Pratyush Das

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Education

Purdue University 2021 -

PhD in Computer Science

Institute of Engineering & Management, Kolkata (MAKAUT) 2017 - 2021

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

Work Experience

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
  - Integrate custom derivatives of numerical computing routines like BLAS and Eigen into Enzyme.

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.

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

Programming Languages and Tools

Experienced: Python, C, CUDA, *nix
Familiar: C++, Java, Scala, ROOT

Summer Schools

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*

Publications

- 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

Talks at Conferences

- 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

Talks at Public Meetings

- 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

Academic Achievements

- 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

Relevant Coursework

- Software Engineering (IEM CS701, IEM CS791)
- Compiler Design (IEM CS702)
- Artificial Intelligence (IEM CS703C, IEM CS793C)
- Database Management System (IEM CS601, IEM CS691)
- Operating System (IEM CS603, IEM CS693)
- Operations Research (IEM CS605A)
- Design and Analysis of Algorithms (IEM CS501, IEM CS591)
- Discrete Mathematics (IEM CS502)
- Object Oriented Programming (IEM CS504D, IEM CS594D)
- Numerical Methods (IEM MCS401, IEM MCS491)
- Mathematics (IEM M401)
- Formal Languages and Automata Theory (IEM CS403)
- Computer Architecture (IEM CS403, IEM CS493)
- Basic Computation and Principles of Computer Programming (IEM CS291)