Ayush Garg

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Personal Profile

Recent Master's in Robotics, Systems and Control graduate from ETH Zürich, with a specialization in machine learning (ML). Through rigorous courses and long-running projects, I have studied the underlying mathematics behind present-day state-of-the-art machine learning systems that are disrupting entire industries. I am excited to find new opportunities in Data Science and/or Machine Learning, where I can develop professional and industry-grade codebases, and apply my strong foundations and skills in ML research and engineering to tackle real-world use cases.

Education

ETH Zürich   *Zürich, Switzerland*

Master of Science in Robotics, Systems and Control (distinction)   *Sept 2019 - Sept 2021*

- **CGPA:** 5.86/6.0
- **Excellence Scholarship and Opportunity Programme (ESOP)** Scholar 2019
- **Relevant Courses:** Deep Learning, Guarantees for Machine Learning, Advanced Machine Learning, Probabilistic Artificial Intelligence, Optimization for Data Science, Computer Vision, Model Predictive Control, Autonomous Mobile Robots, System Identification, Embedded Control Systems, Advanced Topics in Control, Game Theory and Control

Indian Institute of Technology, Delhi   *Delhi, India*

Bachelor of Technology in Mechanical Engineering   *July 2015 - May 2019*

- **CGPA:** 9.5/10
- Ranked **2 out of 160** students in the department
- **IIT Delhi Semester Merit Award:** Conferred 5 times in 8 semesters
- **Relevant Courses:** Optimal Control and Reinforcement Learning, Nonlinear Systems, Statistics and Probability, Numerical Methods and Computations, Data Structures and Algorithms, Linear Algebra, Operations Research

Bal Bharti Public School Rohini   *Delhi, India*

High School   *Apr 2013 - March 2015*

- **All India Senior School Certificate Examination (AISSCE 2015):** 97.6/100
- Subjects: Physics, Chemistry, and Maths with Computer Science

Work Experience

IBM Research Zürich   *Zürich, Switzerland*

ML Research Engineer   *Dec 2021 - Oct 2022*

- **Neuro-symbolic AI:** Solved a Visual-Oddity Detection *cognitive task* by developing a novel Neuro-symbolic architecture based on distillation of underlying concepts from the query images.
- Authored data cleaning, data preparation and modeling code for the same using PyTorch.
- Reduced the computational complexity for inference **from quadratic (SOTA architecture) to linear**, using the novel architecture with no loss of oddity-detection accuracy, while improving interpretability of the model.

IBM Research Zürich   *Zürich, Switzerland*

ML Research Intern   *Sept 2020 - Mar 2021*

- **Automatic Speech Recognition:** Authored a custom ML pipeline in Python from scratch, curated for efficient training of state-of-the-art architectures for Automatic Speech Recognition like RNN-Transducer, using large-scale datasets like Switchboard-300h.
- Conceptualized and implemented a novel recurrent-unit: SNU-o (Spiking Neural Unit- Output). Deduced forward and backward pass operations and **authored custom CUDA C kernels** for efficient training of models using the novel unit. Integrated the kernels into our PyTorch codebase and brought down training time from **40 days to 7 days**.
- Demonstrated the benefits of our SNU-o over LSTM, in terms of latency and computational costs, in a publication at IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), Singapore 2022

Publications

Speech Recognition Using Biologically-Inspired Neural Networks   *Singapore*

International Conference on Acoustics, Speech, and Signal Processing 2022   *May 2022*

Thomas Bohnstingl, Ayush Garg, Stanisław Woźniak, George Saon, Evangelos Eleftheriou, Angeliki Pantazi

Certifications

Apache Spark Developer Associate   *New Delhi, India*
Databricks   *March 2023*
- In-depth understanding of the Spark DataFrame API, the Spark SQL Engine and the basics of the Spark architecture.

AWS Certified Machine Learning: Specialty   *Zürich, Switzerland*
Amazon Web Services   *Oct 2022*
- In-depth understanding of AWS machine learning (ML) services: Ability to build, train, tune, and deploy ML models using the AWS Cloud.

AWS Certified Cloud Practitioner: Foundational   *Zürich, Switzerland*
Amazon Web Services   *Sept 2022*
- Cloud fluency and foundational AWS knowledge: Ability to identify essential AWS services necessary to set up AWS-focused projects.

Technical Skills

Languages   **Proficient:** Python, C, C++, CUDA C, Bash. **Intermediate:** Java, SQL
Technologies   MLFlow, AWS Sagemaker, Apache Spark, Docker, Kubernetes, Git

University Projects

Hard Out-of-Distribution Detection   *Zürich, Switzerland*
ETH Zürich   *Feb 2020 - July 2020*
- Developed a **novel out-of-distribution (OOD) method** for VGG-based vision networks using ensemble-disagreement, for making predictions more robust and real-world deployment more reliable. Worked with datasets like MNIST, Fashion-MNIST, CIFAR-10/100 and Celeb-A.
- Authored a custom Tensorflow 2.0 codebase for data cleaning, preparation and ingestion for training VGG models using ETH Zürich's clusters.
- The work was later improved and *recently appeared in* The Conference on Uncertainty in Artificial Intelligence (UAI) 2022.

Deep Learning for Handwriting Synthesis   *Zürich, Switzerland*
ETH Zürich   *Sept 2019 - Jan 2020*
- Implemented the - then novel - machine translation architecture: **Transformers**, for use in a natural handwriting synthesis task from text inputs, using Tensorflow 1.0.
- Demonstrated its ability to synthesise handwritten characters from text, within one semester.
- Collaborated with a team of 3 students using Gitlab, for a project for the course: Deep Learning.

Reinforcement Learning for Markets   *Zürich, Switzerland*
ETH Zürich   *Sept 2019 - Jan 2020*
- Created a **deep reinforcement-learning** based solution (Deep Q-Networks) using Keras, for the course "Agent-Based Modeling and Social System Simulation" to simulate a double auction game in a cooperative setting

Achievements

2019	**Excellence Scholarship and Opportunity Programme,** One of three Indian students selected for ESOP '19	*Switzerland*
2018	**330/340,** Graduate Record Examinations (GRE). Analytical Writing: **5/6**	*India*
2018	**Research Internship for Young Academics, Ohio State University,** One of seven Indian students selected.	*USA*
2015	**All India Rank: 401,** Joint Entrance Exam - Advanced	*India*
2015	**All India Rank: 36,** Joint Entrance Exam - Mains	*India*
2014	**Final Round,** Indian National Chemistry Olympiad (INChO)	*India*
2014	**Final Round,** Indian National Physics Olympiad (INPhO)	*India*
2014	**Kishore Vaigyanik Protsahan Yojana 2014, All India Rank: 3,** National level high school students olympiad	*India*

Teaching Assistantship

Statistics and Probability, MTL108   *Delhi, India*
Undergraduate Teaching-Assistant, IIT Delhi   *Jan 2019 - May 2019*

Linear Algebra and Differential Equations, MTL101   *Delhi, India*
Undergraduate Teaching-Assistant, IIT Delhi   *Jan 2018 - May 2018*