Shivam Kumar

Computer Science Undergraduate
Indian Institute of Technology, Kanpur

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Educational Qualifications

Year	Degree	Institution(Board)	CGPA/%
2021	B.Tech, CSE	Indian Institute of Technology, Kanpur	9.4/10.0
2017	AISSCE – XII	Sunbeam English School Bhagwanpur (CBSE)	96.4%
2015	AISSE – X	Pristine Children's High School (CBSE)	10.0/10.0

Scholastic Achievements

- **Academic Excellence Award**, awarded twice for outstanding academic performance in year '17-18 and '18-19
- **Ram Prakash Chopra Memorial Scholarship**, awarded for exceptional academic record as a sophomore
- **All India Rank 348**, JEE Mains
- **All India Rank 715**, JEE Advanced
- **KVPY Scholarship Awardee**, amongst 50000 candidates
- **Top 1%**, National Standard Examination in Physics, U.P.

Work Experience

E-Trading Team, JP Morgan & Chase *Mumbai (Remote)*
Quantitative Research Intern May'20 - Jul'20

- Employed several Univariate **feature selection tests** for the analysis of existing baseline price prediction model
- Used feedforward and recurrent neural networks (**LSTM**), linear as well as non-linear **regression** to improve accuracy
- **Standardized** data for optimizing parameterization of individual features, yielding significant improvement
- Implemented several L1 as well as L2 features
- Improved model predictive power by **40%** for HK names

Research Experience

Data Race Detection, Task-Parallel Programs *IIT Kanpur*
Supervisor: Prof. Swarnendu Biswas Jun'19 - Present

- Implemented a SOTA algorithm FastTrack for Task Parallel Programs, using **LLVM** pass for memory instrumentation
- Created an **optimized** form of FastTrack called FastRacer by reducing space as well as time overhead of metadata operations making it execute on all real-world benchmarks
- Designed a **novel** algorithm Tasker by integrating the space efficiency of a popular tree-based technique PTracer with the cheap data race checking of **vector-clock**-based FastRacer
- FastRacer achieved speedup of **1.46X** and Tasker **1.48X** on 128GB-Intel Xeon system with PTRacer as baseline
- Paper based on the research work is under review

Publications

[1] Shivam Kumar, Anupam Agrawal, Swarnendu Biswas. *Efficient Data Race Detection of Structured Task Parallel Programs Using Vector Clocks*. Submitted to OOPSLA conference on Object-Oriented Programming, 2021.

Skills

Languages: C/C++, Python, Haskell, Java, JavaScript, PHP
Utilities: Linux Shell Utilities, Git, LaTeX, Vim, MySql, MongoDB, Numpy, Pandas, Tensorflow, LLVM

Relevant Courses

Operating Systems	Advanced Algorithms	Machine Learning	Advanced Computer Architecture
Compiler Design	Data Structures and Algorithms	Modern Cryptology	Programming for Performance
Database Systems	Discrete Mathematics	Theory of Computation	Parallel Computing
Computer Organization	Statistical Natural Language Processing	Comp. LabI (Bash+Haskell)	Comp. LabII (LAMP+MERN)

Projects

Java Compiler `github.com/shivamkm/java-compiler`
Course Project(CS335), Prof. Swarnendu Biswas Jan'20 - Apr'20

- Designed **lexer** and **parser** of a java compiler using **PLY** framework, printing Abstract Syntax Tree(AST) as output
- Added support for the **symbol table** structure
- Extended the compiler to generate **3-address code(3AC)**
- Provided support for functions, classes, interfaces etc.

Cipher Decoder `github.com/shivamkm/decipher`
Course Project(CS641), Prof. Manindra Agrawal Jan'20 - Apr'20

- Implemented decryption algorithms for multiple ciphers including **Caesar, Permutation-Substitution, Vigenere**
- Implemented Differential Cryptanalysis of Data Encryption Standard(**3-DES**) assuming standard key scheduling

Building GemOS `github.com/shivamkm/gemOS`
Course Project(CS330), Prof. Debadatta Mishra Aug'19 - Nov'19

- Implemented file system calls like open(), read(), write() etc.
- Implemented mmap(), munmap() and mprotect(), while handling **lazy allocation** and **pagefaults**
- Implemented syscalls like cfork() and vfork(), taking care of **copy-on-write** mechanism on shared memory regions

Machine Learning `github.com/shivamkm/machine-learning`
Course Project(CS771), Prof. Purushottam Kar Aug'19 - Nov'19

- Employed algorithms like **SGD**, Coordinate Maximisation, Coordinate Descent etc. for a binary classification problem
- Implemented a **CNN** with linear layers to solve the given image classification problem using **Keras**
- Built a recommendation system using **multi-label** classifier Bonsai with suitable changes to reduce the time overhead

Mobile App `github.com/shivamkm/mobile-app`
Course Project(CS252), Prof. Nisheeth Srivastava Aug'19 - Nov'19

- Built a fully-functional **MERN** application with Secure Login Management Protocol
- Employed MongoDB, Express.js with Node.js on server-side and React-native on client side
- Used mobile-native functionalities like camera and gallery

SAT Solver `github.com/shivamkm/sat-solver`
Course Project(CS202), Prof. Subhajit Roy Aug'18 - Nov'18

- Implemented a SAT Solver for propositional logic in python using Davis Putnam Logemann Loveland (**DPLL)** algorithm
- Encoded **diagonal sudoku** problem in DIMACS form using propositional logic and solved it using self-coded SAT solver

Positions of Responsibility

Academic Mentor, *Counselling Service, IIT Kanpur, 2018-19*
Secretary, *Dramatics Club, IIT Kanpur, 2018-19*