KEIVAN RAHMANI

Ph.D. Student in Nanoengineering & M.S. in Computer Science, UC San Diego
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EDUCATION

Ph.D. in Nanoengineering (GPA 4.0/4.0) | University of California San Diego | *Sep 2022–Present*
M.S. in Computer Science (GPA 4.0/4.0) | University of California San Diego | *Sep 2022–Sep 2025 (Expected)*
M.S. in Environmental Engineering (GPA 4.0/4.0) | University of Alberta | *2019–2021*
B.S. in Chemical Engineering (GPA 17.25/20) | Sharif University of Technology | *2013–2018*

RESEARCH & WORK EXPERIENCE

Graduate Research Assistant, UC San Diego | *Sep 2022–Present*

- **Reinforcement Learning for Cardiac Digital Twins**
  - Architected a Myokit-powered environment to simulate ion channel parameters in hiPSC-CMs under dynamic voltage protocols.
  - Developed an RL pipeline (SAC + LSTM) with domain randomization for real-time parameter estimation, accelerating drug screening.
  - Integrated CMA-ES optimization to refine RL-driven parameter guesses, improving predictive accuracy on diverse electrophysiological conditions.
  - Employed multi-environment parallelization (Python, HPC) for faster convergence and robust observation distributions.
- **Neuronal Intracellular Signal Reconstruction & Calcium Imaging**
  - Extended a physics-informed deep learning framework (originally developed for cardiomyocytes) to reconstruct intracellular neuronal activity from extracellular recordings using nanoelectrode arrays and commercial microelectrode devices.
  - Developed a data-analysis pipelines to investigate genotype-driven changes in neuronal function; developed custom Python-based workflows to correlate calcium dynamics with reconstructed electrophysiological signals.
- **Label Free Detection of Nuclear Membrane Nano-Poration**
  - Built a **high-throughput ML pipeline** to predict nuclear envelope poration events from cell morphology (no fluorescent labels).
  - Engineered an **orientation-invariant VAE** (64D latent space) to capture nuanced cell–nucleus embeddings.
  - Achieved **AUC = 0.86** on limited wet-lab data (~700 samples).
- **Physics-Informed Deep Learning for Electrophysiology**
  - Integrated PDE constraints (Aliev-Panfilov model) into a **UNET loss** to reconstruct intracellular action potentials from extracellular data.
  - Demonstrated **R^2 = 0.99** generalization on nanoelectrode & microelectrode array signals.

Research Assistant, University of Alberta | *May–Sep 2022*

- Built a **sports trading card price predictor** (CNN + player stats APIs).
- Automated **web scraping** of player attributes from EA Sports databases.

Data Scientist, Energy Advantage | *May–Sep 2022*

- **Streamlined ESG reporting** using automated data pipelines.
- Optimized **SQL** workflows for large-scale reporting on energy consumption and carbon footprints.

Associate ML Developer, ALTAML | *Oct–Dec 2021*

- Developed **computer vision feature extraction** on limited datasets, improved the current method accuracy by 83%.
- Optimized data structures for faster image processing.

Graduate Research Assistant, Univ. of Alberta | *Jan 2019–Aug 2021*

- Built ML models to forecast **COVID-19** impacts on Canadian air pollution.
- Applied **deep learning** to VOC adsorption performance in industrial air treatment.

SELECTED PUBLICATIONS (with hyperlinks)

1. **Rahmani, K.**, L. Sadr, E. Sarikhani, H. Naghsh-Nilchi, C. Onwuasoanya, Y. C. Wong, W. Wen, and Z. Jahed. 2025. *"Label-Free Detection of Nuclear Membrane Nano-Poration."* **Small**, *in press*.
2. **Rahmani, K.**, Y. Yang, E. P. Foster, C.-T. Tsai, D. P. Meganathan, D. D. Alvarez, A. Gupta, *et al.* 2025. *"Intelligent in-Cell Electrophysiology: Reconstructing Intracellular Action Potentials Using a Physics-Informed Deep Learning Model Trained on Nanoelectrode Array Recordings."* **Nature Communications** 16(1): 657. [https://www.nature.com/articles/s41467-024-55571-6]

3. Qi, B., L. Sasi, S. Khan, J. Luo, C. Chen, **K. Rahmani**, Z. Jahed, and J. V. Jokerst. 2025. "*Machine Learning for Automated Identification of Anatomical Landmarks in Ultrasound Periodontal Imaging.*" **Dentomaxillofacial Radiology,** twaf001. [https://academic.oup.com/dmfr/article/54/3/210/7945105]
4. Sarikhani, E., V. Patel, Z. Li, D. P. Meganathan, **K. Rahmani**, L. Sadr, R. Hosseini, *et al.* 2024. *"Engineered Nanotopographies Induce Transient Openings in the Nuclear Membrane."* **Advanced Functional Materials**, 2410035. [https://advanced.onlinelibrary.wiley.com/doi/full/10.1002/adfm.202410035]
5. Sarikhani, E., D. P. Meganathan, A.-K. Kure Larsen, **K. Rahmani**, C.-T. Tsai, C.-H. Lu, A. Marquez-Serrano, *et al.* 2024. *"Engineering the Cellular Microenvironment: Integrating Three-Dimensional Nontopographical and Two-Dimensional Biochemical Cues for Precise Control of Cellular Behavior."* **ACS Nano** 18(29): 19064–76. [https://pubs.acs.org/doi/10.1021/acsnano.4c03743]
6. **Rahmani, K.**, A. H. Mamaghani, Z. Hashisho, D. Crompton, and J. E. Anderson. 2022. *"Prediction of Heel Build-up on Activated Carbon Using Machine Learning."* **Journal of Hazardous Materials** 433 (July):128747. [https://www.sciencedirect.com/science/article/pii/S0304389422005362?via%3Dihub]
7. **Rahmani, K.**, A. H. Mamaghani, A. Peyravi, Z. Hashisho, D. Crompton, and J. E. Anderson. 2024. *"Simultaneous Effect of Oxygen Impurity and Flow Rate of Purge Gas on Adsorption Capacity of and Heel Buildup on Activated Carbon during Cyclic Adsorption-Desorption of VOC."* **Journal of Hazardous Materials** 476 (September):135223. [https://www.sciencedirect.com/science/article/pii/S0304389424018028]
8. Davarpanah, M., **K. Rahmani**, S. Kamravaei, Z. Hashisho, D. Crompton, and J. E. Anderson. 2022. *"Modeling the Effect of Humidity and Temperature on VOC Removal Efficiency in a Multistage Fluidized Bed Adsorber."* **Chemical Engineering Journal** 431 (March):133991. [https://www.sciencedirect.com/science/article/pii/S1385894721055649]
9. Liu, Y., C. Li, A. Peyravi, Z. Sun, G. Zhang, **K. Rahmani**, S. Zheng, and Z. Hashisho. 2021. *"Mesoporous MCM-41 Derived from Natural Opoka and Its Application for Organic Vapors Removal."* **Journal of Hazardous Materials** 408 (April):124911. [https://www.sciencedirect.com/science/article/pii/S0304389420329022]
10. Radmansouri, M., E. Bahmani, E. Sarikhani, **K. Rahmani**, F. Sharifianjazi, and M. Irani. 2018. *"Doxorubicin Hydrochloride–Loaded Electrospun Chitosan/Cobalt Ferrite/Titanium Oxide Nanofibers for Hyperthermic Tumor Cell Treatment and Controlled Drug Release."* **International Journal of Biological Macromolecules** 116 (September):378–84. [https://www.sciencedirect.com/science/article/pii/S0141813018302319]

SELECTED ACHIEVEMENTS

- **Patent Pending**: *Reconstructing Intracellular Action Potentials from Extracellular Signals* (63/717,739)
- **Talk**: Cell Bio 2024, the joint meeting of the American Society for Cell Biology (ASCB) and European Molecular Biology Organization (EMBO), San Diego Convention Center, San Diego (Dec 2024) (Title: Intelligent sensing of electrical communication in cells using AI and Nanotechnology)

HONORS, AWARDS & GRANTS

- **KIBM Innovative Research Grant** (2024, $50,000) – awarded to support AI-driven electrophysiology.
- **Best Poster Nominee**, MRS Fall Meeting (2024).
- **1st Rank**, UCSD Nano Engineering Comprehensive Exam (2023).
- **Lehigh Hanson** & **Alberta Graduate Excellence Scholarships** (2019 & 2020 each), ($60,000 total).
- **356th Rank** in Iranian Nationwide University Entrance Exam (*>250,000 participants*).

LEADERSHIP & SERVICE

- **Teaching Assistant**, UC San Diego & Univ. of Alberta (2019–Present): Nanoengineering System Design (NANO 120), Data Science in Material Engineering (NANO 281), Probability & Statistics (NANO 114), Intro to Nano (NANO 201), Chemistry 103, Chemistry 105.
- **Mentorship**: Guided 40 undergrads (NANO 120B) in product design & nanoengineering projects.
- **Voluntary Service**: Fundraising lead for **MAHAK** (children's cancer charity); Sharif Green Society NGO.

TECHNICAL PROFICIENCIES & COURSEWORK

- **Programming & Software:** Python, PyTorch, TensorFlow, SQL, Git, Docker, Myokit (cardiac simulation)
- **Machine Learning & AI:** Physics-Informed Deep Learning, RL, Probabilistic Modeling, LLMs, CV, Vision, VAEs
- **Computational & Data:** CUDA & GPU Programming, High-Performance Computing (HPC) & Parallelization, Optimization, Data Pipelines, Web Scraping, API Integration, Cloud Platforms (Azure, AWS)
- **Experimental Techniques:** Cell Culture, Patch Clamp, Nanoelectrode/Microelectrode Arrays (NEA/MEA), Gas Chromatography-Mass Spectrometry (GC-MS), BET analysis, TGA, X-ray Photoelectron Spectroscopy (XPS)
- **Selected Courses**: Reinforcement Learning, Data Systems for LLMs, Advanced Optimization, Probabilistic Reasoning & Decision-Making, Statistical NLP, Data Science in Materials