國立臺東大學 理工學院
NATIONAL TAITUNG UNIVERSITY COLLEGE of SCIENCE and ENGINEERING

教師指導學生專題製作與論文競賽補助 成果報告

一、 申請補助計畫基本資料

申請教師	徐位文	核定經費	9,500
單位系所	資訊工程學系	經費執行情況	□已請購核銷完畢 □尚未請購核銷 ☑經費餘款 84
計畫執行年度/學期	112 年度第一學期	參賽期程	112 年 10 月 21 日~112 年 11 月 03 日
參加競賽/學術活動名稱	1. IET ICETA 2023 2. APSIPA ASC 2023	作品名稱	1. Breast Cancer Screening with Class Imbalance Datasets of Mammogram Imaging 2. Improving Regularization of Deep Learning Models in Fundus Analysis 3. The Development of an AI-assisted Diagnosis System for Adult Glioma Subtyping Prediction
指導參賽學生姓名	1. 葉峻宇、林上暉 2. 李唯民	班級	資工四甲
競賽性質	■國際性 □校際 □校內(院級以上)	參賽地點	1. 國立虎尾科技大學 2. 臺北國際會議中心 (TICC)
系所主管簽章	教授兼資訊工程學系系主任 賴盈動	日期	112.11.8
學院院長簽章		日期	

一、參賽作品：

1. Chia-Ming Liang, Yao-Chung Chang, **Chun-Yu Yeh**, **Shang-Hui Lin**, Yi-Jui Huang, and **Wei-Wen Hsu***. "Breast Cancer Screening with Class Imbalance Datasets of Mammogram Imaging." *In 2023 IET International Conference on Engineering Technologies and Applications (IET-ICETA)*

   Abstract - In Taiwan, breast cancer ranks as the fourth leading cause of death among women. Many studies have reported that early detection and treatment are crucial in reducing mortality rates. Mammogram imaging is a key screening tool for the early detection and management of breast cancer. However, the identification and interpretation of breast lesions in mammography is not a trivial task. In addition, the extremely biased ratio of positive and negative case numbers makes it more challenging when it comes to the development of the computer-aided diagnosis (CAD) systems. Nevertheless, if we resample the negative cases to make the training dataset class distribution even with the positive cases, the total number of cases may not be sufficient for training a deep learning model. To avoid such dilemma, our strategy is to guide the deep learning models to learn the correct features of lesions by the annotations of lesions, including masses and micro-calcifications, from the medical physician. Subsequently, the deep features from the SPPF layer in a detection model of YOLOv5m are extracted for both positive and negative cases. Finally, a classifier of Random Forests is trained based on the extracted feature for mammography screening. For our experiments, the source datasets were from the competition of Screening Mammography Breast Cancer Detection held by Radiological Society of North America (RSNA) in late 2022. And the performance of our proposed reached to 0.624, 0.77, 0.596, and 0.672 for Accuracy, Sensitivity, Precision, and F1-Score, respectively.

2. **Wei-Wen Hsu**, **Yao-Chung Chang**, **Wei-Min Lee**, Yu-Chuan Huang, and Da-Wen Lu*. "Improving Regularization of Deep Learning Models in Fundus Analysis." *In 2023 Asia Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*

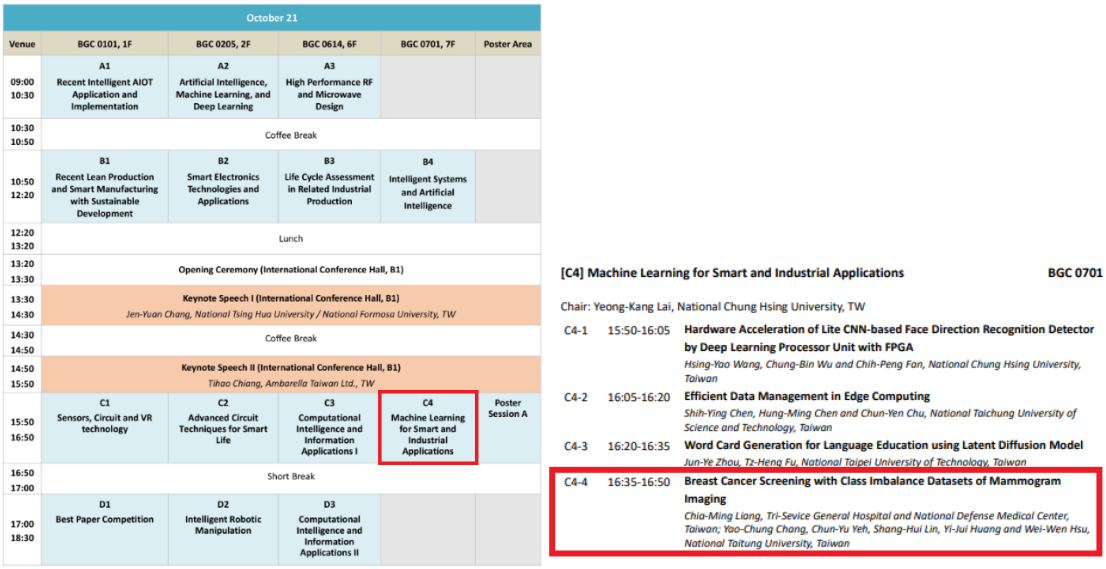
   Abstract - With the advancement of deep learning in many computer vision applications, the development of computer-aided diagnosis systems has been focused on recently. The deep learning approaches for glaucoma assessment through fundus analysis have shown extremely high performance, especially for early detection, in many studies. In addition, researchers also found that the deep learning models detect not only the subtle changes that reflect RNFL thinning but also the morphological features that are present outside the optic disc in fundus photography. It suggests that the deep learning models have great potential for extracting detailed morphologies which may not be aware by human's vision. However, the deep learning models also suffered from the problem of poor regularization when dealing with cross-institutional datasets. That is, the model's performance dropped dramatically on the input images from different institutions. The feature extraction by deep learning models can detect detailed characteristics for distinguishing different categories; nonetheless, these detailed features also cause the overfitting problem for cross-institutional data. Therefore, in this study, we aim to verify our proposed hypothesis by the application of fundus analysis for glaucoma assessment using deep learning approaches. The features with better regularization, called robust features, were selected to reduce the influences from the non-robust features that overfit the training dataset from a specific source. With feature selection, the performance of the glaucoma assessment cross-institutional dataset can be improved from 62.7% to 81% in accuracy.

3. **Wei-Wen Hsu**, Jia-Yi Lin, **Hsin-Hung Lai**, **Wan-Lin Hsu**, **Jeng-Ting Jiang**, and Yao-Feng Li*. "The Development of an AI-Assisted Diagnosis System for Adult Glioma Subtyping Prediction. " *In 2023 Asia Pacific Signal and Information Processing Association Annual Summit and Conference (APSIPA ASC)*

Abstract - Primary brain tumors are among the ten most common causes of cancer-related death, and gliomas are the most prevalent type of adult brain tumor, accounting for 78% of malignant brain tumors. Accurate glioma subtype classification is critical to treating patients with brain tumors; however, developing an automated computer-aided diagnosis system for glioma is not trivial. This study introduces the development of an AI-assisted diagnosis system for adult glioma. There are four subtypes of glioma targeted, including Oligodendroglioma (O), Anaplastic Oligodendroglioma (AO), Astrocytoma (A), and Glioblastoma (G). Instead of directly classifying all whole-slide images into four categories, the hierarchical framework with a multi-view scheme was proposed. That is, two-stage predictions were performed. The first stage is to classify all slides into the Oligo-like and Astro-like classes by observing cells' morphologies with high magnification (x40) views by the patching approach. Subsequently, the second stage is to quantify the areas of normal vessels, hyperplasia vessels (vascular proliferation), and necrosis regions with views of lower magnification (x5, x10) by YOLO segmentation, predicting grading levels for each type. After false detection reduction, the experimental results show the quantification of vessels and necrosis regions are the valuable features to indicate grading levels, and the performance of the proposed two-stage hierarchical framework in the final 4-class predictions surpassed the approach of classifying all slides into 4 categories directly.

二、參加之競賽活動：

1. IET ICETA 2023



October 21

Venue	BGC 0101, 1F	BGC 0205, 2F	BGC 0614, 6F	BGC 0701, 7F	Poster Area
09:00 10:30	A1 Recent Intelligent AIOT Application and Implementation	A2 Artificial Intelligence, Machine Learning, and Deep Learning	A3 High Performance RF and Microwave Design		
10:30 10:50	Coffee Break				
10:50 12:20	B1 Recent Lean Production and Smart Manufacturing with Sustainable Development	B2 Smart Electronics Technologies and Applications	B3 Life Cycle Assessment in Related Industrial Production	B4 Intelligent Systems and Artificial Intelligence	
12:20 13:20	Lunch				
13:20 13:30	Opening Ceremony (International Conference Hall, B1)				
13:30 14:30	Keynote Speech I (International Conference Hall, B1) *Jen-Yuan Chang, National Tsing Hua University / National Formosa University, TW*				
14:30 14:50	Coffee Break				
14:50 15:50	Keynote Speech II (International Conference Hall, B1) *Tihao Chiang, Ambarella Taiwan Ltd., TW*				
15:50 16:50	C1 Sensors, Circuit and VR technology	C2 Advanced Circuit Techniques for Smart Life	C3 Computational Intelligence and Information Applications I	C4 Machine Learning for Smart and Industrial Applications	Poster Session A
16:50 17:00	Short Break				
17:00 18:30	D1 Best Paper Competition	D2 Intelligent Robotic Manipulation	D3 Computational Intelligence and Information Applications II		

[C4] Machine Learning for Smart and Industrial Applications BGC 0701

Chair: Yeong-Kang Lai, National Chung Hsing University, TW

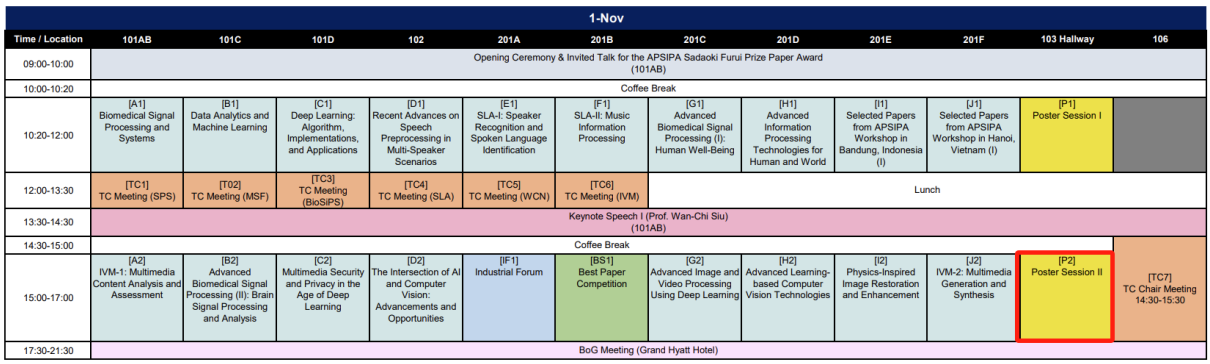
C4-1 15:50-16:05 **Hardware Acceleration of Lite CNN-based Face Direction Recognition Detector by Deep Learning Processor Unit with FPGA**
Hsing-Yao Wang, Chung-Bin Wu and Chih-Peng Fan, National Chung Hsing University, Taiwan

C4-2 16:05-16:20 **Efficient Data Management in Edge Computing**
Shih-Ying Chen, Hung-Ming Chen and Chun-Yen Chu, National Taichung University of Science and Technology, Taiwan

C4-3 16:20-16:35 **Word Card Generation for Language Education using Latent Diffusion Model**
Jun-Ye Zhou, Tz-Heng Fu, National Taipei University of Technology, Taiwan

C4-4 16:35-16:50 **Breast Cancer Screening with Class Imbalance Datasets of Mammogram Imaging**
Chia-Ming Liang, Tri-Sevice General Hospital and National Defense Medical Center, Taiwan; Yao-Chung Chang, Chun-Yu Yeh, Shang-Hui Lin, Yi-Jui Huang and Wei-Wen Hsu, National Taitung University, Taiwan

2. APSIPA ASC 2023



1-Nov

Time / Location	101AB	101C	101D	102	201A	201B	201C	201D	201E	201F	103 Hallway	106
09:00-10:00	Opening Ceremony & Invited Talk for the APSIPA Sadaoki Furui Prize Paper Award (101AB)											
10:00-10:20	Coffee Break											
10:20-12:00	[A1] Biomedical Signal Processing and Systems	[B1] Data Analytics and Machine Learning	[C1] Deep Learning: Algorithm, Implementations, and Applications	[D1] Recent Advances on Speech Preprocessing in Multi-Speaker Scenarios	[E1] SLA-I: Speaker Recognition and Spoken Language Identification	[F1] SLA-II: Music Information Processing	[G1] Advanced Biomedical Signal Processing (I): Human Well-Being	[H1] Advanced Information Processing Technologies for Human and World	[I1] Selected Papers from APSIPA Workshop in Bandung, Indonesia (I)	[J1] Selected Papers from APSIPA Workshop in Hanoi, Vietnam (I)	[P1] Poster Session I	
12:00-13:30	[TC1] TC Meeting (SPS)	[T02] TC Meeting (MSF)	[TC3] TC Meeting (BioSIPS)	[TC4] TC Meeting (SLA)	[TC5] TC Meeting (WCN)	[TC6] TC Meeting (IVM)	Lunch					
13:30-14:30	Keynote Speech I (Prof. Wan-Chi Siu) (101AB)											
14:30-15:00	Coffee Break											
15:00-17:00	[A2] IVM-1: Multimedia Content Analysis and Assessment	[B2] Advanced Biomedical Signal Processing (II): Brain Signal Processing and Analysis	[C2] Multimedia Security and Privacy in the Age of Deep Learning	[D2] The Intersection of AI and Computer Vision: Advancements and Opportunities	[IF1] Industrial Forum	[BS1] Best Paper Competition	[G2] Advanced Image and Video Processing Using Deep Learning	[H2] Advanced Learning-based Computer Vision Technologies	[I2] Physics-Inspired Image Restoration and Enhancement	[J2] IVM-2: Multimedia Generation and Synthesis	[P2] Poster Session II	[TC7] TC Chair Meeting 14:30-15:30
17:30-21:30	BoG Meeting (Grand Hyatt Hotel)											

三、參賽準備與活動記錄

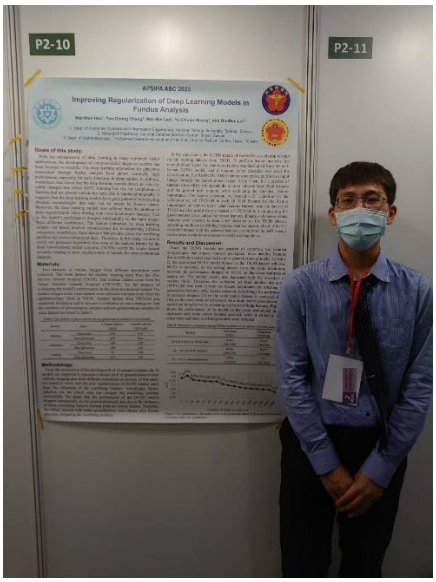
圖說明：IET ICETA 2023 研討會看板

圖說明：IET ICETA 2023 報告時程看板

圖說明：IET ICETA 2023 Keynote

圖說明：IET ICETA 2023 oral presentation

圖說明：APSIPA ASC 2023



圖說明：APSIPA ASC 2023 poster presentation

四、參加競賽成果

1. IET ICETA 2023

心得 1: 在大學期間就能有參加國際性研討會的經驗真的很難得，也是我第一次在正式的場合進行英文報告，在研討會上聽了其他學校學生的報告，還有清華大學教授的演講覺得獲益良多，除此之外也有在虎尾附近走走看看是一次很棒的體驗。

心得 2: 這次去虎尾參加演討會是一個寶貴的經驗。可以了解當前大家的研究方向，並且練習聽別人用英文報告。我期待著將這些新知識和經驗應用到我的研究中，並且不斷的進步。

2. APSIPA ASC 2023

心得: 非常榮幸此次能和徐老師前往台北參加 APSIPA ASC 2023 會議。在會場中我看到許多來自不同研究領域的學者們的研究成果，同時也聆聽許多專家使用英文進行研究成果介紹以及學術演講。在此次會議中，不僅能增廣我的見聞，更能給予我研究上的啟發。