Shrey Bansal

Senior Undergraduate, Department of Computer Science and Engineering

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Education

Indian Institute of Technology, Kanpur — Kanpur, India
Bachelor of Technology, Computer Science and Engineering; CPI: 8.9/10 — *2021 - 2025*

Green Valley High School — Vadodara, India
CBSE Class XII; Grade: 96.6% — *2019 - 2021*

Navrachana School Sama — Vadodara, India
CBSE Class X; Grade: 98.2% — *2018 - 2019*

Scholastic Achievements

- Received the **Academic Excellence Award, IIT Kanpur** (Top 10%) for two consecutive academic years (2022, 23)
- Secured an **All India Rank 174** in **JEE Advanced 2021** among 142k students (2021)
- Secured an **All India Rank 238** in **JEE Main 2021** among 939k students (2021)
- **KVPY Fellowship**, securing **All India Rank 342(SX)** and **511(SA)** conducted by **IISc Banglore** (2020, 21)
- **State Topper, IOQP** - Among **Top 1%** in State - conducted by **IAPT** (2021)

Work Experience

Microsoft — May'24 - Jul'24
Software Engineer Intern — *Noida, India*
- Contributed to the PowerPoint Online Team by developing an **advanced slide editing canvas** for the WebApp
- Engineered a **feature-rich text editor** with functionalities like superscript, subscript, pattern fill, and strike-through
- Managed the **end-to-end text editing pipeline**, including user input detection, data processing, and rendering effects
- Collaborated with **international teams** to develop and deliver resilient code with **multiple fallback** mechanisms

Vibinex — Jun'23 - Aug'23
Software Development Intern — *Remote*
- Implemented a **CI/CD pipeline** using **GitHub Workflows** to automate **deployment process** of the extension
- Utilized GitHub Workflows to **trigger the pipeline** whenever a **pull request is merged** into the main branch
- Developed a feature **in Rust** to assess the **impact of pull request changes** on a codebase's **dependency graph**, utilising existing Language Servers to enable precise **evaluation of relevance** for a specific user

NOCIW — May'23 - Aug'23
Full-Stack Android Development Intern — *Remote*
- Engineered a **location-based** feature in a **React Native App** to dynamically identify and categorize nearby users with similar interests, enhancing user engagement by displaying personalized results
- Designed and upgraded various features to display local business' information on the **community platform**
- Made the feature for users to **claim rewards** based on their collected points, as well as view their upcoming rewards
- Developed a voice messaging feature for a chat application, storing audio as **base64 strings** on **AWS S3 Bucket**, and implemented real-time playback with waveform visualization to enhance user interaction

Publications

[1] S. Saklani, C. Goel, S. Bansal, Z. Wang, S. Dutta, T. M. Athawale, D. Pugmire, and C. R. Johnson. "Uncertainty-informed volume visualization using implicit neural representation". In *Proceedings of the IEEE Workshop on Uncertainty Visualization: Applications, Techniques, Software, and Decision Frameworks*, 2024. doi: 10.48550/arXiv.2408.06018

Research Experience

Data Race Detection in GPUs — Aug'24 - Dec'24
Undergraduate Research Project, Prof. Swarnendu Biswas
- Reviewed several papers to build a foundation for developing an approach to predict data races in GPU environments
- Utilized **NVBit** to generate program trace of micro-benchmarks and large GPU programs via binary instrumentation
- Designed and implemented an offline algorithm to detect predictable data races from the generated trace files
- Ensured soundness by testing on microbenchmarks and detected more races on larger benchmarks than SOTA detectors

Uncertainty-aware Volume Data Modeling and Visualization — Jan'24 - Apr'24
Undergraduate Research Project, Prof. Soumya Dutta — *Publication*
- Leveraged Uncertainty-Aware Deep Neural Networks to efficiently compress and store extensive volumetric data
- Incorporated **Residual Layers**, activation functions such as **SIREN**, and **LR Decay** in the network architecture
- Compared the accuracy and efficiency of three methods of compression: Deep Ensemble, MC dropout, and Evidential
- Utilized PSNR along with volume rendering and distance metrics within isocontour analysis to assess the accuracy
- Performed visual rendering of regenerated volumetric data using **ParaView** with uncertainty-based coloring

Teaching Experience

Tutor Aug'24 - May'25
ESC 111/112 (Fundamentals of Computing)
- Guided **60 undergraduate students** through foundational programming concepts and led **tutorial sessions** pertaining to topics in C programming
- Assisted in **designing problem sets**, ensuring alignment with course objectives and fostering problem-solving skills
- Organized **coding labs**, enabling students to apply theoretical knowledge in practical scenarios, reinforcing their understanding of core computing principles
- Contributing to the creation and evaluation of mid-semester and final assessments by grading assessments

Key Projects

Pipelining MIPS Simulator Apr'25 - Apr'25
Course Project (Computer Architecture, IIT Kanpur), Prof. Mainak Chaudhuri
- Developed a **pipelined 5-stage MIPS integer unit simulator**, from a multi-cycle, unpipelined design
- Implemented interlocked pipeline control to handle hazards, including stall mechanisms and phased execution
- Integrated a full bypass (forwarding) network within the simulation, reducing average CPI from **5.0 to 1.01**

Code Optimization Aug'24 - Nov'24
Course Project (Programming for Performance, IIT Kanpur), Prof. Swarnendu Biswas
- Accelerated CPU performance with SIMD vectorization (**SSE4, AVX2**) and advanced loop transformations (permutation, tiling, unrolling, LICM), cutting runtime from **1.3s to 100ms**
- Optimized GPU kernels with CUDA and Thrust, achieving **16x speedup** for stencil and convolution patterns
- Built **concurrent data structures** (open-addressing hash table, lock-free stack) with fine-grained concurrency

BtrFS MysticClones Feb'24 - Apr'24
Course Project (Linux Kernel Programming, IIT Kanpur), Prof. Debadatta Mishra
- Implemented **Copy-on-Write (CoW)** for **page cache** of cloned files in Linux Kernel, focusing on **btrfs** filesystem
- Handled reading, writing, deleting, and truncating operations for cloned files, ensuring correctness and consistency
- Utilized inode locks to address **multithreaded scenarios** and **FIO** for benchmarking multithreaded operations
- Achieved notable **reductions in latencies** during file read and write operations, enhancing the overall performance

Sssnakelyzer Feb'24 - Apr'24
Course Project (Compiler Design, IIT Kanpur), Prof. Swarnendu Biswas *Project*
- Developed a **Python to x86-64 compiler**, employing **Flex** and **Bison** as lexer and parser alongside **C++**
- Implemented support for static typing, string, lists, function calls and recursion along with OOPs and inheritance
- Translated 3AC Intermediate Code into **executable x86 Assembly** code, facilitating seamless execution with **gcc**
- Achieved top performance as a team by scoring **100% marks** across **all milestones** and **overall implementation**

GemOS Jul'23 - Nov'23
Course Project (Operating Systems, IIT Kanpur), Prof. Debadatta Mishra *Project*
- Implemented system critical syscalls like **strace** and **ftrace** using **circular buffers** in GemOS
- Implemented memory management syscalls like **mmap, munmap** and **mprotect** as well as APIs for **malloc** and **free**
- Crafted lazy allocation strategies and developed vm area page fault handler in a 4-level paging system
- Implemented **cfork** syscall along with a **Copy-on-Write (CoW)** fault handler for efficient memory management

Positions of Responsibility

Technical Secretary Feb'23 - Jan'24
Association for Computing Activities, IIT Kanpur
- Organised events such as Happy Hour, Farewell, ACA Projects, and Summer School for CSE department students

Events Secretary Jun'22 - Apr'23
Entrepreneurship Cell, IIT Kanpur
- Organized the Annual Flagship event E-Summit'22 along with 20 secretaries, hosting and managing several competitions

Technical Skills

- **Languages:** C, C++, CUDA, Rust, Python, SQL, JavaScript, Bash, Verilog HDL, Assembly Language, MIPS
- **Development:** Typescript, React.js, Next.js, Node.js, Express.js, MongoDB, React Native, HTML, CSS
- **Libraries:** Sklearn, NumPy, Pandas, Matplotlib, PyTorch, TensorFlow, Keras, Seaborn, OpenAI
- **Tools:** LaTeX, Docker, SQLite, PostgreSQL, NVBit, Git, Tailwind CSS, Autodesk Inventor, Bootstrap, Ghidra

Key Courses Undertaken

Computer Organization	Operating Systems	Theory of Computation
Introduction to ML	Linux Kernel Programming	Parallel Computing
Compiler Design	Computer Networks	Programming for Performance
Principles of DBMS	Computer Architecture	Introduction to RL
Big Data Visual Analytics	Logic for CS	Probability for CS
Data Structures and Algorithms	Advanced Algorithms	Discrete Maths for CS