Kai-Lin Chen

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Research Interests

- **Medical Image Segmentation, Computer Vision, Deep Learning**
- **Image Optimization and Modality Fusion:** Dual Encoder U-Nets, Segmentation
- **Low-resource Training:** Patch-based Preprocessing, Dynamic Loss Function Selection Method

Education

B.Sc. National Taiwan University   Taipei, Taiwan, 2022 – 2026
   Department of Biomedical Engineering
   Advisor: Prof. Kevin T. Chen
   GPA: 3.83/4.3 (Updated until 2025 Spring)
   Selected Courses: Programming Languages 2023 Fall(A+), Digital Engineering Signal and Systems 2024 Spring(A+), Fundamentals of Biomedical Image Processing 2024 Fall(A+), Machine Learning 2024 Fall(A-), Medical Image Analysis 2025 Spring(A+), Introduction to Biophotonics 2025 Spring(A+), Data Structure 2025 Spring(A-)

Research Experiences

Multimodal Medical Imaging Optimization Lab, NTU, Advisor: Prof. Kevin T. Chen   2023 - Present
Research Assistant
- Labeled airways in dynamic 3D MRI to model breathing cycles for healthy and OSA patients.
- Developed a MATLAB pipeline to segment and measure actin fibers in phase-contrast images.
- Developed data augmentation workflows for low-resource segmentation model training.
- Researched on low-resource (low training data & computing resources) model training methods.
- Designed a Dynamic Loss function Selection Method to tackle severe class imbalance.
- Developed a low-resource segmentation model training method & packaged as a segmentation model training/inference toolbox PAULow. (Now deployed in NTU Cell Tissue Engineering Lab)

Research Center for Applied Sciences, Academia Sinica, Advisor: Prof. Peilin Chen   07/2025 - 08/2025
Summer Research Intern
- Assisted in batch processing of force-sensing microchips as substrates for cell culturing.
- Researched on behaviors of HCC827 and A549 carcinoma cell lines.
- Proposed a new medical image modality by modality fusion for carcinoma cell classification.
- Constructed a CNN classification model for automated carcinoma classification.
- Proposed modality enhanced CNN classification accuracy by 37.67%.
- Modality Fusion Network reduces data processing time by 96%.

Publications

Kai-Lin Chen, Yu-Nong Lin, Pen-hsiu Grace Chao, Kevin T. Chen
A Low Resource Training Strategy for Cell Segmentation Using Patch-Based Attention U-Net
MIDL: Medical Imaging with Deep Learning. Short Paper (2025)

Technical Skills & Languages

- **Programming Languages:** Python, MatLab, C++, LaTeX, HTML
- **Tools:** Pytorch, OpenCV, Tensorflow, FreeSurfer
- **Languages:** Mandarin (Native), English (fluent), Taiwanese Hokkien (fluent), French (intro)

Awards and Fellowships

Silver Medal in RCAS Summer Internship Seminar (Poster + Flash talk)   08/2025

 2nd place in the division of Intelligence Bioengineering Group, among 30 admitted students.

National Science and Technology Council (NSTC), Undergrad Research Fellowship 07/2025 - 02/2026

Selected Projects

PAULow: Patch-based Attention U-Net for Low-resource learning
- Designed a patch-based preprocessing pipeline and custom Attention U-Net architecture for medical image segmentation.
- Proposed a Dynamic Loss Function selection method for severe class imbalance during training.
- Enables training with CPU, with no reliance on pretrained weights; adaptable to diverse ROIs.
- PAULow achieved up to 35.62% dice score improvements compared with Cellpose and Stardist.
- **GitHub Link:** https://github.com/Hiimtiger/PAULow

FICM: Force Informed Cell Map Image Synthesis using Attention-gated Dual Encoder U-Net for carcinoma cell line classification
- Designed a deep learning–based modality fusion framework to generate a new medical image modality for cell mechanobiology.
- Achieved 37% improvement in CNN classification accuracy, reduced 96% data processing time.
- Concluded that internal force is able to provide features to distinguish carcinoma cell lines.
- **GitHub Link**: https://github.com/Hiimtiger/FICM

Unsupervised Segmentation of Pathology Images using Haralick Features
- Applied Haralick features to segment and cluster pathology images without labeled data.
- Enabled faster diagnostic workflows through unsupervised learning techniques.
- Can adaptively infer the number of clusters for multi-class segmentation tasks.
- Demonstrated potential for scalable segmentation for labeling in clinical settings.

Brain Tumor Segmentation from MRI using Patch-Based Attention U-Net for Data-Efficient Learning
- Adapted PAULow's low-resource and data-efficient pipeline to the BraTS dataset.
- Demonstrated strong performance under limited data conditions (30 v.s. 300 cases).
- Achieved higher performance than other U-Net structures in normal & data-limited conditions.

Teachings and Activities

TA: Advanced Engineering Mathematics DBME2004   09/2025 - 12/2025

 Prof. Chung-Ming Chen, Prof. Li-An Chu, National Taiwan University, Taiwan

EngLite Event Organizer and Speaker at NTU   09/2024 - 06/2026

 Organized and hosted several English Speaking events with a spectrum of activities spanning from beer tasting to graduate school application with Prof. Pen-Hsiu Grace Chao.

Welcome Week Ambassador & International Student Volunteer at NTU   2022 - 2023

 Designed an unofficial most optimal touring route using the Dijkstra's algortihm in National Taiwan University and assisted multiple International students survived through registration, navigating the NTU urban-life circle, and course selection throughout their exchange.

MITx: Machine Learning with Python: from Linear Models to Deep Learning

 (Completed 08/2024)