

# Pratyush Das

- *Email* das160@purdue.edu
- *GitHub* <https://github.com/reikdas>

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## Education

### Purdue University

2021 -

*PhD in Computer Science (Advisor - Tiark Rompf). GPA: 3.77/4.0*

- Courses - Operating Systems, Programming Languages, Advanced Topics in Compilers

### Institute of Engineering & Management, Kolkata (MAKAUT)

2017 - 2021

*Bachelor of Technology in Computer Science and Engineering. CGPA: 8.89/10*

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## Teaching Experience

### CS 240: Programming in C

Fall 2021, Spring 2022

Purdue University

Instructed lab sessions, held office hours, graded assignments and exams

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## Internships

### Google Summer of Code - Student

June, 2021 - August, 2021

The LLVM Compiler Infrastructure Organization

Supervisors - William Moses (MIT), Dr. Johannes Doerfert (Argonne National Laboratory)

- Enzyme: LLVM Pass to perform automatic differentiation of statically analyzable LLVM IR
  - Integrated custom derivatives of BLAS functions into Enzyme.
  - Wrote an LLVM pass to inline function definitions from bitcode files into LLVM IR.

### IRIS-HEP - Fellow

June, 2020 - September, 2020

Supervisor - Dr. Jim Pivarski (Princeton University)

- Awkward Array: Library for nested, variable-sized data using NumPy-like idioms
  - Created a source to source compiler to generate equivalent Python for a subset of C++.
  - Created a property based testing framework.
  - Created a source to source compiler to generate equivalent parallel CUDA from specification (Python and type info).

### IRIS-HEP - Fellow

June, 2019 - September, 2019

Location: Fermi National Accelerator Laboratory, USA - LHC Physics Centre

Supervisor - Dr. Jim Pivarski (Princeton University)

- Uproot: Python implementation of ROOT I/O, an open source file format storing over an exabyte of HEP data
  - Completed ROOT file writing interface by adding functionality to write ROOT files with TTrees.
  - Uproot has become one of the most widely used Physics libraries (50K+ downloads).

### DIANA-HEP - Fellow

June, 2018 - September, 2018

Location: Fermi National Accelerator Laboratory, USA - LHC Physics Centre

Supervisor - Dr. Jim Pivarski (Princeton University)

- Uproot
  - Co-developed the Uproot library with Jim Pivarski; authored the ROOT file writing interface.
  - Examined ROOT serialization of objects and added functionality to write ROOT files with object strings and histograms.

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## Volunteer Research Experience

*Supervisor* - Dr. Vassil Vassilev (Princeton University)

November, 2019 - May, 2021

*Collaborations:* IRIS-HEP, CERN ROOT Team, Compiler Research group

- **ROOT:** An open-source data analysis framework storing over an exabyte of data
  - Created new unit testing library, ROOTUnitTestSupport
  - Some rootcling improvements
  - Fixed packaging for macOS
  - Backported several Clang patches from upstream LLVM/Clang
- **Cling:** Interactive C++ interpreter built on top of Clang
  - Configured installer to build using LLVM binary
  - Fixed CI and moved it from Travis to GitHub Actions
  - Maintained cpt.py installer and packager
- **Clang:** C language family frontend for LLVM
  - Several patches to print type information of C++ template arguments
- **Clad:** Clang plugin for automatic differentiation
  - Moved CI from Travis to Github Actions.

*Supervisor* - Dr. Jim Pivarski (Princeton University)

January, 2021 - February, 2021

*Collaborations:* IRIS-HEP

- **Awkward Array**
  - Created a parser for Awkward Array's type system

*Supervisors* - Dr. Jim Pivarski (Princeton University), Dr. Viktor Khristenko (CERN)

June, 2017 - August, 2017

*Collaborations:* CERN CMS Big Data Project, DIANA-HEP

- **spark-root** - Apache Spark datasource for ROOT
  - Separated spark bindings from TTree reading code.
- **root4j** - Java implementation of ROOT file reader
  - Optimized codebase to facilitate interoperability

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## Programming Languages and Tools

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**Experienced:** Python, C, CUDA, \*nix

**Familiar:** C++, Java, Scala, Coq, ROOT, BaSH

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## Summer Schools

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**Oregon Programming Languages Summer School**

2021

*University of Oregon*

**Computational and Data Science for High Energy Physics (CoDaS-HEP)**

2019

*Princeton University*

- Interviewed - *Princeton University News*
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## Publications

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- J.Pivarski, I.Osborne, **P.Das**, D.Lange, P.Elmer, "AwkwardForth: accelerating Uproot with an internal DSL", 25th International Conference on Computing in High-Energy and Nuclear Physics (vCHEP, 2021), DOI: 10.1051/epjconf/202125103002. 2021
  - J.Pivarski, I.Osborne, **P.Das**, A.Biswas, P.Elmer, "Awkward Array: JSON-like data, NumPy-like idioms", Proceedings of the 19th Python in Science Conference (SciPy USA, 2020), Pages 68-74, DOI: 10.25080/Majora-342d178e-00b. 2020
  - E.Rodrigues, et al., "The Scikit HEP Project - overview and prospects", Proceedings of the 24th International Conference on Computing in High Energy and Nuclear Physics (CHEP 2019), DOI: 10.1051/epjconf/202024506028. 2020
  - N.Saha, **P.Das**, H.N.Saha, "Authorship Attribution of Short Texts using a Multi Layer Perceptron", International Journal of Applied Pattern Recognition, 2018 Vol. 5 No. 3, Pages 251-259, DOI: 10.1504/IJAPR.2018.10016100. 2018
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## Invited talks at Conferences

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- GSoC Experience - Enzyme
    - LLVM Developers' Meeting (Remote)* 2021
  - Python in High Energy Physics
    - PyCon USA (Remote)* 2020
  - Python in High Energy Physics
    - SciPy India (Indian Institute of Technology, Bombay)* 2019
  - Writing files with uproot
    - PyHEP (Abington, UK)* 2019
  - Writing files with uproot
    - ROOT Users' Workshop (Academy of Sciences and Arts of Bosnia and Herzegovina)* 2018
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## Invited talks at External Research Group Meetings

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- Language Transformations for the Awkward Array library
  - IRIS-HEP Fellow Presentations (Remote)* 2020
- CUDA backend for the Awkward Array project
  - Princeton University Liberty Research Group Meeting (Remote)* 2020
- Writing TTrees with uproot
  - IRIS-HEP Topical Meeting: Summer student project presentations (Remote)* 2019
- Writing files with uproot
  - DIANA Meeting: Updates on ROOT I/O (Remote)* 2018
- Separation of Concerns - Refactoring code between ROOT4J and Spark-Root
  - DIANA Meeting: Student Projects (Remote); CMS Big Data Science Projects (Remote)* 2017

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## Achievements

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- PurPL funding to attend OOPSLA, 2021. 2021
- Awarded the Director's Award for Best Scientific Mind by the Institute of Engineering & Management, Kolkata. 2021
- Awarded PLMW scholarship to attend POPL, 2021. 2021
- Awarded PLMW scholarship to attend ICFP, 2020. 2020
- Awarded PLMW scholarship to attend PLDI, 2020. 2020
- Awarded the IRIS-HEP undergraduate fellowship by Princeton University. 2020
- Awarded travel grant to speak at PyCon USA, 2020 in Pittsburgh, USA. 2020
- Awarded PLMW scholarship to travel to and attend POPL, 2020 in New Orleans, USA. 2020
- Awarded travel grant to attend CoDaS-HEP summer school at Princeton University. 2019
- Awarded the IRIS-HEP undergraduate fellowship by Princeton University. 2019
- Awarded travel grant to speak at ROOT Users' Workshop, 2018 in Sarajevo, Bosnia and Herzegovina. 2018
- Awarded the DIANA-HEP undergraduate fellowship by Princeton University. 2018