(09)

榮陽交清跨界醫療創新交流會

Cross-Disciplinary Medical Innovation Exchange Forum

時　　間：114 年 6 月 28 日(星期六) 0 8:30~15:00
地　　點：臺北榮民總醫院 醫學科技大樓 1F 會議室

08:30-09:00	***Registration & Opening Remarks***	
	座長：王世仁 教授 (Shyh-Jen Wang)	
09:00-09:30	歷年 CIC 計畫成果發表與 2025CIC 計畫徵件成果 Presentation of Achievements from Previous CIC Projects and Outcomes of the 2025 CIC Call for Proposals	楊盈盈教授 Ying-Ying Yang
	座長：陳志成 教授 (Jyh-Cheng Chen)	
09:30-09:55	醫療 AI: 從精準診斷到先覺預測，從創新研究到落地應用 Medical AI: From Precision Diagnosis to Early Prediction, from Innovative Research to Landing Applications	曾新穆教授 Vincent Shin-Mu Tseng
09:55-10:10	***Coffee Break & Photo Time***	
	座長：王署君 教授 (Shuu-Jiun Wang)	
10:10-10:35	致勝之道與創新思維 The Way to Win and Innovative Thinking	張德明教授 Deh-Ming Chang
	座長：林奇宏 教授 (Chi-Hung Lin)	
10:35-11:00	生醫科技的價值鏈與轉譯 Biomedical Technology Translation: Systems and Value Chain	高為元教授 W. John Kao
	座長：曾建超 教授 (Chien-Chao Tseng)	
11:00-11:25	人工智慧腦機介面於心智健康之應用 Brain-Computer Interface with Artificial Intelligence for Mental Healthcare	魏群樹副教授 Chun-Shu Wei
	座長：楊盈盈 教授 (Ying-Ying Yang)	
11:25-11:50	探索電腦視覺在醫學影像分析的可能性 Exploring the Possibilities of Computer Vision in Medical Image Analysis	王才沛副教授 Tsai-Pei Wang
11:50-13:00	***Coffee Break***	

座長：廖文輝 副教授 (Wen-Huei Liao)

13:00-13:25	深度學習：由自然影像分析到醫學影像分析 Deep Learning: From Natural Image Analysis to Medical Image Analysis	黃春融教授 Chun-Rong Huang

座長：賴尚宏 教授 (Shang-Hong Lai)

13:25-13:50	整合神經調控晶片之智慧物聯網平台：將腦神經疾病診療從醫院帶 到每個人家裡 Integrating the Neuromodulation Chip with an AIoT Platform Towards Bringing the Theranosis of Brain Disorders from Hospital to Everyone's Home	陳新教授 Hsin Chen

座長：周千瀅 教授 (Ying-Ying Yang)

13:50-14:15	從醫病情境對話生成到大語言模型的事實論證 From Clinical Dialogue Generation to Factual Reasoning in Large Language Models	高宏宇教授 Hung-Yu Kao

座長：蘇建維 教授 (Chien-Wei Su)

14:15-14:40	看見與聽見失智症：以簡易行為測試實現可解釋且易取得的早期偵測 AI 工具 Seeing and Hearing Dementia: Explainable and Accessible AI for Early Detection Using Simple Behavioral Tests	郭柏志教授 Po-Chih Kuo

14:40-15:00 Closing Remarks

Medical AI: From precision diagnosis to early prediction, from innovative research to landing applications

醫療 AI: 從精準診斷到先覺預測，從創新研究到落地應用

Vincent S. Tseng
曾新穆
Department of Computer Science, National Yang Ming Chiao Tung University, Taiwan, ROC
國立陽明交通大學 資訊工程系

In this talk, I will introduce recent trends and developments on Medical AI, covering Highly-precise Diagnostic Support, Edge Computing with Wearable/Portable Devices, Non-Invasive Sensing, Multimodal Learning, Early Prediction and Generative AI, through various advanced big data analytics/machine learning techniques on heterogeneous types of biomedical data like medical images, vital signs, electronic health records (EHR), genome, etc.

Some innovative landing applications on Medical AI with breakthrough results will also be illustrated to show how an innovative idea can be shaped and materialized into award-winning products through strategic multi-dimensional planning and actions.

Finally, some underlying challenging issues and open opportunities will also be addressed briefly at the end.

The way to win and innovative thinking

致勝之道與創新思維

Deh-Ming Chang
張德明
Taipei Veterans General Hospital, Taiwan, ROC
臺北榮民總醫院

We may have to learn how to win in life if we expect something from ourselves.

When we find something valuable that helps us accomplish the things that matter most, we do not let go of it.

However, on multiple occasions, discipline and training are necessary to grow and become everything. We have to learn to win in the things we care about most.

Based on my previous experiences, I would like to share with you four keys, including passion, ambition, capacity, and perseverance, which I think were important on the way to win with innovative thinking, if you could be developed in your professional career.

Biomedical technology translation: Systems and value chain

生醫科技的價值鏈與轉譯

W. John Kao
高為元
National Tsing Hua University, Hsinchu, Taiwan, ROC
國立清華大學

Biomedical technology covers a wide range of products including therapeutics, devices, and diagnostics to improve human health and the quality of life. It's a fast-growing sector with a global market size of $630 billion USD with a CAGR of 5.25%. It's also a strategic area of development for Taiwan and many countries/regions around the world. In this course, we will cover several key concepts including "value chain", "patient journey", and "innovation ecosystem" with specific case studies to illustrate technology translation from basic research, through development, to market adoption.

Brain-computer interface with artificial intelligence for mental healthcare

人工智慧腦機介面於心智健康之應用

Chun-Shu Wei
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Emerging innovations at the intersection of neuroscience, engineering, and artificial intelligence are transforming how we understand and treat mental health conditions. In this talk, I will introduce our recent work in Brain-Computer Interface (BCI) technologies and AI-driven analysis methods, highlighting their potential impact on clinical practice. First, I will discuss our development of closed-loop personalized neuromodulation for major depressive disorder (MDD), where EEG-based feedback guides real-time, non-invasive brain stimulation protocols to optimize therapeutic outcomes. By continuously monitoring individual brain states, our system adapts stimulation parameters to enhance efficacy and reduce side effects. Next, I will present how explainable AI (XAI) has been applied to EEG data from schizophrenia patients. Through saliency mapping and rigorous fidelity checks, we can visualize the neural features driving diagnostic classifications, offering clinicians transparent insights into the biomarker patterns associated with psychiatric disorders. These endeavors exemplify the broader theme of clinical smart healthcare—using BCI and AI to personalize mental health interventions, improve diagnostic accuracy, and ultimately elevate patient well-being.

Exploring the possibilities of computer vision in medical image analysis

探索電腦視覺在醫學影像分析的可能性

Tsai-Pei Wang
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The collaboration between the fields of biomedical and computer sciences has always been viewed as having great potential for improving the wellbeing of humankind. This is particular true now with the amazingly fast progress of artificial intelligence. In addition to major advancements from larger scale projects, a lot of exciting possibilities also arise from the many creative questions and ideas of the medical practitioners. Actually, I have been very encouraged to see that many medical professionals are eager to explore possible applications of artificial intelligence, and information science in general, in their everyday practices.

The title of this talk is about computer vision and medical image analysis, as they are the fields that I am more familiar with personally. I would like to share my past and current experiences of working with medical professionals on several diverse problems, including more traditional modalities like MRI and X-ray, application in surgery, etc., and use them as examples of the diverse possibilities of applying computer vision techniques to medical image analysis problems. In addition to the technical aspects, I will talk about the process of collaboration, including the formation and evolution of research ideas.

Deep learning: From natural image analysis to medical image analysis

深度學習：由自然影像分析到醫學影像分析

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Deep learning has been widely used in the computer vision and image processing domains. For natural image processing, deep learning models achieve superior results compared to conventional methods. Starting from natural images, we aim to discuss the reasons why deep learning models achieve better results compared to conventional methods. Although deep learning models can learn good feature representations for natural images, can deep learning models also learn important information from medical images? In this talk, we will take three different types of medical images including endoscopic images, pathology images, and CT images as examples to show how to impose medical knowledge with deep learning models to help physicians diagnose diseases and reduce their burdens for labeling.

In endoscopic images, representing different gastric sections for disease diagnosis serves an important preprocessing step. Precancerous lesions can then be diagnosed from endoscopic images of different gastric sections based on different deep learning models designed from medical prior knowledge. In pathology image analysis, due to the large image resolution, reducing the manual annotation burden is important. In addition, cells with different sizes need to be considered for feature representations. The design of effective deep learning models to solve the aforementioned issues is presented. Finally, to guide physicians to the locations of common bile stones in CT images without pixel-level labels, a weakly supervised deep learning model is designed with explainable results. All of the deep learning models show unique designs with the promising results for medical image analysis and also show the applications of deep learning models from natural images to medical images.

Integrating the neuromodulation chip with an AIoT platform towards bringing the theranosis of brain disorders from hospital to everyone's home

整合神經調控晶片之智慧物聯網平台：將腦神經疾病診療從醫院帶到每個人家裡

Hsin Chen
陳 新
BioPro Scientific Co. Ltd. Department of Electrical Engineering, National Tsing Hua University, Hsinchu, Taiwan, ROC
生奕科技；國立清華大學 電機系

Bio-electronic medicine has become a promising alternative for treating neural diseases. However, the development of bio-electronic medicines relies greatly on understanding how the brain functions and identifying the biomarkers for distinguishing between normal and pathological states. To fulfill this research demand, the Neuro-Engineering Research Group was formed in the NTHU since 2004, and we had been devoted to developing neuromodulation chips and a variety of neuro-interfacing microprobes. These technologies were further applied to investigating novel treatments for the Parkinson's disease. After more than 15 years of research and publishing a bunch of journal papers, our team suddenly realized that no technology was really applicable to improving the treatment for neural disorders.

This "surprising consciousness" motivated us to co-found the BioPro Scientific in 2018. Based on our neuromodulation chip, a miniaturized microsystem, called NeuLive, suitable for recording and stimulating multiple brain regions of a freely-moving animal has been designed and commercialized. In addition, the microsystem allows the stimulation to be triggered only upon the detection of particular disease-related signatures. This function is especially crucial for investigating novel neuromodulation protocols that improve therapeutic efficacy and minimize side effects. All the technologies above have been applied to investigate the feasibility of intervening the progression of Parkinson's disease in early stage. Moreover, similar technologies are extended to realizing the wearable, non-invasive brain modulator called BrainDee, aiming to improve the theranosis of movement disorders. The BrainDee features 32 brain-modulation channels, each of which is able to record EEG and to deliver transcranial electrical stimulation. Particular attention is paid to enabling fast switching between recording and stimulation functions, so that how stimulation modulates brain activity could be investigated. Finally, as sleep disorders are known to be the prodromes of many brain disorders. A lightweight, wearable device called Lilia is for improving insomnia, as well as for detecting REM-sleep behavioural disorders, which is known to be the prodrome of the Parkinson's disease or Lewy body dementia.

This talk will introduce our latest findings and share our adventure journey of switching from academics to a startup. All the systems above will also be demoed. We sincerely hope the story would encourage more talents to devote themselves to the advancement of bio-electronic medicine.

From clinical dialogue generation to factual reasoning in large language models

從醫病情境對話生成到大語言模型的事實論證

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In the era of rapidly advancing generative AI, large language models (LLMs) have been widely applied in medical contexts, including automatic generation of doctor-patient dialogues, medical note summarization, and health consultation responses. However, these models frequently exhibit hallucination—producing outputs that, while grammatically correct and seemingly coherent, may fabricate nonexistent medications, misrepresent relationships between symptoms, or even generate medically incorrect information. These issues arise from the model's reliance on statistical patterns in data, rather than genuine understanding of medical knowledge or reasoning ability, posing significant risks in high-stakes fields like healthcare.

This talk begins with our practical experience of using LLMs to generate doctor-patient conversations, and highlights the structural challenges faced by language models in medical tasks. We will then explore how Retrieval-Augmented Generation (RAG) can be introduced to enhance the factual accuracy and reliability of LLM outputs. RAG integrates LLMs with external knowledge bases, enabling the model to first retrieve relevant information and then generate responses grounded in those facts—effectively reducing hallucination and providing traceable evidence.

We will also cover the implementation architecture of RAG, its application pipeline, benefits, and limitations. Concrete case studies will be presented to compare the performance of standard LLMs and RAG-enhanced models in specific regional datasets. Through this discussion, we aim to encourage a rethinking of LLMs—not merely as text generators, but as systems that must align with verified knowledge and factual integrity. RAG is not only a technical innovation; it is a crucial step toward building trustworthy AI.

Seeing and hearing dementia: Explainable and accessible AI for early detection using simple behavioral tests

看見與聽見失智症：以簡易行為測試實現可解釋且易取得的早期偵測 AI 工具

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Early detection of Alzheimer's disease (AD) and related dementias is essential for timely intervention but remains limited by the cost and complexity of conventional diagnostic tools. In this talk, we present a multimodal approach leveraging video and speech data collected concurrently during the Timed Up and Go (TUG) test and the Cookie Theft (CT) picture description task to support scalable and explainable cognitive assessment.

Our vision-based pipeline analyzes body joint and facial landmark features from the TUG and CT sessions using Convolutional Neural Networks and Support Vector Machines, achieving an F1-score of 0.92±0.03 in distinguishing AD from Non-AD individuals across multiple subtasks including walking, sit-stand, turning, and description. To enhance interpretability, we incorporate model explanation techniques to identify salient behavioral indicators relevant to diagnosis.

In parallel, we introduce a language-based dementia assessment system built on Transformer models. Speech recordings from the CT task were processed using Whisper for acoustic feature extraction and transcription, and BERT for capturing linguistic features. This system achieved a weighted F1-score of 83% and a mean squared error of 8% in predicting dementia-related scores.

Together, these results demonstrate the feasibility of an integrated, low-cost, and interpretable AI-based framework for early detection of cognitive impairment using synchronized multimodal behavioral data.