Md Khayrul Islam

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Education

Lehigh University — Pennsylvania, USA
Ph.D. in Mechanical Engineering; GPA: 3.84/4.00 — *Jan 2021 – May 2025*
- Awarded P.C. Rossin College of Engineering **fellowship**.

Lehigh University — Pennsylvania, USA
M.S. in Mechanical Engineering; GPA: 3.84/4.00 — *Jan 2021 – May 2023*
Thesis Title: Predicting Drug Loading in Extracellular Vesicles through Coarse-Grained Molecular Dynamics Simulation got published on **PCCP**.

IBM — Online
Professional Certificate in Data Science — *Aug 2024*
- Mastered data science competencies including Python, machine learning, SQL, data visualization, and AI, culminating in a capstone project.

Skills

Programming: Python, MATLAB, Bash, SQL
ML and DSA: PyTorch, ImageJ, Pandas, NumPy, OpenCV, ML Algorithms, DSA
Simulation: COMSOL, EspressoMD, ANSYS, LAMMPS, GROMACS, VMD, SolidWorks
Miscellaneous: Docker, Git, High-Performance Computing, Cloud Computing

Work and Research Experience

Lawrence Livermore National Laboratory — Livermore, CA
Incoming Postdoctoral Researcher – Machine Learning and Computer Vision — *Sep 2025 – Present*
- Developing advanced ML and computer vision algorithms for identifying and tracking defects in National Ignition Facility (NIF) laser optics at the Computational Engineering Division.
- Conducting research on optical metrology analysis, automated decision-making frameworks, and predictive modeling to enhance optics performance and longevity.
- Collaborating with multidisciplinary teams of scientists and engineers to integrate AI-driven defect detection into operational laser systems.

University of Washington — Seattle, WA
Research Affiliate, Department of Electrical & Computer Engineering — *Jul 2025 – Aug 2025*
- Formalizing ongoing research collaboration on ML architecture development and hardware-aware optimization for biomedical image analysis.
- Contributing to FPGA-based acceleration strategies and system-level design for ultra-low-latency inference.

Lehigh University — Bethlehem, PA
Graduate Research Assistant — *Jan 2021 - May 2025*
- Collaborated in a multidisciplinary team to publish 11 Q1 journal papers in computational biology and machine learning, featured in prestigious journals including Nature Communications, ACS, and RSC series, with 120++ citations.
- Supervised 4 undergraduate and 1 master's students; led 5 multidisciplinary group projects involving students from Bioengineering, Computer Science, and Mechanical Engineering.
- Designed the official **website** and administered lab's **GitHub**, and Slack; managed computational resources including server setup, management, and resource allocation.

Lehigh University — Bethlehem, PA
High-Performance Computing Server Administrator — *Jan 2023 - May 2025*
- Administered a high-computing server valued at $500K, funded by **NSF**. Engineered initial setup, optimized for on-demand resource allocation, achieving production-readiness for multi-disciplinary research applications.

GMS Composite Knitting Ind. Ltd. — Dhaka, Bangladesh
Management Trainee — *Feb 2019 - Aug 2019*
- Developed an Excel VBA automated line balancing algorithm, improving line balancing efficiency by 15%.
- Optimized floor efficiency via Excel VBA, achieving an 8-12% efficiency boost by maximizing total floor productivity with minimal machinery.

Projects

LightningYOLO: High-Throughput Object Detection — *Jan 2025 – Present*
Designed and optimized world's first YOLO architecture to achieve >10,000 FPS with sub-millisecond latency. Led full ML pipeline—data, model, training. Collaborating with Drexel and Washington University for FPGA integration.

Sub-Millisecond Cell Sorting — *May 2023 – Apr 2025*
Led the development of a state-of-the-art FPGA-accelerated, label-free machine learning framework for real-time cell sorting, in collaboration with Fermi National Accelerator Laboratory and Northwestern University. Achieved sub-millisecond latency (14.5μs) and 98% classification accuracy by optimizing hardware-software co-design for high-precision biomedical applications. **Eng. Appl. Artif. Intell. [Under Review]**

Multiplex Image ML *May 2023 – Dec 2024*
Led and first-authored a multimodal ML framework by architecting a novel pipeline fusing label-free imaging with biomechanical data. Achieved 98.3% accuracy via advanced denoising and segmentation. Published in **Microsystems & Nanoengineering**.

EV Drug Loading Optimization *May 2021 – Apr 2023*
Developed a coarse-grained MD framework for simulating nanopore formation during extracellular vesicle squeezing to optimize drug loading, aligning with interface mechanics and transport phenomena. **Physical Chemistry Chemical Physics**

Maskless Microfluidic Prototyping *Jan 2022 – Jun 2023*
Developed computational models in COMSOL to enhance microfluidic device fabrication with maskless lithography, achieving high fidelity and repeatability. **Nature Communications**

Publications

1. **Khayrul Islam**, Ryan F. Forelli, Jianzhong Han, Deven Bhadane, Joshua C. Agar, Nhan Tran, Seda Memik, and Yaling Liu. Real-time sub-millisecond cell sorting with scalable fpga-accelerated deep learning. *Eng. Appl. Artif. Intell.*, 2025. [Under review]

2. **Khayrul Islam**, Ratul Paul, Shen Wang, Yuwen Zhao, Partho Adhikary, Qiying Li, Xiaochen Qin, and Yaling Liu. MIML: Multiplex image machine learning for high precision cell classification via mechanical traits within microfluidic systems. *Microsystems & Nanoengineering*, 11(1):43, 2025

3. Yue Wu, **Khayrul Islam**, Yaling Liu, and Anand Jagota. Microdroplet resuspension off surfaces. *Langmuir*, 40(52):27206–27215, 2024

4. Mehedi Hasan, **Khayrul Islam**, and AKM Masud. Tailoring polyamide nanocomposites: The synergistic effects of swcnt chirality and maleic anhydride grafting. *ACS Applied Engineering Materials*, 2024

5. Yuwen Zhao, Yue Wu, **Khayrul Islam**, Ratul Paul, Yuyuan Zhou, Xiaochen Qin, Qiying Li, and Yaling Liu. Microphysiologically engineered vessel-tumor model to investigate vascular transport dynamics of immune cells. *ACS Applied Materials Interfaces*, 16(18):22839–22849, 2024

6. Shen Wang, Jianzhong Han, Jingru Huang, **Khayrul Islam**, Yuheng Shi, Yuyuan Zhou, Dongwook Kim, Jane Zhou, Zhaorui Lian, Yaling Liu, et al. Deep learning-based predictive classification of functional subpopulations of hematopoietic stem cells and multipotent progenitors. *Stem Cell Research Therapy*, 15(1):74, 2024

7. Yue Wu, Yuwen Zhao, **Khayrul Islam**, Yuyuan Zhou, Saeed Omidi, Yevgeny Berdichevsky, and Yaling Liu. Acoustofluidic engineering of functional vessel-on-a-chip. *ACS Biomaterials Science Engineering*, 9(11):6273–6281, 2023

8. Ratul Paul, Yuwen Zhao, Declan Coster, Xiaochen Qin, **Khayrul Islam**, Yue Wu, and Yaling Liu. Rapid prototyping of high-resolution large format microfluidic device through maskless image guided in-situ photopolymerization. *Nature Communications*, 14(1):4520, 2023

9. Anshu Raj, Sk Md Ahnaf Akif Alvi, **Khayrul Islam**, Mohammad Motalab, and Shuozhi Xu. An atomistic study of the tensile deformation of carbon nanotube–polymethylmethacrylate composites. *Polymers*, 15(13):2956, 2023

10. Yue Wu, Yuwen Zhao, Yuyuan Zhou, **Khayrul Islam**, and Yaling Liu. Microfluidic droplet-assisted fabrication of vessel-supported tumors for preclinical drug discovery. *ACS Applied Materials Interfaces*, 15(12):15152–15161, 2023

11. **Khayrul Islam**, Meghdad Razizadeh, and Yaling Liu. Coarse-grained molecular simulation of extracellular vesicle squeezing for drug loading. *Physical Chemistry Chemical Physics*, 25(17):12308–12321, 2023

12. Yue Wu, Yuyuan Zhou, Ratul Paul, Xiaochen Qin, **Khayrul Islam**, and Yaling Liu. Adaptable microfluidic vessel-on-a-chip platform for investigating tumor metastatic transport in bloodstream. *Analytical Chemistry*, 94(35):12159–12166, 2022

13. Mehdi Nikfar, Ratul Paul, **Khayrul Islam**, Meghdad Razizadeh, Anand Jagota, and Yaling Liu. Respiratory droplet resuspension near surfaces: Modeling and analysis. *Journal of Applied Physics*, 130(2), 2021

14. **Khayrul Islam**, Sourav Saha, and AKM Masud. Molecular dynamics simulation of the mechanical properties of cnt-polyoxymethylene composite with a reactive forcefield. *Molecular Simulation*, 46(5):380–387, 2020

Conference Presentations

1. **Khayrul Islam**, Yuwen Zhao, Shen Wang, and Yaling Liu. Machine learning based classification of cells by mechanical properties in microfluidic device. *48th Annual Northeast Bioengineering Conference (NEBEC 2022) (April 2022), Columbia University, New York City, New York*, 2022

2. **Khayrul Islam**, Tahreen Nabila, and AKM Masud. Investigation of the mechanical properties of polypropylene /carbon nanotube composite by molecular dynamics simulation. *13th International Conference on Mechanical Engineering, Dhaka, Bangladesh*, 2019

References

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