

Shreyansh Pachauri

B.Tech Graduate, Indian Institute of Technology Kanpur
Major: Chemical Engineering | Minor: CSE (Machine Learning Applications)

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ACADEMIC QUALIFICATIONS

Year	Degree	Institute	Performance
2024	B. Tech	Indian Institute of Technology, Kanpur	7.6/10.0
2020	ISC (XII)	Dr. Virendra Swarup Education Centre, Kanpur	97.75 %
2018	ICSE (X)	Dr. Virendra Swarup Education Centre, Kanpur	95.8 %

ACHIEVEMENTS

- Received an **On-Campus Placement Offer** from **Indxx**, a **FinTech** Firm and a leading **global index provider** 2023
- Received **A* grade** in a class of more than 100 students for excellent performance in the course **Introduction to Indian Society**. 2021
- Secured an **All India Rank 3008** and **3872** in **JEE Advanced 2020** and **JEE Mains 2020** among **11 Lakh** candidates. 2020
- Conferred with **Inspire Scholarship** granted by **Government of India** to **Top 1%** students in **Class XII ISC** examinations. 2020

PROFESSIONAL EXPERIENCE

Machine Learning Engineer Intern | Embifi Global Services Pvt Ltd (Jan'23 - Jun'23)
B2B FinTech Startup, provider of API-enabled white label solutions for financial institutions

Objective	- Analyse the Risk associated with Loans based on the Repayment History of the Borrower using statistical scoring - Develop a dynamic scoring model to track the performance of a borrower and the Expected Loss on a Loan
Approach	- Designed a Behavioral Scoring Model using ANNs to track the probability of default of existing loan customers - Implemented Data Augmentation through SMOTE to handle Imbalanced Training Data of 30000 labelled examples - Developed a framework to extract the Features from the MongoDB Collections using the Customer ID as input - Worked on the backend deployment of the model on AWS-EC2 Server by creating a REST-API to predict the Score
Impact	- Planned and worked on the overall implementation of the Model Pipeline to analyse the borrower's performance on a loan - Boosted the risk prediction accuracy and speed , optimizing loan recovery decisions and minimizing the potential losses

RESEARCH EXPERIENCE

Curiosity driven Exploration by Self Supervised Learning
Mentor: Prof. Ashutosh Modi | Department of Computer Science Engineering | IIT Kanpur (Mar'24 - Apr'24)

Objective	- To implement the Intrinsic Curiosity Module based Exploration algorithm on various OpenAI Environments - To experiment with the ICM module and try to improve the already existing Curiosity-driven exploration methods
Approach	- Carried out a thorough literature review on papers that involve solving a DRL Problem using Curiosity-driven Exploration - Experimented ICM with Cartpole, Mountain Car, Acrobat and Lunar Lander with DQN, A3C and PPO as base algorithms - Proposed a generalized Kernel-based formulation of the Curiosity driven Intrinsic Reward Signal in the ICM Module
Impact	- Obtained better performance in Extremely Sparse Reward environments like Mountain Car with ICM exploration - Improved the performance of ICM by using RBF Kernel based formulation of the Curiosity driven Intrinsic Reward Signal

Critical Points Search in Multi-Dimensional Potential Energy Surfaces using Active Learning
Mentor: Prof. Nitin Kaistha | Department of Chemical Engineering | IIT Kanpur (Jan'24 - Apr'24)

Objective	- Develop ML based algorithm to accelerate search for saddle points in Potential Energy Surfaces for atomistic simulations - Reducing the number of Function Evaluations while locating the Saddle Point to improve the speed of the algorithm
Approach	- Carried out a thorough literature survey to understand various methods of Probabilistic Regression to model a surface - Implemented Gaussian Process Regression to model a surface using given function and function-derivative values - Developed an algorithm to locate the Local Extremas reducing the function evaluations to 1/10th of Gradient Descent

QoS - Driven Scheduling in 5G Radio Access Networks using Deep Reinforcement Learning
Mentor: Prof. Thirumulanathan D. | Department of Economic Sciences | IIT Kanpur (Jun'23 - Aug'23)

Objective	- Develop an RL framework for 5G scheduling that selects best scheduling rule at each TTI to fulfil scheduling objectives
Approach	- Carried out a thorough literature survey on papers that involve solving a multi-objective problem using Deep RL - Investigated a multi-objective optimization problem for QoS satisfaction, which is more challenging than classic RRAC - Studied implementation of Dynamic Programming and AC-RL Framework to maximize the QoS satisfaction at each TTI

Simulating Non-Spherical Particles using Discrete Element Method Algorithms in C++
Mentor: Prof. Anurag Tripathi | Department of Chemical Engineering | IIT Kanpur (Jan'23 - Apr'23)

Objective	- To simulate the motion of a Single Non-Spherical Particle inside a Closed Box using the Multi-Sphere Model
Approach	- Examined NBS, NBS-Munjiza, Hierarchical Contact Search Algorithms and other Broad Search DEM Algorithms - Studied the already existing DEM C++ code for simulating the motion of moving Spherical Particles in a Closed Box - Inspected the C++ implementation of Non-Spherical particles in open-source softwares LIGGGHTS and MUSEN
Impact	- Implemented the Multi-Sphere Model through Quaternions using OOPS for simulating the Non-Spherical Particles - Interpreted and obtained visualization of simulations of a moving Non-Spherical Particle using GNUPlot Graphing Tool

Research Intern | Associated with Department of Science & Technology, Govt of India (Dec'22 - Jan'23)

Objective	- Design the algorithms for working of a Low-Cost Land Area Measuring Device via Digital Signal Processing
Approach	- Designed an Offset Sensor Optical Encoder to calculate the distance travelled by the device with error less than 10 cm - Explored Moving Averages and Exponential Filter methods to measure angle change accurately using Gyrosensor - Used Kalman Filter to remove noise from the Gyrosensor data to accurately measure the change in orientation of device - Studied application of Numerical Integration methods over acceleration data to calculate Horizontal Displacement
Impact	- Measured the displacement and orientation of the device accurately upto 1% via Digital Signal Processing

KEY PROJECTS

Deep Reinforcement Learning | CS780: Intro to DRL | Instructor: Prof Ashutosh Modi | CSE, IIT K (Jan'24 - Apr'24)

Objective	- To learn and implement various State of the Art RL and DRL algorithms on various OpenAI Gym environments
Approach	- Implemented Exploration Strategies like Epsilon Greedy , Softmax and UCB over 2 different Bandit Environments - Used Dynamic Programming to learn the Optimal State Values and Optimal Policy in a Random Maze Environment - Tested Monte Carlo Control , SARSA , SARSA(λ) , Q-Learning , Double-Q learning , Trajectory Sampling - Implemented NFQ , DQN , DDQN , D3QN-PER , VPG and REINFORCE on Mountain Car & CartPole Environment - Implemented DDPG , TD3 and PPO algorithms on Pendulum, Hopper and Half Cheetah Environments on Open AI Gym
Impact	- Analysed the results of various Deep-RL Algorithms implemented from scratch over various Open-AI Gym Environments

HexaCAPTCHA | CS771: Intro to Machine Learning | Instructor: Prof Purushottam Kar | CSE, IIT K (Jun'23 - Jul'23)

Objective	- To predict the parity of the hexadecimal numbers given on Captcha images minimizing the total Model Size
Approach	- Used techniques like image dilation , erosion and morphological transformations for preprocessing of captcha image - Implemented K-Means Clustering for segregating the digits and extracting out the last digit of the 500 x 100 image - Trained a Convolutional Neural Network to predict the parity of the processed and extracted captcha image
Impact	- Obtained a Convolutional Neural Network Model with 97.75% accuracy and a model size of 7.5 MB

Fake News Classifier | ECO765: ML for Economists | Instructor: Prof Thirumulanathan D | ECO, IIT K (Mar'23 - Apr'23)

Objective	- Build a Fake News Classifier using Natural Language Processing on a dataset containing labelled data of articles
Approach	- Used TensorFlow framework to implement LSTM to build a fake news classifier using various NLP algorithms - Performed lemmatization on the dataset and created one hot representation using various functions of the NLTK library - Built a multi-layer DNN , added Dropout layers to reduce overfitting and cross-validated using N-Fold Cross Validation
Impact	- Implemented the GridSearchCV function to optimize the model's hyper-parameters and achieved an accuracy of 90.6%

Sparse PUF Cracker | CS771: Intro to Machine Learning | Instructor: Prof Purushottam Kar | CSE, IIT K (May'23 - Jun'23)

Objective	- To build a ML model to breach conditional delay unit(CDU) security built using physical unclonable functions (PUFs)
Approach	- Developed linear models using projected gradient descent , lasso relaxation and mini-batch stochastic descent methods
Impact	- Achieved an R^2 Score of 0.97 using Projected Gradient Descent in breaking Sparse PUF on every CDU security question

MINOR PROJECTS

Introduction to ML in Chemical Engineering | SimuTech, Dept of CHE, IIT Kanpur (Dec'22 - Jan'23)

- Mentored a group of 50 students introducing them to **Machine Learning** and its application in **Chemical Engineering**.
- Introduced the Mentees to **Locally Weighted Regression**, **Generalized Linear Models** and **K-Means Clustering**.
- Acquainted the mentees to various Data Cleaning and Data Preprocessing Methods on a Dataset of **Air Quality Index**.
- Introduced the **modelling** of Relative Humidity based on 13 Air Quality factors using **Regression**, **KNN** and **Neural Networks**.

ML-enabled DEM Framework | Course Project: CHE616 | IIT Kanpur (Mar'24 - Apr'24)

- Performed **Literature Review** of various **Geometrical Methods** which are used to model Non Spherical Particles in DEM
- Performed **Literature Survey** on ANN based Contact Detection and Resolution and developed a ML-enabled DEM framework
- Compared the performance of **ANN-based DEM** and **Geometrical DEM** in various Experiments of Granular Mechanics

Recommender Systems and Unsupervised Machine Learning | Coursera Project (Jan'22 - Feb'22)

- Implemented the **Collaborative Filtering** algorithm to build a **Recommender System** based on **movie ratings**.
- Applied the **K-means clustering** algorithm for **Image Compression** and **compressed the images** by **factor of 6**.
- Implemented the **PCA** algorithm on Face Images Dataset for **Dimension Reduction** and then recovered the same.

Reactor Sizing in Chemical Reaction Engineering | Course Project: CHE331 | Dept of CHE, IIT Kanpur (Mar'23 - Apr'23)

- Developed **MATLAB** code to compute minimum reactor volume based on **residence time** and **concentration** data
- Applied **reaction kinetics** and **reactor design equations** for different configurations, including **PFR** and **CSTR**
- Implemented appropriate **numerical techniques** to handle the given input parameters and **optimize** the reactor sizing
- Determined a minimal volume of **0.75 m³** for the combination of **PFR** and **CSTR** by analyzing the different reactor systems

RELEVANT COURSES AND TECHNICAL SKILLS

Skills	- Programming Languages: Python C++ C R Java Julia MATLAB Octave - Softwares: Git GitHub SQL MongoDB Simulink COMSOL LTE-Sim Aspen Plus Micro-Cap L ^A T _E X - Machine Learning and Data Science: Tensorflow PyTorch OpenCV NLTK Scikit-Learn PyMongo PySpark
Courses	Intro to ML ML for Economists Data Structure and Algorithm Deep Reinforcement Learning Probability & Statistics Fundamentals of Computing Numerical Methods Real Analysis Linear Algebra and ODE Chemical Process Control

MENTORSHIP EXPERIENCE

Deep Learning Applications in Chemical Engineering | SimuTech, Dept of CHE, IIT Kanpur (Feb'23 - May'23)

- Mentored **15 sophomores** on **Deep Learning** and its **CHE applications** with emphasis on mathematical understanding
- Generated an **ANN model** to predict the **adsorption capacity** of biomass ashes using C, H, N, Si and BET as input nodes
- Generated image dataset of two classes: **Laminar** and **Turbulent** Flow via performing simulations of fluid flow in **COMSOL**
- Trained the **ZF-Net** Architecture to classify between the types of fluid flows achieving an accuracy of 0.94 over the test dataset

Content Writer Intern | UnchaAI, EdTech Startup (Jun'21 - Aug'21)

- Worked as a **Content Writing Intern** at UnchaAI and wrote **15 detailed and well-researched** blogs for JEE aspirants.
- **Contacted** people from various backgrounds to perform research and present various perspectives of JEE preparation.

POSITIONS OF RESPONSIBILITY

Mentor, SimuTech | **Chemineers Society** | **IIT Kanpur** | *Chemical Engineering Departmental Student Body* (Jul'22 - Jun'23)

- Offered **2 SimuTech Projects** for the **academic** and **skill-based** growth of **450+** **UG & PG Chemical Engineering** Students
- Initiated **Winter Projects** to mentor **100+** **UG students** over various **ML algos** and their applications in Chemical Engineering
- Introduced the **mentees** to various **simulation softwares** and **Python Libraries** such as **COMSOL, PyTorch, OpenCV**

EXTRACURRICULARS

- Secured **2nd** Position in **TechWeek'21**, an intra-college Technical Competition as a team of 5 out of **100+** participating teams.
- Achieved **2nd** Position in an intra-school **Hindi Poetry Writing Competition** organized on the occasion of Hindi Diwas 2018