Po-Han (Kozak) HOU

Curriculum Vitae

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Education

Bachelor of Science, Space Science and Engineering – National Central University — Taoyuan, Taiwan, Sep 2020 ~ Present

- Credit Program: Artificial Intelligence
- Research Interests: Numerical Methods, Physics-based Machine Learning, High-Performance Scientific Computing
- Cumulative GPA: 4.04 / 4.3 (Top 10% in the class)

Undergrad Summer Visitor [Summer Session] – Stanford University — California, USA, Jun 2023 ~ Aug 2023

- Relevant Coursework: Stochastic Process, High Performance Computing
- Cumulative GPA: 3.70 / 4.3

Research Experience

Undergraduate Research Assistant — Taoyuan, Taiwan, Sep 2021 ~ Jun 2023

Space Environment Laboratory – National Central University

- Engaging in research focused on physics models in space, machine learning, and their combination
- *Project: Empirical Physics Informed Neural Networks for Magnetopause Tracking*
- *Project: Comparing Kalman Filter with Recurrent-based machine learning on Satellite Attitude Determination*
- *Project: Automatic Emergency Dust-Free solution on-board International Space Station with Bi-GRU*

Deep Learning Research Intern (AI/Modulus [NVIDIA – SimNet]) — Hsinchu, Taiwan, Jul 2022 ~ Aug 2022

National Center for High-Performance Computing (NARLabs – NCHC)

- Engaging in research focused on Physics Informed Neural Networks (PINNs), including Physics Informed Neural Operator (PINO) and Fourier Neural Operator (FNO)
- Examining zero-shot generalization on 1D Advection Equation via PINNs
- *Project: Implementing Fourier Neural Operator (FNO) for Image Classification via TensorFlow*

Work Experience

Software R&D Intern — Hsinchu, Taiwan, Sep 2023 ~ Present

Moldex3D – CoreTech System Co., Ltd. Headquarters

- Integrated NVIDIA-Modulus into Moldex3D(CAE software), allowing clients to simulate thermal analysis with pre-trained PINN and FNO models under various boundary/initial conditions and materials.

Network Administrator Intern — Yunlin, Taiwan, Jul 2019 ~ Aug 2020

XingAn Clinic

- Responsible for setting up the website and establishing the clinic's appointment scheduling system. (Source: http://www.xingan.org.tw/).

Publications

In progress:

- **Hou, P.-H.**, Lin, C. -Y., Shue, J.-H. *Regression-based Physics Informed Neural Networks (Reg-PINNs) for Magnetopause Tracking.* (Source: https://github.com/KozakHou/Reg-PINNs)

Published:

- **Hou, P.-H.**, Lin, W.-C., Hou, H.-C., Huang, Y.-H., Shue, J.-H. (2022*) Automatic Emergency Dust-Free solution on-board International Space Station with Bi-GRU (AED-ISS), arXiv:2210.08549.* Available at: https://doi.org/10.48550/arXiv.2210.08549.
- Chou, H.-H, Chiang, W.-J, Kuo, C.-W, Lung. C, **Hou, P.-H,** Wang, E.-J, Chen, Y.-T, Zhao, Y.-X, Kuo, J.-S (2021) *Utilizing Pop-Up Platform on the CubeSat to Achieve Commercial Activities in the Universe (UCCU), International Conference on Astronautics and Space Exploration (iCASE).*

Skills

- Combining skills related to computer science, engineering, and/or mathematics and having an interest in interdisciplinary collaboration.
- 3 years of strong Python experience (Numerical Methods, TensorFlow(PINN), PyTorch(Neural Operator))
- 2 years of strong MATLAB experience (Satellite ADCS Simulation, Remote Sensing Analysis)
- Julia (Numerical Methods) – 1 year / C (OpenMP) – 1 year / ANSYS Fluent, STK / OpenFOAM

Awards and Recognition

Honor for Academic Excellence – National Central University 2023
- Placed in the top 1% of the department for the semester. (2023 Spring Term)

Future Star Awards – The Space Science Society of the Republic of China
- Introduced the Regression-based Physics Informed Neural Network architecture, which ranked among the top five out of 54 posters presented at The Space Science Society of the Republic of China technology exhibition. 2023

Best Technical Awards – AI Space Challenge, ASEAN
- Proposed a particulate matter sensor integrating atmospheric physics parameters and geomagnetic sensing on the International Space Station with Bi-GRU, which was specially awarded by Geo-Insight, for demonstrating the best design and technology among all participating teams (a total of 34 teams) from ASEAN countries. 2022

Disaster Risk Monitoring Using Satellite Imagery Certification – United Nations Satellite Centre
- This certification requires completing tasks within 8 hours, including data retrieval from the UNOSAT satellite image database, performing digital image pre-processing and pipelining, and training a high accuracy, near real-time flood prediction model with TensorRT. 2023

TensorFlow Developer Certificate – Google TensorFlow
- This certification requires candidates to complete tasks in Computer Vision, Natural Language Processing, and Data Augmentation using TensorFlow during a five-hour examination. (Obtained by 50 individuals in Taiwan and approximately 4900 individuals worldwide) 2023

Extracurriculars & Leadership Experience

Student Member - Taiwanese Society for Computational Neurosciences, TSCN Aug 2022 ~ Present
- Participate in both in-person and online symposiums and workshops, sharing personal experiences and integrating concepts from cognitive neuroscience.

Teaching Assistant – Service-Learning Center – National Central University Sep 2023 ~ Present
- Volunteered as a teaching assistant for the service-learning course. Led our department's freshmen to the campus landfill for recycling activities in collaboration with the General Affairs Division's Environmental Protection Group. Supervised and advocated for resource recycling within the department building.

Student Representative - Department of Space Science and Engineering Sep 2022 ~ Jun 2023
- Held a Learning Effectiveness Committee meeting to collect student feedback and engage in discussions with relevant faculty and staff members, further strengthening the bond between learners and instructors.
- Organized various events as the designated events holder for the department, including the Learning Effectiveness Committee, Yuri's Night, and parties, among others.

Team Leader – AI Space Challenge, The Association of Southeast Asian Nations (ASEAN) Dec 2021 ~ Jun 2022
- As representatives of Taiwan, we proposed an integrated particle warning system that combines a multivariate physics model with an edge computing system on the International Space Station.
- Made scheduling decisions and acted as a bridge between the supervising professor and the organizing committee.
- Collaborated with Taipei-Tech to jointly develop an end-to-end particle warning system.

Side Projects

Numerical Methods and Physics Informed Neural Networks in Advection Function
- Demonstrated that Physics-Informed Neural Networks (PINNs) have a relatively lower likelihood of dissipation occurrence during long-term evolution compared to traditional numerical solution methods such as the Finite Difference Method and Finite Volume Method. (Source: https://github.com/KozakHou/Python-Tensorflow-DeepXDE/tree/main)

High Performance Computing with NVIDIA-RAPIDS
- Conducted benchmarks on data manipulation from the geostationary satellite, HIMAWARI-8, using CPU nodes (Intel - Xeon W-2123) and multi-GPUs (NVIDIA - A100 * 2 / NVIDIA - RTX5000).
- Employed RAPIDS to replace Scikit-Learn and trained the MNIST dataset using SVM on a GPU (NVIDIA - RTX5000), resulting in a significantly reduced training time of only 17 seconds.(Source: https://github.com/KozakHou/cuDF-and-cuML)

Benchmarks on ImageNet and MNIST with self-constructed Neural Networks
- Investigated the mechanism of the Fourier Neural Operator and implemented it independently using TensorFlow.
- Benchmarks on the standard MNIST image classification problem showed that it outperformed FCN, CNN, and ResNet in terms of accuracy, albeit at the cost of longer training and inferencing times. (Source: https://github.com/KozakHou/Image-Classification)