apache TVM

Seattle, WA

OPEN DEEP LEARNING COMPILER STACK FOR CPUs, GPUS, AND SPECIALIZED ACCELERATORS

Feb. 2018 - PRESENT

- Became the 8th most impactful contributor (by lines of code modified) out of 300+ contributors, as of 11/30/2019.
- Was awarded reviewer status by the TVM community.

Judgement-Based Grading

Seattle, WA

CHROME EXTENSION

Jul. 2016 - Sep. 2016

- Built a UI over Canvas's SpeedGrader interface to implement judgement-based grading, a grading technique based on research in CS education.

Induction Tutor

WEB APPLICATION

- Built the first ever interface for both teaching induction to computer science students and for automating grading of induction proofs.

Seattle, WA

Apr. 2016 - Jul. 2016

Publications

Relay: A New IR for Machine Learning Frameworks

JARED ROESCH, STEVEN LYUBOMIRSKY, **LOGAN WEBER**, JOSH POLLOCK, MARISA KIRISAME, TIANQI CHEN, ZACHARY TATLOCK

2018

Proceedings of the 2nd ACM SIGPLAN International Workshop on Machine Learning and Programming Languages (MAPL 2018).

Preprints

Learning to Compile Programs to Neural Networks

LOGAN WEBER, JESSE MICHEL, ALEX RENDA, MICHAEL CARBIN

2024

Submission to ICLR 2024

A Theory of Equivalence-Preserving Program Embeddings

LOGAN WEBER*, JESSE MICHEL*, ALEX RENDA, SAMAN AMARASINGHE, MICHAEL CARBIN

2023

Submission to ICLR 2023

A Theory of Semantic Program Embeddings

JESSE MICHEL, **LOGAN WEBER**, SAMAN AMARASINGHE, MICHAEL CARBIN

2021

Submission to NeurIPS 2021

Relay: A High-Level Compiler for Deep Learning

JARED ROESCH, STEVEN LYUBOMIRSKY, MARISA KIRISAME, **LOGAN WEBER**, JOSH POLLOCK, TIANQI CHEN, ZACHARY TATLOCK

2019

ArXiv Preprint

Writing

Formal Verification of a Closest Pair Algorithm

LOGAN WEBER

2022

MIT 6.850 (Geometric Computing) Final Project

Towards An Algorithm for Reeb Graph Construction on Constructive Solid Geometry

LOGAN WEBER

2021

MIT 6.838 (Shape Analysis) Final Project

Fast(ish) Algorithms for Integer Programming

LOGAN WEBER AND JOSH POLLOCK

2020

MIT 6.854 (Advanced Algorithms) Final Project

Living Life On The Low-Power Edge: Tiny Models On Tiny Devices

LOGAN WEBER

2020

Master's Thesis

TinyML: How TVM Is Taming Tiny

LOGAN WEBER AND ANDREW REUSCH

2020

Post on TVM, OctoML, and Arm Blogs

Experience

Oregon Programming Languages Summer School Attendee

Eugene, OR

UNIVERSITY OF OREGON

June 2022

- Engaged in two weeks of rigorous study of programming language theory.

Oregon Programming Languages Summer School Attendee

Virtual

UNIVERSITY OF OREGON

June 2021

- Engaged in two weeks of rigorous study of programming language theory.

Part-Time Research Engineer

Seattle, WA

OCTOML INC

September 2019 - September 2020

- Researched methods for running and optimizing machine learning models on microcontrollers.
- Became OctoML's very first intern!

Graduate Research Assistant

UNIVERSITY OF WASHINGTON, PLSE AND SAMPL LABS

Seattle, WA

June 2019 - August 2019

- Researched methods for running and optimizing machine learning models on microcontrollers.
- Researched methods for performing and analyzing machine learning experiments in a reproducible and scalable manner.

Software Engineering Intern

NVIDIA, GRAPHICS DRIVERS TEAM

Santa Clara, CA

September 2018 - December 2018

- Created a tool to visualize arbitrary hierarchical temporal data (e.g., to visual graphics driver performance, kernel thread scheduling, and lock contention).

Software Engineering Intern

DUOLINGO, CORE LEARNING TEAM

Pittsburg, PA

June 2018 - September 2018

- Researched methods to more accurately assess learners' language proficiency.

Software Engineering Intern

GOOGLE, ANDROID CAMERA TEAM

Mountain View, CA

June 2017 - September 2017

- Contributed to several open source projects for Android camera testing.

Undergraduate Research Assistant

UNIVERSITY OF WASHINGTON, BLANK LAB

Seattle, WA

March 2016 - June 2017

- Built educational infrastructure for upper-level computer science courses.

Teaching Assistant

UW CSE DEPARTMENT

Seattle, WA

March 2016 - June 2019

- Assisted teaching and grading for upper-level computer science courses.

Hay Baler & Equipment Technician

CHARLTON FARMS INC

Ellensburg, WA

June 2014 - September 2015

- Coordinated with 2-10 other equipment operators to strategically prepare/bale 1000 acres of hay under 95-hour work weeks.

Presentation

NSF Expeditions in Computing Neurosymbolic Meeting

CO-PRESENTER FOR SEMANTIC PROGRAM EMBEDDINGS RESEARCH PROJECT

Cambridge, MA

October 2022

TVM Conference 2019

PRESENTER FOR μ TVM

Seattle, Washington, USA

December 2019

Arm Research Summit

POSTER PRESENTER FOR μ TVM

Austin, Texas, USA

September 2019

TVM For Fun and Profit Tutorial at ISCA 2019

PRESENTER FOR μ TVM

Phoenix, Arizona, USA

June 2019

Paul G. Allen School of Computer Science Research Poster Fair

POSTER PRESENTER FOR RELAY (2ND PLACE)

Seattle, Washington, USA

May 2019

Teaching

6.UAR, Preparation for Undergraduate Research

GRADUATE TEACHING ASSISTANT

Massachusetts Institute of Technology

February 2023 - June 2023

CSE 451, Introduction to Operating Systems

GRADUATE TEACHING ASSISTANT

University of Washington

March 2019 - June 2019

CSE 490Q, Introduction to Quantum Computing and Quantum Programming in Q#

GRADUATE TEACHING ASSISTANT

University of Washington

January 2019 - March 2019

CSE 410, Computer Systems

GRADUATE TEACHING ASSISTANT

University of Washington

March 2018 - June 2018

CSE 311, Foundations of Computing I

UNDERGRADUATE TEACHING ASSISTANT

University of Washington

March 2017 - June 2017

CSE 332, Data Structures and Parallelism

UNDERGRADUATE TEACHING ASSISTANT

University of Washington

January 2017 - March 2017

CSE 332, Data Structures and Parallelism

UNDERGRADUATE TEACHING ASSISTANT

University of Washington

September 2016 - December 2016

Service

MIT PLR Paper Selection Committee and AV Chair

Cambridge, MA

MIT PROGRAMMING LANGUAGES REVIEW

Nov. 2023 - May 2024

- Proposed and discussed papers to include in the MIT PLR program.
- Facilitated an audio and video setup for the MIT PLR, which included both remote and physical participants.

ADA TVM Tutorial Co-Organizer

Ann Arbor, MI

DEEP LEARNING ON BARE-METAL DEVICES

Sep. 2019

- Taught participants how to use TVM and the microcontroller backend, μ TVM.
- Guided participants through implementation of lazy execution for μ TVM.

Personal Projects

Blockly

Seattle, WA

VIRTUAL REALITY PUZZLE GAME TO TEACH PROGRAMMING CONCEPTS

Mar. 2020 - June. 2020

0x10c

Seattle, WA

RUST 3D GAME ENGINE

Sep. 2017 - Dec. 2018

Exort

Ellensburg, WA

JAVA 3D MOBA ENGINE PROTOTYPE

Mar. 2014 - Oct. 2014

ModernGL

Ellensburg, WA

JAVA LIBRARY FOR OPENGL 3.0+

Mar. 2014 - July 2015

Junkbot

Ellensburg, WA

JAVA 2D PLATFORMER

Sep. 2013 - Dec. 2013

Tetris

Ellensburg, WA

JAVA NES TETRIS RECREATION

Apr. 2013 - June 2013

Java2D

Ellensburg, WA

JAVA 2D GAME ENGINE

Dec. 2012 - Mar. 2014

Fallborn

Ellensburg, WA

JAVA 2D DYNAMIC LIGHTING ENGINE

Apr. 2012 - May. 2012