Prateek Kumar Pandey

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Academic Qualifications

Year	Degree/Certificate	Institute	CGPA/%
2020 - 2025	B.Tech. + M.Tech. (CHE)	Indian Institute of Technology Kanpur	PG: 9.00, UG: 7.81
2020	CBSE (XII)	NBF Public School, Jaipur	94.20%
2018	CBSE (X)	NBF Public School, Jaipur	95.00%

Research Experience

Simulation of Electrical Double Layers | Master's Thesis *Jan'24 - Present*

Supervised by: Prof. Vishal Agarwal (Dept. of CHE) & Prof. Swarnendu Biswas (Dept. of CSE)

- Development of novel, fast, & parallelized algorithms to enhance performance in simulations of **Electrical Double Layers**
- Implemented **Particle Mesh Ewald Summation** algorithm in **C** to calculate potential energies acting in an ionic system
- Optimized **3D Ewald** Summation using Fast Fourier Transform, reducing computational complexity from $O(N^2)$ to $O(NlogN)$
- Deployed **OpenMP** directives to parallelize the code, significantly improving execution speed and computational efficiency
- The code was benchmarked by computing the potential energy for particle systems of different sizes using **LAMMPS**
- Extended the approach to **2D Ewald**, employing the **gsl-integration** library for calculations of reciprocal space energies
- Future work will focus on refining computationally intensive tasks using algorithmic techniques and mathematical methods

Work Experience

Summer Intern | Colgate-Palmolive India Ltd., Chennai *May'23 - Jul'23*

Objective	• Development of an **Automatic Line Scheduler** to optimize production plans at Colgate's manufacturing units
Approach	• Compiled an exhaustive **BOM** for SKUs produced at the facility, facilitating precise & efficient line scheduling • Identified production workflow bottlenecks affecting the **packaging**, **moulding**, **T&ER**, & **cream-making** • Devised an **Excel VBA** model integrating process **bottlenecks** across various **production line segments** • Implemented minimum **changeover cost** & **time** as critical constraints, **optimizing** manufacturing operations
Result	• Enhanced scheduling using **solver functions**, leading to an efficient **production plan** & **resource utilization** • Delivered a fully automated tool that optimizes **monthly production planning** & **daily machine scheduling** • The tool efficiently manages the daily production of ∼**1.5M toothbrushes** and ∼**1 lakh tubes of toothpaste**

Projects

cp: course project | sp: self project

Linking Writing Processes to Writing Quality [cp] *Oct'23 - Nov'23*

- Analyzed essay data with **Pandas** & **Seaborn**, focusing on the writing process metrics & their correlation with essay scores
- Engineered features like action times, word counts, cursor positions, & statistical summaries (mean, max) using **Numpy**
- Deployed models using **Scikit-learn**, **LightGBM**, **XGBoost**, & **CatBoost** libraries, to predict the essay scores
- Refined model hyperparameters with **Optuna** & **ensemble methods**, attaining a top Cross Validation RMSE of **0.638332**

Automated Exploratory Data Analysis [sp] *Jul'23 - Aug'23*

- Streamlined the data preprocessing & analysis workflow for datasets provided by users employing **Python** & **Streamlit**
- Utilized **NumPy** & **Pandas** libraries to handle data preprocessing tasks & create a preliminary summary of the dataset
- Created & deployed a user-friendly interface using **Matplotlib** & **Streamlit**, allowing users to perform thorough EDA
- Delivered an innovative tool that empowers users to extract valuable insights from their data, enabling well-informed choices

Pairs Trading Strategy [sp] *Jun'23 - Jul'23*

- Engineered data-driven **Quant Trading** strategies in **Python**, leveraging 6 years of historical data for Indian equity stocks
- Identified the top 10 stock pairs through **cointegration analysis**, ensuring stationary time series for robust trading signals
- Calculated **hedge ratio** with linear regression & normalized spread using moving average to capture buy, sell, & exit positions
- Implemented **distance** & cointegration approaches on market data to accurately select optimal securities for **pair trading**

Rustduino | Electronics Club, IIT Kanpur *May'21 - Jul'21*

- Built a generic, fast & memory efficient **Hardware Abstraction Library (HAL)** & **Communication Control Library**
- Aimed at building libraries in the **Rust** programming language specifically for the **ATmega328p** & **ATmega2560p** chips
- Optimized the program, achieving a **67%** improvement for the ATmega328p chip & a **62%** improvement (in terms of memory utilization) for the ATmega2560p chip by **directly interfacing** the Arduino boards using Rust language's features

Technical Skills

Programming Languages	Software and Tools
C/C++, MATLAB, Python, Rust, Bash, SQL	Aspen Plus, COMSOL, DWSIM, LAMMPS, OpenMP, Git, tensorflow, Excel

Relevant Courses

*: Ongoing

Intro to Machine Learning	Probability & Statistics	Data Mining & Knowledge Discovery
Statistical Mechanics	Intro to Quantum Mechanical Methods	Deep Learning for Chemical Engg.*
Macro-Economics	Introduction to Electronics	Introduction to Economics

Positions of Responsibility

- **Teaching Assistant** for Chemical Engineering Design (CHE453), aiding a seamless lecture & lab experience for 105 students
- Efficiently organized lectures, managed resources, & guided freshers as **Secretary** of the Electronics Club, IIT Kanpur
- As a **Student Guide** mentored 6 freshmen, helping them adapt academically, socially, & personally to institute's environment