

Deepak Mathur

Department of Computer Science & Engineering
Indian Institute of Technology, Kanpur

✉ deepakm22@iitk.ac.in / 📞 +91-7985748986
📧 Deepakmathur09 / 📺 deepakmathur

EDUCATION

Year	Degree/Certificate	Institute	CPI/%
2022-Present	M.Tech/Computer Science & Engg.	Indian Institute of Technology, Kanpur	9.33/10
2018-2022	B.Tech/Computer Science & Engg.	Rajkiya Engineering College, Kannauj	8.83/10
2015-2017	CBSE(XII)	Maharishi Vidya Mandir, Prayagraj	83.5%
2014-2015	CBSE(X)	Maharishi Vidya Mandir, Prayagraj	8.8/10

RESEARCH EXPERIENCE (M.TECH THESIS)

- **Neural Invariant** | Guide : Prof. Subhajit Roy (Feb'23 - Present)
Pytorch, z3solver, Scikit-learn, Comet
 - Ensuring program verification through assessment of Loop invariants using **Hoare logic**
 - Trained a Neural network to function as a Loop invariant, generating datasets using z3solver.
 - Integrated comet with ML model for production monitoring. .
 - Achieved an impressive **accuracy of approximately 0.99**.

ACADEMIC PROJECTS

- **Insights for Restaurant Industry Enhancement** (CS661) | Instructor : Prof. Soumya Dutta (Feb'23 - May'23)
HTML, CSS, JavaScript, and Apache Echarts.js
 - Employed **data visualization** to analyze the Zomato dataset, extracting customer behavior insights and **devising data-driven recommendations** to enhance restaurant business and customer experience.
 - Leveraged Kaggle's Zomato dataset containing **17 attributes** to create **dynamic** and **interactive visuals**.
 - The project employed various visualization methods, including Stacked Bar Charts, Stacked Line Charts, Doughnut Charts, **Cartesian Heat-maps**, and **Trees with Polyline Edges**.
- **Blockchain based Recruitment Management System** (CS731) | Instructor : Prof. Angshuman Karmakar (Feb'23 - May'23)
React, Node.js, MySQL, Solidity and Hardhat
 - Implemented **Ethereum smart contracts** with **Solidity**, integrated blockchain solutions into a Web-App using **Hardhat**.
 - Utilized blockchain for verifiable recruitment updates, transparent with candidate's status, and designed fair reward system for awarding points to companies and candidates based on their profile strength in DApp.
 - Executed **bonus component**, implementing **real-time email notifications** for candidates regarding new job postings, which significantly contributed to achieving the **outstanding score of 110/100**.
- **Escaping the Caves: Deciphering Cryptosystems** (CS641) | Instructor : Prof. Manindra Agrawal (Feb'23 - May'23)
 - Conducted in-depth analysis and decryption of various cryptosystems, encompassing **Substitution, Vigenere, Substitution-Permutation (SPN Structure), DES, EAEAE, and AES**.
 - Utilized a range of sophisticated cryptanalysis techniques, including **frequency analysis, differential cryptanalysis, lattice-based methods, and brute force**, to exploit weaknesses within these cryptographic systems.
- **Smart Street-Lighting** (CS667A) | Instructor : Prof. Priyanka Bagade (Aug'22 - Nov'22)
Arduino UNO, raspberry Pi, LoRa, GPS Module, PIR and LDR sensor and, IC
 - Prototyped a **cost-effective** smart street-lighting system with a scalable **LoRa two-tier architecture**.
 - **Improved energy efficiency and LED fault detection**, surpassing ZigBee and BLE limitations.
 - Showcased potential seamless node-to-node communication and integration within existing infrastructure.
- **Program Analysis, Verification and Testing** (CS639) | Instructor : Prof. Subhajit Roy (Aug'22 - Nov'22)
Kachau framework and Python
 - Performed **Dataflow analysis** on intermediate representation(IR) to generate **optimized kachua programs**.
 - Conducted input mutation for comprehensive path coverage, employing **fuzzing techniques**.
 - Employed **Symbolic Execution** to derive unspecified constants within a program, achieving semantic equivalence.
 - Ranked program statements based on their potential for containing faults using **SBFL techniques**.
- **CAPTCHA Crack System** (CS771A) | Instructor : Prof. Purushottam kar (Aug'22 - Nov'22)
OpenCV and Scikit-learn
 - Applied **HSV model** to identify background pixels, enhancing CAPTCHA text character detection on a dataset of size 2000.
 - Developed **brightness-based thresholding** for accurate character-background and segmented images into individual characters
 - Trained **multiclass SVM model** using flattened image data for precise character classification with an **accuracy of 100%**.
- **Program Repair by Error Classification** (CS771A) | Instructor : Prof. Purushottam kar (Aug'22 - Nov'22)
Imblearn and Scikit-learn
 - Addressed highly imbalanced dataset using the **SMOTE function**
 - Explored multiple classification techniques, including **One-vs-All (OvA), Decision Trees (DT), and Random Forests**.
 - Evaluated model performance using metrics such as **pred@k** and **mpred@k** (k ranges from 1 to 5), alongside file size analysis.
 - Achieved superior outcomes with OvA employing l2 penalty regularization, surpassing the performance of other models.
- **Linear Model Feasibility for 3-PUF-XOR Predictions**(CS771A) | Instructor : Prof. Purushottam kar (Aug'22 - Nov'22)
 - Established **mathematical mapping** of binary digits to signs and vice versa to reveal XOR function's inherent product nature

- Trained using **Primal Mini Batch Sub Gradient Descent SVM**, achieving an impressive **Average Hinge Loss Error of 0.84** and **Average Misclassification Error of 0.03**.

SCHOLASTIC ACHIEVEMENTS AND EXTRA-CURRICULAR

- Received the **Academic Excellence Award** for exceptional academic performance in IIT-Kanpur (2022)
- Secured **All India Rank 199** in GATE CS, in a cohort of approximately 80,000 candidates. (2022)
- **Distinction** in Undergraduate studies at AKTU. (2022)

POSITIONS OF RESPONSIBILITY

- **Teaching Assistant** : Theory of Computation (CS340) (Jul'23 - present)
- **Student Guide** : Facilitated new student orientation and offered guidance for acclimatizing to the campus. (Jul'23 - present)
- **Teaching Assistant** : Fundamentals of Computing (ESC111/112) (Nov'22 - Jul'23)

RELEVANT COURSES

(* received highest possible grade(10))

- **Mtech Courses** : Program Analysis Verification & Testing* | Introduction to Internet of Things and its Industrial Applications* | Introduction to Machine Learning | Modern Cryptology | Blockchain Technology and Application | Big Data Visual Analytics.
- **Btech Courses** : Programming for problem-solving* | Data Structures & Algorithms | Operating Systems | Computer Networks* | Database Management System | Web Technology*.
- **Languages/Libraries/Utilities** : C, C++, Python, Scikit-learn, Pytorch, React.js, Node.js, Git, SQL, ~~FF~~TeX.