Education

PhD University of Edinburgh.

(2022 - Ongoing)

Master by International Institute of Information Technology Hyderabad India.

Research (2020 - 2021)

Undergraduate International Institute of Information Technology Hyderabad India.

2015 - 2020

Publications

Lambda the Ultimate SSA: Siddharth Bhat, Tobias Grosser. CGO 2021

QSSA: An SSA based IR for Quantum Computing: Anurudh Peduri, **Siddharth Bhat**, Tobias Grosser. CC 2021

Optimizing Geometric Multigrid Computation using a DSL Approach: Vinay Vasista, Kumudha KN, **Siddharth Bhat**, Uday Bondhugula. Supercomputing (SC), Nov 2017

Word Embeddings as Tuples of Feature Probabilities: **Siddharth Bhat**, Alok Debnath, Souvik Banerjee, Manish Shrivastava Representation Learning for NLP, 2020

Work Experience

- Winter 2019 Teaching Assistant for Natural Language: Applications, IIIT-H.
 - Monitored projects, took sessions on word embeddings, involving word2vec, GloVe, fasttext.
- Summer 2019 Intern at Tweag.io, Paris, France.

Re-implemented portions of GHC(Glasgow Haskell Compiler) runtime for Asterius (link), a Haskell to WebAssembly compiler. Involved Haskell, C, and WebAssembly.

Winter 2018 Teaching Assistant for Principles of Programming Languages, IIIT-H.

Course covers the book "Essentials of Programming Languages" by Dan Friedman. Helped write lecture notes, set assignments, graded assignments and exams.

Summer 2018 Visiting research intern at ETH Zurich, Zurich, Switzerland.

Investigating formal verification of polyhedral compilation. PolyIR (Link) is a formal specification of polyhedral programs.

Summer 2018 **GSoC mentor, Polly Labs**.

Mentoring a project to enable Polly's loop optimisations into Chapel.

Mar-Dec '17 ETH Zurich, Research Intern at SPCL, Zurich, Switzerland.

Worked on Polly, a polyhedral loop optimizer for LLVM.

Jan-Mar '17 Course content contributor, IIIT-H.

Wrote lecture notes for the Intro to programming course (link)

Summer 2016 Research Intern, IISC Bangalore, Bangalore.

Worked on PolyMage, DSL compiler for optimising loop transforms. Contributed to ISL and PLUTO. Implemented tiling patterns, optimised PolyMage for stencils.

Summer 2016 Selected for GSoC 2016, Google.

Binding SymEngine, a symbolic math library to Haskell. Had to drop this to intern at IISc, Bangalore. Still maintain the library (symengine.hs)

Summer 2015 GSoC 2015, Google.

Worked on VisPy, a pure Python graphics library which uses OpenGL internally for performace. Successfully completed.

Open Source Contributions

Coq Submitted issues, bug-fixes, helped improve developer documentation.

VE-LLVM Collaboration with VE-LLVM, a formal semantics of the LLVM compiler toolchain in Coq

Polly Implementing support for Fortran, added unified memory abilities to the CUDA backend within Polly, a polyhedral loop optimiser for LLVM. (Link to commits)

Symengine.hs GSoC 2016. Haskell bindings to SymEngine, a C++ symbolic manipulation library.

VisPy GSoC 2015. Rewrote scene graph for performance. Added visuals, high level API for easy use of plotting. Implemented auto-resizing with **Cassowary**, a linear optimisation library.

Rust Contributed to the Rust compiler and ecosystem. Found compiler errors, fixed libraries. Was part of *Piston*, group of Rust programmers that experimented with writing game engines.

Haskell Contributed to the Haskell ecosystem. Reported and fixed bugs in *stack*, *stackage*, *diagrams*, *GHC*, etc. (Link to GHC commits).

PLUTO Source to Source C optimiser for loop nests. Improved the PLUTO API that had gone out of sync with master. Discovered bugs in PLUTO for diamond tiling transforms

PolyMage DSL Compiler than generates C code. Uses **Polyhedral Compilation** Extended the compiler to add stencils, time iterated-stencils.

PPSSPP PPSSP is a C++ open source PSP emulator. Wrote most of the touch handling code. Implemented atomic locks for audio performance.

My Projects

Lean-MLIR Formal semantics for the MLIR compiler framework, defined within the Lean4 proof assistant.

Iz An MLIR based compiler backend for the Lean4 proof assistant.

Lean4 Metapro- A textbook on metaprogramming in Lean4. I wrote the chapters on tactics and metaprogramming Book gramming for embedded DSLs.

Lean-to A Jupyter kernel for the Lean4 proof assistant.

Simplexhc A custom compiler for a subset of Haskell. The goal is to try and apply *polyhedral* compilation ideas to compile a lazy, pure, functional programming language. with LLVM as a backend. Has **64** stars on github.

Sublime A plugin for sublime text to quickly jump between pieces of your codebase. **26k downloads**Bookmarks and counting.

Cellular A collection of Cellular Automata written in Haskell. Uses **Comonads** for abstraction. **130**Automata stars on Github.

Teleport A simple tool to switch between projects written in Haskell. Shows how to write "real world Haskell". Published as a **Literal Haskell tutorial**. **90** stars on github

TIMi A visual interpreter of the **template instantiation machine** to understand evaluation of lazy functional languages. **51** stars on github.

Miscellaneous

Barvinok	Talk at ETH Zurich: Slides describing the barvnok algorithm to count lattice points in polyhedra
FunctionalConf	Talk on implementing embedded probabilistic programming languages in Haskell (Slides)
Haskell Exchange 2020	Talk on optimizing smallpt-hs (a port of a ray tracer to haskell) to beat C++ performance (Slides)
FPIndia	Talk explaning the paper egg: fast and extensible equality saturation. (Slides)
Theory seminar, winter '19	Talk on impossibility of compass-straightedge constructions using field theory.
math.se	Answer on math.stackexchange. 4724 reputation, top 2% this year. General interest in algebra and geometry.

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