Jaikwan **Bae**

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Experience

Samsung Electronics Gyeongi, South Korea
Staff Engineer (CL3) *Dec. 2023 – Present*

- **[Computer Vision]** Developing image processing algorithms for semiconductor chip failure analysis. Convolutional neural network (CNN) machine learning models and traditional computer vision models were deployed and maintained to analyze SEM (scanning electron microscopy) and TEM (transmission electron microscopy) images.

Personal Projects - https://utilmon.github.io/ *Sep. 2022 - Present*

- Used variational quantum algorithms to calculate physical and chemical properties of H_3^+, C_3H_2, LiH, H_2 and solve various optimization problems such as TSP, stock portfolio optimization, and knapsack problem.
- Implemented quantum machine learning models for multiclass classifications and time series predictions with error correction methods such as M3 and T-Rex.

Cornell University Ithaca, NY
Research Assistant - High intensity, femtosecond photoemission *Oct. 2016 – Aug. 2022*

- **[Semiconductor growths (CVD) | Ultra-high vacuum, High-voltage system]** Improved superconducting (Nb) and III-V semiconductor (GaAs, GaN) photocathodes lifetime by an order of magnitude with unconventional Negative Electron Affinity (NEA) activation recipes (Cs-Sb, Cs-Te) for spin-polarized electron source applications.
- [**Python** | PDE] Predicted unconventional correlation between electron beam properties and laser intensity used for photoemission. The Boltzmann equation (PDE) approach was used to calculate the Fermi-Dirac distribution of electrons during the photoemission process of Cu under high-intensity laser irradiation.
- [**Machine Learning** | FNN, CNN] Achieved 1000x speed up in electron beam simulation time by building a prediction model using Feedforward neural network (FNN) and Convolutional neural network (CNN) models. Electron beam properties such as horizontal/vertical emittances and beam sizes were predicted with 98 % accuracy.
- [**C++** | HPC | **Monte Carlo**] Built a Monte Carlo simulation code to calculate the photoemission properties of GaAs under high-intensity laser operation conditions. Nonequilibrium dynamics of electrons were simulated based on various Fermi's Golden Rule scattering rate calculations with high performance computing (HPC).
- [HPC | **DFT**] Studied work function reduction of cesiated GaAs photocathode with *ab initio* Density Functional Theory (DFT) calculations.

Education

Ph.D. & M.S.	*Condensed Matter Physics*	**Cornell University**	*Aug. 2022*
B.S.	*Physics*	**University of Rochester**	*May 2016*

Certificates and courses

IBM Certified Associate Developer – Quantum Computation using Qiskit v0.2x *IBM*
IBM Quantum challenge fall 2022 – Advanced Badge *IBM*
Introduction to Quantum Information *KAIST, Coursera*

Skills

Programming Language: Python, C, C++, Java, MATLAB, Mathematica, LabVIEW, LaTex, SQL

Technology: Qiskit, Q#, Pennylane, AWS (EC2, Lambda, S3), PyTorch, Git, Docker, GCP, REST, TensorFlow, Scikit-learn

Selected Papers

1. **Bae, J.,** *et al.* "Brightness of femtosecond nonequilibrium photoemission …" **JAP** 124, 244903 (2018) - **Editor's Pick**
2. Chubenko, O., **Bae**, *et al*. "Monte Carlo modeling of spin-polarized photoemission …" **JAP** 130.6, 063101 (2021)
3. **Bae, J.,** *et al.* "Rugged spin-polarized electron sources based on negative electron affinity GaAs …" **APL** 112, 154101 (2018)