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Eljan Mahammadli

Website
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Research Interests

My research focuses on large language models (LLMs), vision-language models (VLMs), and multimodal systems.

Education

George Washington University — Washington, D.C.
M.S. in Computer Science, GPA: 3.45/4.0 (Overall GPA: 3.62/4.0) — *Sep 2022 – May 2024*

- **Concentrations**: Deep Learning & Large Language Models
- **Coursework**: Machine Learning, Neural Networks & Deep Learning, Artificial Intelligence, Cloud Computing, Guided Research Methods
- **Thesis**: Developed the first-ever Pretrained Small Language Model for the Azerbaijani Language from scratch under supervision of Dr. Samir Rustamov

ADA University — Baku, Azerbaijan
M.S. in Data Analysis, GPA: 3.62/4.0 — *Sep 2022 – May 2024*

- **Concentrations**: Deep Learning & Large Language Models
- **Coursework**: Big Data Analytics, Advanced Software Paradigms, Design and Analysis of Algorithms

Khazar University — Baku, Azerbaijan
B.S. in Computer Engineering, GPA: 90/100 — *Aug 2018 – Jun 2022*

- **Concentrations**: Machine Learning, Recommendation systems, Computer Vision
- **Coursework**: Introduction to Neural Networks, Applied Statistical Analysis, DBMS, Software Engineering, Game Development

Work Experience

Polygraf AI — Austin, TX
Machine Learning Engineer — *Jan 2024 – Current*

- Design, train, and fine-tune state-of-the-art large language models, develop AI agents leveraging retrieval-augmented techniques, and build efficient, scalable ML training and inference systems.

Unibank OJSC — Baku, Azerbaijan
Jul 2022 – Jan 2024

- **Data Scientist** (Jul 2022 – Jan 2024): Developed and deployed accurate credit scoring and customer churn models, and implemented automated monitoring systems for real-time performance tracking.
- **Data Scientist Intern** (May 2021 – Aug 2021): Designed and implemented a personalized recommender system leveraging customer purchase data and advanced feature engineering, enhancing user experience and driving increased product adoption through tailored recommendations.

Data Science Academy — Baku, Azerbaijan
Teaching Assistant — *Nov 2020 – May 2021*

- Assisted in delivering advanced data science concepts with industry experts, mentored students, reviewed projects, developed and evaluated Python assignments, and solved real-life data science problems using large datasets.

Projects

- **GradiPy: A Lightweight Neural Network Library**: GradiPy, a lightweight Python deep learning library and Autograd engine, as part of my coursework at GW University (CSCI 6366). Built from scratch using only NumPy, Gradipy features a PyTorch-like API and supports essential operations for forward and backward passes. The library includes core components such as linear and convolutional layers, activation functions, loss functions (e.g., cross-entropy, NLL), and optimizers (e.g., SGD, Adam). It also provides implementations of foundational architectures like ResNet-50 and GPT-2.

- **AzLlama: master's thesis on pretraining SLM for Azerbaijani language**: My master's thesis explores the development of an open-source generative language model for Azerbaijani, an underrepresented language in the field of NLP. This project aims to bridge the gap left by large proprietary models, focusing on creating a more accessible solution. See the **model** and **demo** on Hugging Face.
  - **Dataset Collection:** Compiled the largest corpus of Azerbaijani texts to date, approximately 3 billion tokens, sourced from diverse platforms including Wikipedia, websites, books, and various scraped datasets.
  - **Model Development:** Trained a decoder-only language model with different sizes, such as 150 million parameters, using the LLaMA-2 architecture. Integrated instruction-based fine-tuning to enable chat-based interactions in Azerbaijani.
  - **Evaluation:** AzLlama achieves competitive performance with contextual alignment (F1: 68.35%) and semantic similarity (82.87%), outperforming larger models like Mixtral-8x22B and Llama2-70B, highlighting its efficiency for underrepresented languages in NLP.
- **CSCI 6511 Group Project: Generalized Tic-Tac-Toe Agent**:
  - Designed and implemented a Generalized Tic-Tac-Toe AI agent for n * n boards, achieving **first place** in the Artificial Intelligence (CSCI 6511) competition on the **Notexponential** platform as team **AI-lliance X n O**. Integrated REST API for real-time game interactions, optimized decision-making with a minimax algorithm enhanced by alpha-beta pruning, developed a custom heuristic for strategic board evaluation, and refined AI strategies in a competitive tournament setting.

Involvement

- **SPE Khazar University Student Chapter**: I led a volunteer Python tutoring initiative as part of the SPE (Society of Petroleum Engineers) Khazar team, helping engineers from various universities acquire programming skills during the digitalization of various fields. The program was conducted at Khazar University, when I was 3rd-year Computer Engineering student. The program covered Python programming and Introduction to Data Science.
- **QSS Analytics**: Assisted as an Academic Mentor in a comprehensive Data Science Bootcamp, mentoring students individually and in groups, reviewing projects, and preparing real-life Python case studies to enhance practical coding and data analysis skills.

Patents

- **Patent Pending**: System and Method for Identifying and Determining a Content Source, Application No. POLW-002, Applied November 2024. Developed as part of Polygraf AI, where I was a major contributor to the innovation and implementation.

Honors & Awards

- **Selected for Dual Degree Master's Program (2022)**: One of 20 students selected annually by BP and the Azerbaijan Education Ministry for the prestigious Dual Degree Master's Program between ADA University (Data Analysis) and George Washington University (Computer Science).
- **Red Diploma, Khazar University (2022)**: Graduated with distinction, awarded for outstanding academic performance.
- **Azerbaijan Government Scholarship Holder (2018 - 2022)**: Granted a full scholarship award due to the high result on the national university entrance exam (649 out of 700).
- **Honor list - Khazar University (2018 - 2022)**: Upon the academic performance of the term, included on Dean's Honor List 7 times.
- **Istak Lyceum Commendation (2013 - 2016)**: Upon the academic and performance and social activity of the term, awarded with certificates 6 times during secondary and high school
- **Top Rated badge - UpWork Inc. (2021)**: Awarded by a badge for delivering quality work with stellar feedback. This badge represents 10% of all freelancers on the platform.

Skills

Languages: Python, Java, C++, C, SQL

Technologies & Frameworks: PyTorch, Hugging Face Transformers, scikit-learn, NumPy, pandas, Matplotlib, Docker, Flask, FastAPI, AWS