Ayush Garg

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Professional Profile

I am a Master's in Robotics and AI graduate from ETH Zürich, with a specialization in Machine Learning (ML) research.

- Through mathematically-rigorous courses and long-running research projects, I have studied the underlying mathematics behind present-day state-of-the-art (SOTA) machine learning systems that are disrupting entire industries.
- Having done foundational work in a deep-tech startup and implemented SOTA NLP systems in production, I have developed a new passion for developing and deploying data-intensive applications at scale.

I am now excited to find new opportunities in ML Research/Engineering where I can develop professional and industry-grade ML systems and apply my strong foundations in research and engineering to tackle real-world use cases.

Work Experience

Datacy Inc.
San Francisco, CA, USA

Founding ML Engineer: 100% Remote — *June 2023 - Dec 2023*

- **Real-time content-tagging:** Developed and implemented an MLOps architecture for real-time tagging of live user-generated data (handling about **2M records per day**) using Terraform (IaC), Kubernetes (AWS EKS), AWS Sagemaker etc. and storing the results in AWS RDS implementing a PostgreSQL database server.
- Optimized costs and real-time performance metrics (latency and throughput) of the deployed SOTA deep-learning models for NLP (XLM-RoBERTa, DistilBERT, BART etc. from HuggingFace Hub) by compiling them using **torch-neuron**, for use on AWS Sagemaker endpoints with Amazon-Inferentia (inf1) chips designed for low-latency and low-cost inference.
- Solved a business use-case of identifying product-types from product-titles and descriptions by fine-tuning an XLM-RoBERTa large model pre-trained on the SQuAD 2.0 dataset (**560M parameters**) using Masked-Language-Modeling and Question-Answering training tasks.

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 query-input images. Implemented data cleaning, data preparation and modeling code for the same using PyTorch.
- Reduced the computational complexity for inference from **quadratic to linear** as compared to the SOTA architecture, 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 / Master Thesis Student — *Sep 2020 - Sep 2021*

- **Automatic Speech Recognition (ASR):** Authored a custom ML pipeline in Python from scratch, curated for efficient training of SOTA deep-learning based ASR architectures like **RNN-Transducer** and **LAS: Listen, Attend and Spell**, using **large-scale datasets like Switchboard-300h**.
- Designed and implemented a novel recurrent-unit: **SNU-O (Spiking Neural Unit-Output)** with drastically improved performance for ASR, by building on the successes of SNU: Spiking Neural Unit [2018]. Demonstrated its capabilities in a publication at ICASSP 2022.
- Improved training time for an RNN-T model based on our novel unit **from 40 days to 7 days** by deducing forward and backward pass equations and writing **custom CUDA-C kernels** for the same. Created PyTorch bindings for the kernels and integrated them into our codebase for training.

Patents & Publications

Graph Transformers without Positional Encodings
New Delhi, India

arXiv preprint arXiv:2401.17791 — *Feb 2024*

Ayush Garg

Neuronal Activity Modulation Of Artificial Neural Networks
Virginia, USA

United States Patent and Trademark Office: Patent Under Review — *June 2023*

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

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

Technical Skills

Programming Languages
- **Proficient:** Python, C, C++, CUDA C, Bash, SQL
- **Intermediate:** Java

Machine Learning Ops   AWS Sagemaker, Kubeflow, MLFlow, Apache Spark, PyTorch, Tensorflow, HuggingFace, Langchain

Software Engineering   Git, Docker, Kubernetes, PostgreSQL, Terraform, AWS Services (S3, SQS, EKS, RDS, Lambda, CloudWatch)

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

IIT 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

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.

University Projects

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

Deep Learning for Handwriting Synthesis
Zürich, Switzerland
ETH Zürich
Sept 2019 - Jan 2020
- Adapted and implemented a **Transformer** for use in a natural handwriting synthesis task from text inputs, using **Tensorflow 1.0** and demonstrated its ability to synthesise handwritten characters from text.
- Used **Gitlab** to collaborate with a team of 4 students for the final 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 (using **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	**All India Rank: 3,** Kishore Vaigyanik Protsahan Yojana (KVPY): National-level high-school olympiad	*India*