Shreyansh Pachauri

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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 **ANN**s 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 $1/10^{th}$** 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 Network**s.

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** m^3 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 | LaTeX - **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 2^{nd} Position in **TechWeek'21**, an intra-college Technical Competition as a team of 5 out of **100+** participating teams.
- Achieved 2^{nd} Position in an intra-school **Hindi Poetry Writing Competition** organized on the occasion of Hindi Diwas 2018