Pratham Sahu

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Academic Qualifications

Year	Degree/Certificate	Institute	CPI/%
2021 - Present	B.Tech	Indian Institute of Technology Kanpur	9.31/10
2021	Karnataka State Board(XII)	St Jerome's PU College, Bangalore	98.3%
2019	ICSE(X)	Vibgyor High, Bangalore	96.4%

Scholastic Achievements

- Secured **All India Rank 131** in **JEE Advanced 2021**, conducted by IIT Kharagpur, among 1,50,000 shortlisted candidates
- Secured an **All India Rank of 87** in **JEE Mains 2021**, conducted by **NTA** among 1.1 million candidates
- Secured **AIR 44** in **Indian National Physics Olympiad(INPhO),** in **2021** and made it to **National Selection Camp(IPhO)**
- Secured **AIR 31 Indian National Astronomy Olympiad(IAO),** in **2021** and made it to **National Selection Camp(IOAA)**
- Secured **AIR 19 Indian National Chemistry Olympiad(INChO),** in **2021** and made it to **National Selection Camp(IChO)**
- Recipient of the **Directors Scholarship, IIT Kanpur** in the year 2022 for having an exceptional JEE Advanced rank
- Awarded **KVPY SA 2019** fellowship, securing an **All India Rank 340** conducted by Indian Institute of Science, Bangalore
- Awarded **KVPY SX 2020** fellowship, securing an **All India Rank 148** conducted by Indian Institute of Science, Bangalore
- Received the **Academic Excellence Award** for exceptional academic performance in 2021-22 and 2022-2023 academic session
- Recipient of the **National Talent Search Examination(NTSE) Scholarship** conducted by **NCERT** in 2019

Internships and Key Projects

- **Adobe Research, Bangalore** (*May '24 - current*)
  Intern Research Assistant, Big Data Experience Lab
  - Working as a part of the **Data-driven Systems, Insights, Experiences team**.
  - Working on **data and domain aware strategy generation** by leveraging customer data and finetuning of LLMs.
- **Yonsei Vision and Learning Laboratory, Seoul, South Korea** | *Prof. Jonghyun Choi* (*May '23 - Sep '23*)
  Intern Research Assistant
  - Engaged in research on developing efficient deep neural architectures and effective **continual machine learning** algorithms
  - Performed extensive survey on **sampling, improving time and efficiency with limited accuracy loss** of ML algorithms
  - Assessed on developing efficient **coresets for streaming data** to mitigate forgetting in incremental deep learning setups
  - Worked on **incremental classification** to come up with a novel technique to evolve existing methods in **episodic-replay**
- **MSenseAI, Bengaluru** | **Platform Software Engineering Intern** (*Jul '22 - Aug '22*)
  - Implemented open source IoT Platform **ThingsBoard** to add functionalities to suit specific needs of the product
  - Successfully implemented open source JS library **Annotorious** to implement picture annotating on the platform

Competitions and Workshops

- **ISC Student Cluster Competition | Results Awaited**
  Prof. Preeti Malakar & Prof. Swarnendu Biswas (*Aug '23 - May '24*)
  - Led a team of six third-year students in the world's **largest student HPC Competition**, becoming the **first Indian team** to get selected. Finished **8th out of 21 shortlisted teams**, being the **only new team in the competition**.
  - Optimized the μ**phys package** in **ICON** application, using **OpenACC** directives to make the code portable to **CUDA backends**, and employed parallelization techniques to achieve a **20x improvement in performance.**
  - Built, ran, visualized, and profiled the performance of the **NekoCFD** application on CPU and GPU backends on the Bridges2 supercomputer. Demonstrated **weak and strong scaling** performance and visualised using **paraviewCLI**.

Selected Projects

- **Controlled Interthread memory sharing in multi-threaded applications**
  Linux Kernel Programming| *Prof. Debadatta Mishra*| Report (*Jan '24 - May '24*)
  - Designed a **novel** memory framework for **threads to achieve previlege seperation** in the same address space.
  - Used **TLB entries** to boost previleges temporarily on cores with threads having higher previleges for the same page. Used **inter-processor interrupts** to stop other cores from accessing boosted Page Table entries and thus ensuring correctness. Optimized for efficiency using **TSX** provided by a few older x86 systems and pointed out issues with same.
  - Implemented the design on the **Linux kernel using modules, core kernel code**, and provided **user-space APIs**.
  - Conducted thorough testing and benchmarking, verifying correctness and assessing memory access time trade-offs.
- **Modelling Performance Variability in HPC Clusters(Undergraduate Project)**
  Ongoing Prof. Preeti Malakar|Report (*Jan '24 - current*)
  - Analyzed job interference impact on performance variability in a large-scale production supercomputer**(Param Sanganak)**.
  - Characterized supercomputer jobs using profilers(IPMPI), I/O tracing, network tracing, and hardware counters(perf).
  - Designed algorithm to mitigate job interference effects on performance, integrated and simulated on Slurm Scheduler.
  - Received an **A*** for exceptional contributions to research in the field of **performance and variability modelling**.

- **PuppyLove2.0 | Programming Club** (*Jan '23 - Apr '23*)
  - Built a **cryptographically secure** dating application for the campus community which ensured zero-server side knowledge.
  - Deployed the application using **Kubernetes** along with security measures to ward off large DOS attacks on the server.
  - Achieved successful registration of **2800** campus residents and around **300 matches** being made by our application.
- **Python Compiler | CS335 Course Project** | *Prof. Swarnendu Biswas* (*Jan '24 - Apr '24*)
  - Developed an end-to-end compiler to convert a subset of **Python** language features to **x86 assembly code**.
  - Designed lexer using flex, parser using bison and semantic analyzer to support for **classes, multilevel inheritance, arrays, and non-primitive types** in python. Included support for **type checking and implicit type conversion**.
  - Used a **hierarchical symbol table** and **Abstract Syntax tree based IR** to form a **3AC IR**, which was then converted to x86 assembly code using template functions. Awared **97% marks for complete implementation**.
- **Operating System Design | CS330 Course Project** | *Prof. Swarnendu Biswas* (*Aug '23 - Nov '23*)
  - Implemented support for **system call tracing and function call tracing** on a toy OS with x86 architecture.
  - Implemented **mmap, munmap and remap** semantics in the OS ensuring least fragmentation of virtual memory.
  - Implemented **regular(copy all)** and **Copy-on-Write(CoW)** semantic for **fork handling** within the toy OS.
- **Scalable Parallel Feature Extraction and Tracking for Large Time-varying 3D Volume Data**
  CS677 Course Project | *Prof. Preeti Malakar & Prof. Soumya Dutta* (*Aug '23 - Nov '23*)
  - Implemented a **high performance parallel feature extraction and tracking** algorithm for large 3D volume data.
  - Validated the algorithm on large scale datasets and compared the performance with existing state-of-the-art methods.
  - Performed **weak-scaling and strong-scaling analysis** to evaluate the performance of the algorithm on large scale clusters.
- **CSE-Bubble | CS220 Course Project** | *Prof. Urbi Chatterjee* (*Jan '23 - Apr '23*)
  - Implemented a **Verilog hardware description** of a **32-bit processor**, featuring ISA, ALU, and a memory unit.
  - Verified correctness by running **RISC-V(MPI)** assembly code for **Bubble Sort** on the on a FPGA board.
- **CampusPay | CS253 Course Project** | *Prof. Indranil Saha* (*Jan '23 - Apr '23*)
  - Developed the code-base for a website to handle finances and dues for ease of campus community and vendors.
  - Utilised **Django** framework to create the webite's backend, **ReactJS** for the website's frontend and **SQLite** for database

Relevant Courses

Computer Architecture	Parallel Computing(A*)	Linux Kernel Programming
Compilers	Computer Organisation	Networks
CUDA programming	Analysis and Design of Algorithms	Data Structtures and Algorithms
Mathematical Logic	Fundamentals of Computing	Undergraduate Project(A*)
Operating Systems	Large data analysis and visualisation(A*)	Theory of Computation
Probability	Introduction to Machine Learning	Software Development and Operations

Technical Skills

- **Programming Languages:** C, C++, Python, Java, Javascript, Solidity, RUST, CUDA, DPC++
- **Software and Libraries:** gdb, perf, Tau profiler, Nvidia Nsight, Numpy, Pandas, MatplotLib, MERN stack, Git, NextJS, PyTorch, Django, Kubernetes, Docker
- **Exposure:** Bash, Linux Kernel Programming, VerilogHDL, MIPS, XHR, AJAX, MQTT, GCP

Volunteering

- **Coordinator, Programming Club IITK** (*Mar '23 - Apr '24*))
  - Managed one of the most active clubs of IIT Kanpur which delves into the multiple domains of programming
  - Worked on open source projects targetting the campus community such as **StudentSearch** and **PuppyLove**
  - Organised Linux install fest, **Spring Camp** (2 weeks of workshops across 5 domains) and **Opportunity Open Source conference with Canonical and Linux Foundation** for the benefit of the Campus Programming Community.
  - Mentored $\tilde{1}5$ students to get introduced to the concepts of Operating Systems and understanding the Linux Kernel.
- **Secretary, Programming Club IITK** (*Sep '22 - Mar '23*)
  - Assisted in conducting competitions, activities, lectures, and workshops for programming enthusiasts in IIT Kanpur.
- **Student Guide, Counselling Service IIT Kanpur** (*Sep '22 - May '23*)
  - Mentored a group of 6 freshmen academically and emotionally to get acclimatized to the new college environment