

# Vidush Singhal

West Lafayette, IN, USA (Open to work)

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## Summary

I am a Ph.D. candidate in Electrical and Computer Engineering at Purdue University, specializing in compilers. I have significant experience working on the LLVM compiler. I am experienced with MLIR, and compilers for GPU. My research interests lie in compiler optimizations, automatic parallelization, data layout optimization, compilers for GPU, security and software verification.

## Experience

### Microsoft Research ([RiSE](#))

*Research Intern*

Redmond, WA

May 2025 – Aug 2025

- Built a clang based source-to-source transpiler ([C2Pulse](#)) for verifying memory correctness of C programs.
- Authored  $\approx 7K$  loc in C++, creating a robust transformation and benchmarking infrastructure.
- Verified parts of DPE (Dice Protection Environment) protocols for memory safety and correctness.

### Lawrence Livermore National Laboratory ([LLNL](#))

*Computing Scholar Intern*

Livermore, CA

May 2024 – Aug 2024

- Developed LLVM IR passes for optimizing memory layout of allocations using the Attributor framework.
- Optimized the implementation of the LLVM GPU sanitizer, such as, hoisting checks out of loops.
- Improved XSbench runtime by **6%** when run via the sanitizer as a consequence of the optimizations.

### Nod.ai ([Acquired by AMD](#))

*Machine Learning Compiler Intern*

Santa Clara, CA

May 2022 – Aug 2022

- Implemented Torch-MLIR kernels for various PyTorch ops.
- Improved end-to-end compiler flow from PyTorch to MLIR by supporting more PyTorch ops.
- Provided end to end support for the Facebook DLRM model.
- Improved search/scheduling strategy of in-house software using fuzzing.

### Purdue University - [PLCL Group](#)

*Graduate Research Assistant*

West Lafayette, IN

May 2021 – Present

#### • **Gibbon Compiler**

- Optimizing layout of data types for better spatial locality.
- Observed **speedups of 1.14x to 54x** over best prior work.
- Implemented a transformation similar to structure of arrays for better vectorization.
- Observed **10x speedup** for manually written initial experiments.

#### • **Orchard Compiler**

- Developed a compiler framework to automatically fuse and parallelize tree traversals.
- Observed **speedups ranging from 1-5x** over baseline tree traversals.

#### • **Cornucopia**

- Developed a framework that uses fuzzing to generate a database of binaries using llc's optimization flags.
- **Discovered various bugs** with the LLVM compiler's optimization passes.
- **Uncovered bugs** in Angr, Ghidra etc. that failed to de-compile Cornucopia generated binaries.
- Developed a framework that stores ground truth meta-data in the binary to test against BATs.

#### • **Copse Compiler**

- A framework to evaluate FHE decision trees in a vectorized fashion.

### Senior Design Project - [SoCET Team](#)

*Undergraduate Research*

West Lafayette, IN

Jul 2020 – May 2021

- Developed a LLVM based compiler tool for optimizing sparsity of programs.
- Modified the LLVM RISCV backend by writing multiple machine IR passes.
- The compiler identified sparse regions and annotated/marked them as sparse statically.

## Education

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Purdue University, West Lafayette, IN		
Ph.D. in Electrical & Computer Engineering	Expected Aug 2027	
M.S. in Electrical & Computer Engineering	May 2023	
B.S. in Computer Engineering	Class of 2021	
<b>Relevant Coursework:</b> Compiler Code Generation and Optimization (ECE 66300), Compilers for GPUs (CS 59200), Graph Theory (MA 57500), Programming Parallel Machines (ECE 56300), Reasoning about programs (CS 56000), Formal Languages, Computability, and Parallelization (ECE 66400), Programming Languages (CS 56500), Holistic Software Security (ECE 69500)		

## Publications

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- Raghav Malik, **Vidush Singhal**, Benjamin Gottfried, Milind Kulkarni. “Vectorized Secure Evaluation of Decision Forests.” *PLDI 2021*.
- **Vidush Singhal**, Akul Abhilash Pillai, Charitha Saumya, Milind Kulkarni, Aravind Machiry. “Cornucopia: A Framework for Feedback Guided Generation of Binaries.” *ASE 2022*.
- **Vidush Singhal**, Chaitanya Koparkar, Joseph Zullo, Artem Pelenitsyn, Mike Rainey, Milind Kulkarni. “Optimizing Layout of Recursive Datatypes with Marmoset.” *ECOOP 2024*.
- **Vidush Singhal**, Laith Sakka, Kirshanthan Sundararajah, Ryan Newton, Milind Kulkarni. “Orchard: Heterogeneous Parallelism and Fine-grained Fusion for Complex Tree Traversals.” *ACM TACO 2024*.
- Chaitanya S. Koparkar, **Vidush Singhal**, Aditya Gupta, Mike Rainey, Michael Vollmer, Artem Pelenitsyn, Sam Tobin-Hochstadt, Milind Kulkarni, Ryan R. Newton. “Garbage Collection for Mostly Serialized Heaps.” *ISMM 2024*.

## Skills

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Assembly, C, C++, Haskell, Python, CUDA, CMake, Makefile, LLVM IR, MLIR, Clang, GCC ,OpenMP, MPI, Cilk, Coq, Dafny, FStar, Pulse, Git, Gem5, AFL++, GDB, Linux, GDB

## Awards, Grants & Service

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Dean's List and Semester Honors, Purdue University	(2017 - 2020)
LLVM Developers' Meeting Travel Grant	2024
Artifact Evaluation Committee Member - PLDI, CGO, ICFP, PPoPP, POPL	(2023–2025)
Seminar Co-Coordinator, <a href="#">Purdue Programming Languages and Systems Research Group</a>	(2025 - present)