Anar **Rzayev**

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Research Interests

My research interests lie broadly at the intersection of artificial intelligence and biomedical sciences. I am passionate about developing and applying AI methodologies to address complex challenges in biology and medicine. My work encompasses areas such as computational biology, bioinformatics, and biomedical data analysis.

Education

EPFL (École Polytechnique Fédérale de Lausanne) — *Lausanne, Switzerland*

BSc. in Computer Science & Mathematics, exchange semester — *Jan 2023 - Aug 2023*

Coursework: Number theory in cryptography, Computer vision, Time series, Computational linear algebra

KAIST (Korea Advanced Institute of Science and Technology) — *Daejeon, South Korea*

BSc. in Computer Science & Mathematics - Top 7.7% of class (92.30 percentile) — *Sep 2019 - Aug 2025 (Expected)*

Experience

QuantCo Deutschland GmbH — *Essen, Germany*

Medical AI Intern — *Oct 2023 - Feb 2024*

- Developed algorithms to measure signal-to-noise ratios (SNR) in MRI images, enhancing biophysical modeling and quality assurance.
- Implemented denoising methods such as MP–PCA, Non–Local Means, Patch2Self, and DDM^2, to improve pelvic DWI imaging quality.

Laboratory of Protein Design and Immunoengineering (LPDI) — *Lausanne, Switzerland*

Research Engineer (mentored by Prof. Bruno Correia) — *Jan 2023 - Aug 2023*

- Applied geometric deep learning and point cloud techniques to create 3D meshes of protein surfaces.
- Contributed to developing discrete denoising diffusion for graph generation models to solve retrosynthesis planning.

Institute for Basic Sciences (IBS) — *Daejeon, South Korea*

AI Research Assistant (supervised by Prof. Meeyoung Cha) — *Dec 2021 - Jan 2023*

- Researched antibody design using geometric deep learning and SE(3)-equivariant models for next-generation vaccine development.
- Applied NLP and graph machine learning for inverse protein folding, sequence optimization, and binding prediction.
- Developed contrastive learning frameworks for immunogenicity prediction of antibodies targeting SARS-CoV-2, Influenza, and HIV.

XBrain, Inc. — *Seoul, South Korea*

Machine Learning Engineer Intern — *Jun 2021 - Sep 2021*

- Designed various color classification algorithms for the automobile industry, achieving 91% accuracy along with considerably high mAP (Mean Average Precision) in which vehicles can be detected and categorized via real-time recordings as well.
- Developed end-to-end object detection pipelines with MobileNetV2 and YOLOv5 on vehicle datasets, along with data processing and visualization tools.

R.I.S.K. Company — *Baku, Azerbaijan*

Software Developer Intern — *January 2021 - March 2021*

- Worked practically and theoretically on the Collision Risk Model (CRM) that simulates a safe landing for aircraft.
- Developed aeronautical data handlers and designed databases for the Air Navigation Department using MySQL and Azure SQL.

Publications

[1] J. Myung, N. Lee, Y. Zhou, J. Jin, R. A. Putri, D. Antypas, H. Borkakoty, E. Kim, **A. Rzayev**, ... "BLEnD: A Benchmark for LLMs on Everyday Knowledge in Diverse Cultures and Languages," ***Accepted at NeurIPS 2024 Datasets and Benchmarks Track***, 2024. [ArXiv]

[2] G. I. Winata, F. Hudi, P. A. Irawan, D. Anugraha, R. A. Putri, Y. Wang, A. Nohejl, U. A. Prathama, N. Ousidhoum, A. Amriani, **A. Rzayev**, ... "WORLDCUISINES: A Massive-Scale Benchmark for Multilingual and Multicultural Visual Question Answering on Global Cuisines," *arXiv preprint*, 2024. [ArXiv]

[3] M. Lee, **A. Rzayev**, H. Jung, L. F. Vecchietti, M. Cha, H. M. Kim, "Structure-based Representation for Protein Functionality Prediction Using Machine Learning," *Proceedings of the Korean Information Science Society Conference*, pp. 2087–2089, 2022. (**Received Excellence Award at KSC 2022**) [DBpia]

[4] B. Hangeldiyev, **A. Rzayev**, A. Armanuly, L. F. Vecchietti, M. Cha, H. M. Kim, "Antibody Sequence Design With Graph-Based Deep Learning Methods," *Proceedings of the Korean Information Science Society Conference*, pp. 1640–1642, 2022. (**Presented at KCC Conference 2022**) [DBpia]

[5] **A. Rzayev**, "Contrastive Learning for Antibody Representation and Classification Targeting Pathogenic Viruses," *Undergraduate Research Program*, KAIST, 2022. (**Encouragement Award**) [KAIST]

Projects

Contrastive Learning for Pathogen-Specific Antibody Classification *Summer 2022 - Winter 2022*

- Explored a novel structure-based encoder for precise antibody representation learning, employing multiview contrastive learning to evaluate antigen-specificity against viruses SARS-CoV-2, Hemagglutinin Influenza, and HIV.
- Demonstrated effectiveness of the model by achieving high precision/recall/F1-score, supported by a research grant of ₩10,000,000 (approximately $7,200) to advance the project's resources and capabilities.

Caption from Plain Image for Improving Hateful Memes Detection *Spring 2022*

- Developed a preprocessing pipeline for memes, separating images from text and complementing text with descriptive image captions, leveraging the superiority of multimodal models like VisualBERT.
- Identified the pivotal role of caption quality in model performance, with the benchmark annotator accuracy set at 84.7 % by Facebook AI, highlighting the challenge and importance of accurate meme context.

Histopathologic Cancer Detection *Fall 2020*

- Achieved 91% accuracy in metastasis detection using state-of-art CNNs with adaptive learning rates and data augmentation.
- Enhanced dataset robustness by applying a dropout algorithm to corrupt images, followed by effective reconstruction and controlled noise.

Honors & Awards

2023 & 2024	**KAIST Math Problem of the Week - 3rd Place,** Recognized for top performance in the competitions	*South Korea*
2019-2024	**KAIST Scholarship,** Scholarship for international undergraduate students	*South Korea*
2019 & 2017	**2 Bronze Medals,** International Mathematical Olympiad (IMO)	*UK & Brazil*
2019 & 2017	**2 Gold Medals,** Azerbaijan National Science Olympiad (Mathematics)	*Azerbaijan*
2019	**Gold Medal (High Distinction),** Awarded upon graduation with distinction	*Azerbaijan*
2019	**Silver Medal,** Balkan Mathematical Olympiad (BMO)	*Moldova*
2018	**Bronze Medal,** Balkan Mathematical Olympiad (BMO)	*Serbia*

Teaching Experience

School of Computing *Daejeon, South Korea*

Teaching Assistant (TA) *Aug 2024 - present*

- CS204: Discrete Mathematics (Fall 2024, instructor: Jinah Park)

School of Digital Humanities and Computational Social Sciences *Daejeon, South Korea*

Teaching Assistant (TA) *Aug 2022 - present*

- HSS405: Logic and Artificial Intelligence (Spring 2022 & Spring 2024, instructor: Woosuk Park)
- HSS328: Philosophy of Mathematics (Fall 2022 & Fall 2024, instructor: Woosuk Park)

Math Olympiad Leader and Coach *Baku, Azerbaijan*

Ministry of Education of Azerbaijan Republic *Jan 2020 - Dec 2020*

- Taught competitive mathematics and problem-solving strategies in Number Theory and Algebra.
- Served as deputy leader at several prestigious competitions, including IMO and European Girls Mathematical Olympiad 2020.
- Ensured accurate translation of problems for these competitions and assisted the team leader during coordination processes.

Skills

Programming Languages	Python, C/C++, Matlab, R, Scala, OCaml, SQL
Libraries & Frameworks	PyTorch, TensorFlow, Torchdrug, RDKit, OpenBLAS, CUDA, cuBLAS, OpenGL
Tools & Software	Docker, Linux, Wandb.ai, DIPY, Bazel, CMake, Azure SQL, Google Cloud Platform
Lanuages	English (IELTS 7.5), Azerbaijani (native), Russian (native), Turkish (bilingual), Korean (lower intermediate)