Chun-Wei Liu

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Education

Columbia University   *New York, NY*
M.S. IN APPLIED PHYSICS   *09/2021-PRESENT*
- Courses: Quantum Optics, Condensed Matter Physics, Laser Physics, Semiconductor Physics and Device Microfabrication

National Cheng Kung University (NCKU)   *Tainan, Taiwan*
B.S. IN CIVIL ENGINEERING   *06/2020*
- Overall GPA: 3.55/4.3, Physics Core: 4.16/4.3
- Courses: Quantum Physics, Electromagnetism, Machine Learning, Material Science and Engineering, Mechanics of Materials, Automata

Research Experience

Research Assistant **, Physics Dept. Will Lab,** Prof. Sebastian Will   *New York, NY*
TWEESR - PROGRAMMABLE ATOMIC TWEEZER ARRAYS [**DAMOP2022**]   *09/2021 - PRESENT*
- Developing algorithms for atom-rearranging during tweezer array loading with high filling rate and with linear scaling.
- Constructing a multiplexing laser-optics system with stable PID control backend and sharp user-interface frontend.
- Building 3D MOT that successfully trapping Strontium atoms for further quantum simulation applications.

Research Assistant **, Physics Dept. Matterwave Lab,** Prof. Pei Chen Kuan   *Tainan, Taiwan*
QUANTUM WALKS   *08/2019 - 08/2021*
- Investigated quantum spatial search algorithms powered by quantum walk protocols.
- Obtained analytical and numerical solutions for the evolution of an engineered quantum walk Hamiltonian.
- Explored the potential of quantum simulating Quantum Cellular Automata through discrete-time quantum walks.

Research Assistant **, Civil Engineering Dept. AI Material Lab,** Prof. Yun Che Wang   *Tainan, Taiwan*
MACHINE LEARNING IN MATERIAL DESIGN. [**APCOM2019**] [**CTAM44**][**MLDT2021**][**USNCCM16**]   *02/2019 - 06/2020*
- Applied generative adversarial networks (GAN) to generate high-fidelity microstructure images.
- Adapted the 19-layer VGG networks (VGGNet) that can predict mechanical properties from material images with 95% accuracy.
- Simulating mechanical properties of microstructure samples via Finite Element Methods (FEM) softwares.
- Investigated a Bayesian-optimization model that can fine-tune GAN-generated microstructure geometry through the rapid-labeling VGGNet.

CONSTRUCTING HOMOGENOUS MATERIALS UNSING COMPUTATIONAL METHODS.
- Applied multi-processing on molecular simulation to generate microstructures 40 times more efficient on cloud platforms.
- Implemented a stochastic protocol to produce large scale homogenous microstructure datasets by two-point correlation function.

Publication

[1] *Chun Wei Liu*, Pei Chen Kuan, *"Coherent localization in quantum walks"*. (In preparation).

[2] Yun-Che Wang, *Chun Wei Liu*, Tsai-Wen Ko, *"Optimization of Chiral Metamaterials via Deep Neural Networks"*, 16th U.S. National Congress on Computational Mechanics (USNCCM16), 2021.

[3] Yun-Che Wang, *Chun Wei Liu*, Tsai-Wen Ko, *"Using Deep Neural Networks to Generate Hierarchical Metamaterials for Enhanced Mechanical Properties"*, Mechanistic Machine Learning and Digital Twins for Computational Science, Engineering and Technology (MMLDT), 2021.

[4] Yun-Che Wang, *Chun Wei Liu*, Pei-Chen Cheng, Jyun-Ping Wang, Tsai-Wen Ko *"Design of Chiral Metamaterials via Deep Neural Networks"*, 44th National Conference on Theoretical and Applied Mechanics (CTAM44), 2020.

Honors & Awards

2020   **Chairman Special Award (entering final round),** IBMq Qiskit Hackathon Taiwan
2018   **5th Place (out of 250 students),** Asia Pacific Mechanics Contest for College Students
2017   **Dean's list ,** GPA in top 5% of the department

Presentation

Design of Viscoelastic Auxetic Materials Through Machine Deep Learning |Link   *Taipei, Taiwan*
ASIAN PACIFIC CONGRESSON COMPUTATIONAL MECHANICS (APCOM2019)   *12/2019*
- Discussed the use of VGG networks as an alternative of Finite Element Methods (FEM) when labeling mechanical properties for microstructures.

Selected Projects

Predicting Handwriting Recognition With Parametrized Quantum Circuit |Link   *Xitou, Taiwan*
FOR IBMQ QISKIT HACKTHON TAIWAN 2020   *09/2020*
- Implemented 4qubit-Ry gate circuits in predicting MNIST dataset with the learning curve converged after ten iterations.
- Analized the potential in predicting molecular ground state energies with Quantum LSTM Meta-Learner and VQE.

Skills

Languages: Python **Libraries/Tools:** MATLAB, Qiskits, Mathematica, PyTorch **Other Technologies:** COMSOL, GNU/Linux, Raspberry Pi, Git, LAMMPS