

CHIEH-YU PAN

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Research Profile

Multimodal AI and computer vision researcher investigating how structured domain knowledge can improve fine-grained visual prediction. Developed KARINA, a framework presented in a first-authored paper at IEEE CAI 2026. It grounds ingredient knowledge in corresponding food regions and achieved the best reported nutrition estimation results across three benchmarks. Research experience spans the full cycle from problem formulation and model design to evaluation across datasets, ablation analysis, and public implementation.

Education

National Cheng Kung University

M.S. in Computer Science and Information Engineering, GPA: 4.06/4.30

Sep. 2023 – Jan. 2026

Tainan, Taiwan

- **Thesis:** *KARINA: Knowledge-Augmented Representation for Ingredient-Level Nutrition Analysis from Food Images*; Advisor: Prof. Wei-Ta Chu. [Paper] [Code]
- Selected coursework: Computer Vision and Deep Learning; Image Processing; Reliability Data Analysis.

KTH Royal Institute of Technology

Exchange Studies in Computer Science, 37.5 ECTS

Aug. 2025 – Jan. 2026

Stockholm, Sweden

- Selected coursework: Image Analysis and Computer Vision; Big Data in Media Technology; Social Robotics.

National Cheng Kung University

B.S. in Engineering Science, GPA: 3.95/4.30

Sep. 2019 – Jun. 2023

Tainan, Taiwan

- Selected coursework: Introduction to Artificial Intelligence; Machine Learning; Multimedia Content Analysis; Algorithms; Linear Algebra.

Publications

1. **C.-Y. Pan** and W.-T. Chu, "KARINA: Knowledge-Augmented Representation for Ingredient-Level Nutrition Analysis from Food Images," in *Proceedings of the 2026 IEEE Conference on Artificial Intelligence (CAI)*, pp. 1–6, 2026. doi:10.1109/CAI68641.2026.11536297. [Code]
2. **C.-Y. Pan**, X.-N. Lu, Y.-P. Cheng, X.-Y. Li, and Y.-M. Huang, "[Integrating Virtual Reality Technology and Simulation-Based Learning to Enhance Student Learning Performance and Engagement]," in *Proceedings of the 2022 Taiwan Academic Network Conference (TANET)*, pp. 1268–1273, 2022. In Chinese; oral presentation.
3. **C.-Y. Pan**, Y.-P. Cheng, and Y.-M. Huang, "Enhancing Learning Performance of Engineering Students in Virtual Reality Environment," in the *20th International Symposium on Novel and Sustainable Technology (ISNST)*, Tainan, Taiwan, Oct. 27–28, 2022. Short paper and poster presentation; Excellent Poster Presentation Award.

Research Experience

Graduate Researcher – KARINA Multimodal Nutrition Analysis

National Cheng Kung University; Master's thesis; Advisor: Prof. Wei-Ta Chu

2023 – 2025

Tainan, Taiwan

- Designed and implemented KARINA, a knowledge-augmented RGB-D vision-language framework that estimates calories, mass, fat, carbohydrates, and protein from food images. It achieved the best reported results on Nutrition5K, NutritionVerse-Real, and NutritionVerse-Synth, including 13.3% mean PMAE on Nutrition5K versus the previous best of 15.6%.
- Used a large multimodal model to generate ingredient descriptions and qualitative nutritional profiles as weak semantic supervision; ablation studies showed that this knowledge reduced protein error by 18% and fat and carbohydrate errors by 13%.
- Developed Mask-based Ingredient-level Augmentation to ground each ingredient description in its corresponding food region. Automatically generated Grounded SAM masks enabled fine-grained visual-text alignment without additional manual annotation and reduced mean PMAE from 14.1% to 13.3%.

Undergraduate Researcher – VR for Engineering Education

National Cheng Kung University; Undergraduate research project; Advisor: Prof. Yueh-Min Huang

2022 – 2023

Tainan, Taiwan

- Co-developed an NSTC-funded, narrative-driven VR learning environment that taught Raspberry Pi fundamentals through game scenarios culminating in a Python traffic-light programming challenge.
- Co-designed and conducted two evaluations: a pre/post study increased mean test scores from 39.39 to 86.36 ($p < .001$), while a separate controlled study with 28 undergraduates found significantly higher post-test performance in the VR group than in the control group ($p = .018$).

Selected Projects

- Proactive Multimodal Social Robot** | [Code] 2025 – Present
- Designed a proactive Misty II social robot to move beyond request-response voice assistants by detecting opportunities for support before an explicit user request. Validated the prototype in ten scripted cases spanning visual-only, speech-only, and combined cues, including visible distress, verbal disclosure, and facing the robot; it initiated supportive check-ins or offers of assistance in response to the detected cues.
 - Integrated visual and speech perception, structured LLM planning, three-tier persistent memory, and a bounded executor. A closed-loop approach controller re-observes user distance and asks for consent before moving, preventing unconstrained model outputs from directly controlling physical motion.
 - Validated the integration against AutoMisty's 28 published benchmark tasks spanning elementary, simple, compound, and complex behaviors; currently re-architecting the single-pass planner as a ReAct-style loop that incorporates environmental feedback into successive reasoning and action steps.
- Emergency Dispatch after AMHS Failure** | *TSMC Intelligent Manufacturing Workshop* 2025
- Led a cross-disciplinary team spanning industrial engineering, computer science, and engineering science during a five-day workshop; decomposed an unfamiliar semiconductor logistics problem into queue-time, capacity, and routing constraints, coordinated the schedule and task allocation, integrated the solution, and delivered the final presentation.
 - Developed a dispatch heuristic for 40 WIP lots, 20 carts with variable capacities, and a 50-location transfer-time matrix; completed both evaluated settings without Q-time violations and earned 2nd place.
- Invoice Recognition and ERP Automation** | *DIGI+ Talent Program* | [Code] 2022
- Led computer-vision development in a CS/EE/Finance team; combined YOLOv5, OCR, and iterative crop refinement to achieve 96% invoice-level exact-match accuracy on the test set.
 - Designed the system for a real-world volume of approximately 55,000 invoices per month and connected extracted fields to an RPA/ERP workflow, with an estimated 78% reduction in processing time from 1,833 to 403 staff-hours per month.

Teaching & Service

- Teaching Assistant, Introduction to Artificial Intelligence** 2023 – 2025
National Cheng Kung University Tainan, Taiwan
- Designed AI assignments and scalable grading workflows, held office hours, and provided technical guidance to more than 300 students as course enrollment tripled.
- Research Computing Administrator** 2023 – 2025
National Cheng Kung University Tainan, Taiwan
- Administered shared research infrastructure comprising seven Linux servers and 22 NVIDIA GPUs for 15 researchers, including operating-system, driver, and PyTorch upgrades, user management, and training-job troubleshooting.

Honors & Funding

- Transnational Study and Research Scholarship Grant** (NT\$82,500) 2025–2026
NCKU Office of International Affairs
- 2nd Place**, TSMC Intelligent Manufacturing Workshop 2025
- Research Creativity Award**, National Science and Technology Council, Taiwan 2023
- Undergraduate Research Project Grant** (NT\$48,000; 8 months) 2022–2023
National Science and Technology Council, Taiwan
- 2nd Place, Research Category**, NCKU Undergraduate Research Poster Competition 2022
- Excellent Poster Presentation Award**, 20th ISNST 2022
- Outstanding Award**, Ministry of Digital Affairs DIGI+ Talent Program 2022

Skills

- Programming and ML:** Python, C/C++, PyTorch, Hugging Face Transformers, OpenCV
- Computer vision:** Vision-language modeling, RGB-D fusion, image segmentation, object detection, multimodal alignment
- Systems and agents:** Linux, NVIDIA GPU administration, structured LLM planning, persistent memory, Git
- Languages:** Mandarin Chinese (native); English (professional working proficiency)