Aigerim Keutayeva

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Education

MSc in Robotics June 2023
Nazarbayev University *Astana, Kazakhstan*
GPA: 3.63/4.0 — Graduated with Honors, top 10%
Full scholarship from the Ministry of Education and Science of the Republic of Kazakhstan
Thesis: Robust Subject-Independent BCIs using Attention Mechanism based Deep Learning models

BSc in Robotics and Mechatronics June 2021
Nazarbayev University *Astana, Kazakhstan*
GPA: 3.44/4.0
Full scholarship from the Ministry of Education and Science of the Republic of Kazakhstan
Graduate project: Shoulder Rehabilitation Exoskeleton: Biomechanics, Design and Control

Research Interests

Machine Learning, Brain-Computer Interfaces, Signal Processing, Human-Robot Interaction, Robotics, Digital Twins

Professional Experience

Full-time Research Assistant July 2023 – Present
Brain-Machine Interfaces Lab *Nazarbayev University*
PI: Berdakh Abibullaev, PhD, Associate Professor
- Implemented and tested deep learning models for EEG signal classification in BCIs.
- Performed comprehensive literature reviews to synthesize state-of-the-art BCI research, contributing to publications in high-impact journals and conferences.

Graduate Research Assistant June 2022 – June 2023
Digital Manufacturing Lab *Nazarbayev University*
PI: Essam Shehab, PhD, Head of Department and Professor
- Implemented and tested ML models for digital twin systems, focusing on real-time defect detection.
- Executed data preprocessing and feature engineering for additive manufacturing systems.
- Co-authored publication in IEEE Access on ML in digital twin systems.

Undergraduate Research Assistant January 2021 – January 2022
Brain-Machine Interfaces Lab *Nazarbayev University*
PI: Berdakh Abibullaev, PhD, Associate Professor
- Implemented and tested deep learning models for EEG signal classification in BCIs.
- Analyzed EEG datasets for feature extraction and model training.
- Conducted literature reviews and analyzed findings related to BCI

Undergraduate Research Assistant May 2019 – November 2020
Power Conversion and Motion Control Lab *Nazarbayev University*
PI: Ton Duc Do, PhD, Associate Professor
- Assisted in the design and real-time implementation of control strategies for dynamic systems.
- Developed MATLAB simulations for inverted pendulum stabilization.
- Awarded with FRIP Research Grant for project development.

Publications

Journal Articles (peer-reviewed)

[1] **Keutayeva, A.**, & Abibullaev, B. (2024). Data Constraints and Performance Optimization for Transformer-based Models in EEG-based Brain-Computer Interfaces: A Survey. *IEEE Access*, 12, 62628-62647. https://doi.org/10.1109/ACCESS.2024.3394696

[2] Abibullaev, B., **Keutayeva, A.**, & Zollanvari, A. (2023). Deep Learning in EEG-Based BCIs: A Comprehensive Review of Transformer Models, Advantages, Challenges, and Applications. *IEEE Access*, 11, 127271-127301. https://doi.org/10.1109/ACCESS.2023.3329678

[3] **Keutayeva, A.**, & Abibullaev, B. (2023). Exploring the Potential of Attention Mechanism-Based Deep Learning for Robust Subject-Independent Motor-Imagery Based BCIs. *IEEE Access*, 11, 107562-107580. https://doi.org/10.1109/ACCESS.2023.3320561

[4] Jyeniskhan, N., **Keutayeva, A.**, Kazbek, G., Ali, M. H., & Shehab, E. (2023). Integrating Machine Learning Model and Digital Twin System for Additive Manufacturing. *IEEE Access*, 11, 71113-71126. https://doi.org/10.1109/ACCESS.2023.3294486

Conference Presentations

[5] **Keutayeva, A.**, & Abibullaev, B. (2024). Subject-Independent Brain-Computer Interfaces: A Comparative Study of Attention Mechanism-Driven Deep Learning Models. In B. J. Choi, D. Singh, U. S. Tiwary, & W. Y. Chung (Eds.), *Intelligent Human Computer Interaction: IHCI 2023* (Lecture Notes in Computer Science, vol. 14531). Springer, Cham. https://doi.org/10.1007/978-3-031-53827-8_23

In Submission/Progress

[6] **Keutayeva, A.**, Fakhrutdinov, N., & Abibullayev, B. (2024). Compact Convolutional Transformers in Subject Independent Motor Imagery EEG-based BCIs. In *Scientific Reports*. (Journal Article)

[7] **Keutayeva, A.**, Zollanvari, A., & Abibullaev, B. (2024). Evolving Trends and Future Prospects of Transformer Models in EEG-based Motor-Imagery BCI Systems. In *Discovering the Frontiers of Human-Robot Interaction*, Springer. (Book Chapter)

Academic and Industry Experience

Graduate Teaching Assistant Fall 2022

***Course**: Robotics II: Control, Modeling and Learning with Lab* *Department of Robotics Engineering*

- Led lab sessions for 22 students, focusing on **Gazebo**, **ROS**, **MATLAB**, and **Simulink** for robotic simulation, control, and modeling.
- Guided students in deploying algorithms on **Linux**-based systems and integrating sensors with robotic platforms.
- Marked weekly assignments from students.

Graduate Teaching Assistant Spring 2022

***Course**: Microcontrollers with Lab* *Department of Robotics Engineering*

- Assisted in organizing and conducting lab sessions on **Arduino**, **Logic ICs**, and **FPGA** technologies, during two weekly lab sessions.
- Prepared and verified lab equipment, including FPGAs and associated software, to facilitate hands-on student learning.
- Guided and supported 54 students in lab exercises, graded assignments, and monitored exams, while managing grade entries in **Moodle**.

Electrical and Electronics Engineering Intern June 2019 – August 2019

Kazakhstan Aselsan Engineering (KAE) LLP *Astana, Kazakhstan*

- Assisted in the assembly, soldering, and testing of military and commercial components and systems, ensuring adherence to IPC-J-STD-001 and IPC-A-610 standards.
- Produced and tested circuit cards, focusing on SMD component installation and quality control.
- Supported routine product design and fabrication processes, collaborating with the team to meet project deadlines and ensure the successful completion of tasks.

Honors & Awards

Shell Eco-marathon Grant March 2020 – May 2021

Awarded $10,000 by Shell to support the design and construction of an ultra-energy-efficient vehicle as part of SunQar, the NU student team's participation in the 2020 Shell Eco-marathon Asia.

"Fostering Research and Innovation Potential" Research Grant December 2019

Young Researchers Alliance and Corporate Fund "Social Development Fund", Nazarbayev University

Proposed a research project on the design, construction, and implementation of a two-wheeled, environmentally friendly, and energy-efficient self-balancing vehicle.

Dean's List Fall 2022, Fall 2018

Recognized for academic excellence at Nazarbayev University.

Academic Service & Volunteering Experience

Peer Reviewer

Institute of Electrical and Electronics Engineers (IEEE) — *May 2023 – Present*

Professional membership

Young Researchers Alliance (YRA) — *January 2020 – Present*

Student Volunteer

Nazarbayev University Buddy Program — *August 2019 – December 2019*

Astana Mining & Metallurgy Congress 2019, Airport Greeter — *June 2019*

AIFC Astana Finance Days organization — *July 2018*

25th World Mining Congress 2018, Registry Operator — *June 2018*

EXPO Volunteer Cup, sport event organization — *October 2017*

Technical Skills

Operating Systems: Windows, Linux
Programming Languages: Python, C, Java, HTML/CSS, ROS
Frameworks & Libraries: TensorFlow, PyTorch, Scikit-learn, Transformers, MNE, BBCI, NumPy, Pandas, Matplotlib, Seaborn
Tools & Platforms: Git, LaTeX, Docker, VS Code, Jupyter, Anaconda, Arduino, Raspberry Pi, Eclipse, MATLAB, SolidWorks, CoppeliaSim

Language Skills

Languages: English (Fluent, C1), Kazakh (Native), Russian (Native)

References

Dr. Berdakh Abibullaev berdakh.abibullaev@nu.edu.kz
Associate Professor, Department of Robotics Engineering — *Nazarbayev University*

Dr. Essam Shehab essam.shehab@nu.edu.kz
Professor and Head of Mechanical and Aerospace Engineering Department — *Nazarbayev University*

Dr. Amin Zollanvari amin.zollanvari@nu.edu.kz
Associate Professor, Department of Electrical and Computer Engineering — *Nazarbayev University*

Dr. Zhanat Kappasov zhkappassov@nu.edu.kz
Assistant Professor, Department of Robotics Engineering — *Nazarbayev University*