2021中華醫學會
110年度聯合學術研討會

時間：110年6月5日（星期六）

贊助單位：

臺北榮民總醫院、臺中榮民總醫院、高雄榮民總醫院
科技部、財團法人鄒濟勳醫學研究發展基金會
財團法人林堉璘宏泰教育基金會

理事長開幕詞

歡迎各位會員、女士、先生參與110年度的中華醫學會聯合學術研討會，本人謹代表全體理監事及會務工作同仁向大家表示誠摯的感謝!

中華醫學會從初期的篳路藍縷、一路的辛勤耕耘茁壯，始終秉持著以促進會員間的友誼及增進醫學知識的交流。尊此宗旨，本會發行中華醫學會雜誌，提供高水準的醫學論文發表的平台。每年評選並頒發優秀論文獎項，作為肯定年輕研究學者的鼓勵。中華醫學會能夠提供優秀論文的獎項，都要感謝來自各基金會的慷慨贊助，以及臺北榮總、臺中榮總、高雄榮總歷任院長及各公益教育文化等單位的鼎力相助和共襄盛舉。目前中華醫學會雜誌主編職務敦聘李發耀教授擔任，在李教授的帶領下，戮力提升雜誌學術品質，在推動國際化與數位化不遺餘力，2019年本雜誌Impact Factor已達2.17，成績斐然。

去年以來全球深受COVID-19疫情的衝擊，但國際上醫學領域的學術交流，並未因此停止。今年5月起國內疫情升溫，內政部規定暫停舉行會員大會，因此今年大會採用全視訊線上的方式進行，提供各位會員、女士、先生在安全無虞的環境下，持續有精進醫學知識及與國內外學者交流的管道。本屆大會由臺北榮總放射線部、胃腸肝膽科、及過敏免疫風濕科規劃籌辦了智慧醫療、胃癌先進治療、乾癬相關疾病等精彩主題，由國內、外專家學者，分享他們的經驗與學術成就。另外，109 年度優秀論文獎頒典禮也受疫情影響而取消，藉此機會本人特別恭喜 9 位得獎醫師:臺北榮總耳鼻喉頭頸醫學部-陳彥奇醫師、臺北榮總 一般內科-張景智醫師、臺北榮總 整形外科-王天祥醫師、萬芳醫院 心臟內科-莊再庚醫師、部立桃園醫院 泌尿外科-林冠榮醫師、臺北榮總醫研部-林益瑩研究員、臺北榮總 神經內科-林浚仁醫師、臺北榮總 放射腫瘤科-康鈺玫醫師、臺北榮總 病理檢驗部微生物科病毒組-吳易企醫檢師。期待後輩新秀繼續努力，為臺灣醫界，注入新活力。

學會近年來承蒙各位會員鼎力支持，會務得以延續傳承，各項學術活動也可繼續蓬勃發展，本人僅代表學會再一次向會員們表達最誠摯的謝意，並感謝所有演講者的無私奉獻，及工作人員的辛勞！更盼望藉由聯合學術研討會的交流，讓所有與會人士都能從中受益。最後，謹祝福與會的貴賓、會員、女士、先生與家人，身體健康、精神愉快，也祝福大會順利圓滿! 謝謝大家!

中華醫學會理事長 許惠恒 謹致

中華醫學會110年度

聯合學術研討會節目表

第二十三介白質-新近發現的乾癬及相關疾病治療標的

IL-23 as a New Therapeutic Target for Psoriasis & Allied Disease

時　　間：6 月 5 日(星期六) 08:30~12:00
地　　點：線上會議
協辦單位：嬌生股份有限公司

08:30-08:40	***Opening Remarks***	蔡長祐教授 Chang-Youh Tsai

座長：蔡長祐 教授 (Chang-Youh Tsai)

08:40-09:30	IL-23 在發炎反應中的角色 IL-23 in Inflammation an Overview	邱顯鎰醫師 Hsien-Yi Chiu

座長：張雲亭 教授 (Yun-Ting Chang)

09:30-10:20	IL-23 在乾癬的角色與治療 The role of IL-23 in Psoriasis Treatment	陳志強醫師 Chih-Chiang Chen

座長：周昌德 教授 (Chung-Tei Chou)

10:20-11:10	介白素-23 在關節炎及相關疾病中所扮演的角色 The Role of IL-23 in Arthritis Associated Ailment	廖顯宗醫師 Hsien-Tzung Liao
11:10-11:50	Panel Discussion	ALL
11:50-12:00	***Closing Remarks***	周昌德教授 Chung-Tei Chou

IL-23 in inflammation an overview

IL-23 在發炎反應中的反應

Hsien-Yi Chiu
邱顯鎰
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IL-23 is a proinflammatory cytokine which has been discovered for nearly two decades. It is primarily produced by antigen-presenting cells such as activated dendritic cells. The pivotal role of IL-23 is related to T17 maintenance and expansion, which demonstrates its importance in immune-mediated diseases such as psoriasis (PsO), psoriatic arthritis (PsA), and inflammatory bowel diseases (IBDs). Here, the presentation would focus on the role of IL-23 in immune axis.

The role of IL-23 in psoriasis treatment

IL-23 在乾癬的角色與治療

Chih-Chiang Chen
陳志強
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臺北榮民總醫院 皮膚部

Psoriasis, a chronic, systemic inflammatory disease with prominent skin involvement, affects approximately 2-4% of the world's population and profoundly impairs patients' health-related quality of life. Over the past 15 years, substantial improvements in the efficacy of biologics to treat moderate-to-severe psoriasis have been achieved. As a result, at least a 90% reduction of the baseline Psoriasis Area and Severity Index (PASI 90 response) is replacing PASI 75 as the standard response for measuring successful treatment of psoriasis.

Nowadays, psoriasis is considered as a systemic disorder, the so-called "psoriatic disease" because it affects not only skin, but other organs, including joints and cardiovascular system. As a disease that affects the physical appearance of the patient as well as the joints which might results in joints deformity and disabling, psoriasis is socially stigmatizing and isolating, which may result in depression and anxiety. Refer to its pathogenesis, psoriasis belongs to one kind of autoimmune disorder which involves in both innate and adaptive immunity. In fact, more and more researches have indicated that IL-23/IL-17 axis play major role in the pathogenesis of psoriasis. Based on its molecular mechanism, variety of effective biologics targeting tumor necrosis factor-alpha (TNF-a), both interleukin (IL)-12 and IL-23, and most recently IL-17 and IL-23 alone were developed.

Among all the biologics, monoclonal antibody that binds to the p19 subunit of IL-23 and inhibits the intracellular and downstream signaling of IL-23, which is required for terminal differentiation and survival of T helper (Th)17 cells has demonstrated a positive response with long term efficacy in psoriasis treatment. Multiple observations suggest disease modification in patients with psoriasis receiving anti-IL-23 treatment. Here, I will present you the differential impact of IL-23 vs IL-17 blockade on serum cytokines and immune cell subtypes in psoriatic skin from several clinical trial studies.

The role of IL-23 in arthritis associated ailment

介白素 -23 在關節炎及相關疾病中所扮演的角色

Hsien-Tzung Liao
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Psoriasis (PsO) is one of the most common inflammatory skin diseases, with an estimated prevalence of 0.6-4.8% of the global population. Patients typically present with characteristic erythematous plaques with a coarse overlying scale on specific sites such as elbows, knees, scalp, umbilicus and palms. Psoriatic disease also has multiple comorbidities, including psoriatic arthritis (PsA), nail lesions (such as pitting of nails and onycholysis), cardiovascular disease, inflammatory bowel disease, metabolic syndrome and psychiatric conditions, that can severely impact an individual's quality of life and daily functioning. The transition from a cutaneous to a synovio-entheseal disease affects about one-third of PsO patients, who develop to PsA over time. PsO precedes joint involvement on average by 7 years (range 0–20 years). The importance of early diagnosis and early intervention in articular disease is highlighted by the fact that a delay of 6 months in initiating PsA treatment already can cause peripheral joint erosions, with subsequent impairment of joint function.

In recent years, except for tumor necrosis factor and IL-17, enhanced understanding of the pathogenesis of psoriatic disease especially the role of T helper 17 cells, has resulted in the development of new classes of biologic drugs targeting modulators along its disease pathway. Among these, inhibitors of interleukin-23 have emerged as safe and effective options for the treatment of moderate-to-severe PsO and PsA. Besides, selective interleukin-23 inhibitors may also possess a effectiveness and more favorable risk profile without an increased risk of candidiasis. Overall, these highly effective medications are contributing to a rising standard for psoriatic disease outcomes through resolution of skin lesions and joint manifestations and improvement of patient quality of life.

胃腺癌治療之新進展

Advances in the Management of Gastric Adenocarcinoma

時　　間：6 月 5 日(星期六) 13:30~16:45
地　　點：線上會議

13:30-13:35	***Opening Remarks***	侯明志教授 Ming-Chih Hou
	座長：侯明志 教授 (Ming-Chih Hou)	
13:35-14:05	ESD 在早期胃癌的治療 The Role of ESD for Gastric Cancer Treatment	Prof. Takuji Gotoda (日本)
	座長：方文良 副教授 (Wen-Liang Fang)	
14:05-14:25	胃癌手術的新進展 Advances in the Surgery for Gastric Cancer	黃國宏副教授 Kuo-Hung Huang
	座長：羅世薰 教授 (Su-Shun Lo)	
14:25-14:45	腹腔溫熱化學治療 Hyperthermic Intraperitoneal Chemotherapy (HIPEC) for Gastric Cancer	謝茂志醫師 Mao-Chih Hsieh
14:45-15:00	***Coffee Break***	
	座長：黃怡翔 教授 (Yi-Hsiang Huang)	
15:00-15:30	胃癌免疫治療之新進展 Update of Immunotherapy in Gastric Adenocarcinoma	Prof. Taroh Satoh (日本)
15:30-15:50	胃癌化學治療及標靶治療之新進展 Update of Chemotherapy and Target therapy for Gastric Adenocarcinoma	陳明晃教授 Ming-Huang Chen
15:50-16:20	胃癌免疫治療深度經驗分享 Expert insights of IO for gastric cancer: When and how to incorporate immune checkpoint inhibitors?	Prof. Sun-Young Rha (韓國)
16:20-16:40	胃癌治療經驗分享 Case Sharing for the Treatment of Gastric Adenocarcinoma	許劭榮副教授 Shao-Jung Hsu
16:40-16:45	***Closing Remarks***	黃怡翔教授 Yi-Hsiang Huang

The role of endoscopic submucosal dissection (ESD) for gastric cancer treatment

ESD 在早期胃癌的治療

Takuji Gotoda

Division of Gastroenterology and Hepatology, Department of Medicine, Nihon University School of Medicine, Tokyo, Japan

Endoscopic submucosal dissection (ESD) has become a mainstream less-invasive treatment option with similar results to gastrectomy with lymph node dissection for early gastric cancers (EGC) with a very low risk for lymph node metastasis (LNM). In the guidelines of Japanese Gastric Cancer Association, the endoscopic curability after ESD is classified into three groups: eCura A(sbsolute indication), eCura B (expanded indication), and eCuraC-1/C-2 according to the rescetability and estimated risk of LNM. In eCuraA/B, scheduled surveillance gastroscopy is recommended for detecting metachronouse EGC in Japan. Re-ESD, abulation or surgical resection should be recommended in patients with eCura C-1. In eCura C-2, gastrectomy with lymph node dissection is generally proposed as the standard treatment strategy because of the higher risk for LNM.

Recently, gastric cancer is considered a disease of the elderly population because of decreasing prevalence of *Helicobacter pylori (H. pylori)* infection. Thus, considering the relatively low rate of LNM, surgical treatment according to the guideline in all elderly patients may be excessive. Although gastrectomy with lymph node dissection reduce cancer-specific mortality, surgical treatment might result in worse quality of life (QOL) especially in elderly patients. Recently, risk-scoring systems (eCura system) for LNM may be helpful to decide the treatment option in such patients with eCura C-2. Although permanent “cure” of cancer is absolutely important, in our clinical practice, many factors can affect treatment options, such as the patient’s age, potential adverse events, or the patient’s preferences. Of course, it should be noted that, when recurrence is detected in patients who were followed up without additional surgical treatment after ESD, most of them have a poor prognosis. To select an appropriate treatment option, especially in elderly patients with eCura C-2, a new tool for evaluating the condition of patients should be established.

Advances in the surgery for gastric cancer

胃癌手術的新進展

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In Taiwan, gastric cancer is currently ranked the ninth common cancer and the seventh cancer mortality. Surgical resection with radical lymph nodes dissection still plays an important role for gastric cancer. Surgical gastrectomy included subtotal gastrectomy, total gastrectomy, proximal gastrectomy and pylorus-preserving gastrectomy. Conventional reconstruction after gastrectomy includes B-I, B-II, and Roux-en Y anastomosis. Currently, delta-shape B-I anastomosis and double tract Roux-en Y reconstruction are emerging for distal gastrectomy and proximal gastrectomy, respectively. Minimal invasive gastrectomy is popular for radical gastrectomy in recent decades. Conventional laparoscopy and Robot-assisted laparoscopic gastrectomy were the major technique for minimal invasive gastric surgery. With the development of 3D image system, 3D laparoscopic gastrectomy gradually becomes the most common minimal invasive procedure for gastric surgery.

Hyperthermic intraperitoneal chemotherapy (HIPEC) for gastric cancer

腹腔溫熱化學治療

Mao-Chih Hsieh
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Heat kills cells including cancer cells. The effect of hyperthermia including temperature, duration and many intracellular factors. The adequate temperature and duration were studied to apply in medical treatment.

Peritoneal metastasis (PM) is the most common form of metastasis in gastric cancer. PM can be regarded as regional metastasis instead of distant metastasis. The conventional treatment for PM is systemic chemotherapy. Cancer cells escape from the primary site into the peritoneal cavity, becoming the free cancer cells. However, drugs into the peritoneal cavity through systemic chemotherapy, the concentration are low and the cancer cytotoxic effect is poor. Direct drug contact with cancer cells by adding heated water with chemotherapeutic agents into the peritoneal cavity is a rational concept.

Hyperthermic intraperitoneal chemotherapy (HIPEC) was applied for gastric cancer with PM since 1981 in Japan. In Taiwan, HIPEC was started at VGH-Taipei in 1992 and later was carried out by Wan-Fang Hospital since 2000. Combining with cytoreduction surgery (CRS), HIPEC was performed in curative intent. Peritoneal cancer index (PCI) was used to describe the extent of peritoneal metastasis and completeness of cytoreduction score (CC-score) was used evaluation of cytoreduction. To reduce PCI before surgery was found a significant factor to improve long term survival. Comprehensive managements including laparoscopic HIPEC, extensive peritoneal lavage, IP/IV bidirectional chemotherapy, CRS/HIPEC, adjuvant chemotherapy, improve the treatment result in patients of gastric cancer with PM.

A total of 164 patient is Wan-Fang Hospital received all kinds of HIPEC managements. There are 45 patients receiving NIPS and 96 patients received onetime curative intent CRS + HIPEC. The 5-year survival was 9.8% and 10.9%. PCI was 29.4 and 19.8 respectively, with operative complications of 4.4% and 36.5% (25% of severe morbidity).

A better oncological result is noted by CRS/HIPEC in selecting cases of gastric cancer with PM. Bidirectional chemotherapy further improved the survival in recent years. In cases of gastric cancer with PM, CRS/HIPEC offers an alternative treatment strategy.

Checkpoint inhibitors for Advanced Gastric Cancer

Taroh Satoh Osaka university

Advanced Gastrc Cancer(AGC) is a devastating disease with 12months Median Overall Survival. No new first line agents have been approved since the introduction of Trastuzumab for Her2 positive Gastric cancer in 2009. Recently, Checkpoint Inhibitors such as have shown great advances in this area.

In 2017 pembrolizumab approved by FDA as salvage line treatment for PDL-1 positive AGC based on the results of KEYNOTE-059 phase II study. Nivolumab approved by PMDA with the results of Attraction 2 trial in which nivolumab showed survival advantage over best supportive care with Hazard Ratio of 0.63.

Last year two important positive Phase III studies have been reported. In Checmate 649 tiral An international multicenter study CheckMate 649 enrolled approximately 1,500 patients with advanced or metastatic gastric cancer that could not be resected by surgery. OS in patients with CPS 5 or higher, the primary endpoint, had a hazard ratio of 0.71 (98.4% confidence interval: 0.59-0.86) and p <0.0001, which were significantly better in the nivolumab + chemotherapy group (Figure). 1). The median OS was 14.4 months in the nivolumab + chemotherapy group and 11.1 months in the chemotherapy group, with a difference of 3.3 months. Based on this study FDA approved Nivolumab for first line Gastric Cancer.

The ATTRACTION-4 trial is randomized 1: 1 to nivolumab plus chemotherapy or placebo plus chemotherapy in patients with untreated, unresectable, advanced or recurrent gastric-esophagogastric junction cancer. Chemotherapy SOX or CapeOX is the choice of the attending physician. In the interim analysis of PFS, a significant difference was observed when the hazard ratio was 0.68 (95% confidence interval: 0.51-0.90) and p = 0.0007.

There was a median PFS difference of 2 months, but the OS hazard ratio was 0.90, with no difference.

Currently Keynote 859 pembrolizumab plus chemotherapy have been investigated with Her2 negative AGC. Tisrelizumab have been evaluated as well. For her2 positive one, Keynote 811 tiral have shown great promise with increased response rate with its interim analysis.

For perioperative treatment Attraction5 adjuvant nivolumab plus chemotherapy is ongoing. Neoadjuvant and adjuvant pembrolizumab in Keynote585, Neoadjuvant and adjuvant duruvalumab in Matterhorn are also on going

Update of chemotherapy and targeted therapy for gastric adenocarcinoma

胃癌化學治療及標靶治療之新進展

Ming-Huang Chen
陳明晃
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臺北榮民總醫院 腫瘤醫學部

In the past decades, surgery and chemotherapy remains to be the primary treatment for gastric cancer; however, advancements in surgery and chemotherapy have reach a plateau. In 2020, targeted therapy and immunology have finally shine a light in gastric cancer. There are new drug approvals and developments in gastric cancer, including HER2 targeted therapies and new chemotherapy.

Ten years after publication of ToGA Trial, trastuzumab has finally received national health reimbursement for advanced gastric cancer in Taiwan in 2020. In addition, new emerging targets are available to overcome trastuzumab resistance. The first one, trastuzumab deruxtecan (DS-8201), an antibody-drug conjugate consisting of an anti-HER2 antibody, a cleavable tetrapeptide-based linker, and a cytotoxic topoisomerase I inhibitor was approved by FDA for the treatment of patients with HER2 positive unresectable or metastatic gastric or gastroesophageal junction adenocarcinoma who have received two or more prior regimens including trastuzumab. The latter, margetuximab, a monoclonal antibody that binds to the same epitope of HER2 as trastuzumab, also demonstrated to be effective in HER2 positive gastric cancer. Although HER2 positive accounts for less than 10% of gastric cancer, trials in combination with other anticancer treatments including immunotherapy, also are underway. Other targeted therapy such as claudin-18.2 and FGFR2b are also potential therapeutic targets for gastric cancer.

In addition to targeted therapy, new chemotherapy, TAS120 (Lonsurf) has become one of the standard for third line treatment in metastatic gastric cancer since their approval in 2019.

Encouraging result from TAGS demonstrated improve in progression-free survival and overall survival suggesting TAS120 is one of the standard 3rd line therapy of metastatic gastric cancer.

Expert insights of IO for gastric cancer: When and how to incorporate immune checkpoint inhibitors?

胃癌免疫治療深度經驗分享

Sun Young Rha

Department of Medical Oncology, Internal Medicine, Yonsei Cancer Center, Songdang Institute for Cancer Research Yonsei University College of Medicine, Yonsei University Health System, Seoul, Korea

Precision medicine including targeted and immunotherapy is becoming more feasible in many cancers with accumulation of immune-genomic information. However, the progress of precision medicine in metastatic gastric cancer(GC) is very slow and only in a limited subpopulation is getting benefit from targeted and immunotherapy. The potential reasons for these limitations are 1) tumor heterogeneity and difficulties in proper sample availability, 2) proper target identification with target validity, 3) drug efficacy and availability, and 4) complex clinical behavior with unproven biology behind. Based on TCGA molecular classification, current NGS technology makes it feasible for proper subgrouping and selecting each patient's molecular subgrouping. Our cooperative and integrative effort will support precision medicine in reality. Also, recent clinical trials data supports changing strategy of systemic treatment for metastatic GC, including immune checkpoint inhibitors. Here I will share the recent data and discuss the potential changing strategies based on the role of IOs in GC.

Experience sharing for the treatment of gastric adenocarcinoma

胃癌治療經驗分享

Shao-Jung Hsu
許劭榮
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臺北榮民總醫院 胃腸肝膽科

Gastric cancer is the fourth leading cause of cancer related death all over the world. Despite the evolving of target therapy, the outcome of unresectable gastric adenocarcinoma is still poor.

Immunotherapy has changed the clinical practice of cancer treatment in the recent years. By targeting the host immune system, immunotherapy has proven amazing efficacy in several solid organ tumors. The efficacy of immunotherapy deeply correlated with the immune microenvironment and the immunogenicity of the tumor cells. Although a lot of mechanisms remains unexplored, recent studies has shown promising results of immunotherapy in selective patients with gastric cancer. In this section, we will review the latest trials of immunotherapy in gastric cancer.

智慧醫療的未來進行式

Smart Healthcare: Its Future Progressive Tense

時　　間：6 月 5 日(星期六) 08:30~17:10
地　　點：線上會議

主辦：臺北榮民總醫院

本活動經費來源：公益信託林堉璘宏泰教育文化公益基金、財團法人許金德紀念基金會、財團法人沈力揚教授醫學教育獎學紀念基金會、臺北榮民總醫院放射線部、台灣飛利浦股份有限公司

08:30-08:40	***開幕致詞*** ***Opening Remarks***	國軍退除役官兵輔導委員會 馮世寬主任委員 理事長 許惠恒教授 Wayne Huey-Herng Sheu

Session 1：智慧醫療的產官學研商-1

座長：　高壽延 教授　(Shou-Yen Kao)
陳威明 教授　(Wei-Ming Chen)
曾新穆 教授　(Vincent S. Tseng)

08:45-09:05	健保大數據　醫療新契機 Big Data and New Opportunities of NHI	李伯璋教授 Po-Chang Lee,
09:05-09:25	台灣智慧醫院之趨勢與挑戰 The Trend & Challenge of Taiwan Smart Hospitals	賴飛羆教授 Fei-Pei Lai
09:25-09:45	精準健康與資料治理的挑戰 Precision Health and Data Governance Challenges	杜奕瑾董事長 Ethan Tu
09:45-10:00	***Break***	

Session 2：智慧醫療的產官學研商-2

座長：　馬　旭 教授　(Hsu Ma)
曾令民 教授　(Ling-Ming Tseng)
許瑞彰 顧問　(Gordon Hsu)

10:00-10:20	創造學產雙贏：智慧數位病理的未來發展策略 Win-Win of Academic-Industrial Cooperation: Future Development Strategy for AI Digital Pathology	梁文議主任 Wen-Yih Liang

10:20-10:40	5G 及其在醫療體系的應用 5G and it's Medical Applications	謝志鴻教授/陳志成教授 Bob Hsieh/Jyh-Cheng Chen (共同主講)
10:40-11:00	人工智能賦能的健康照護解決方案 AI-Empowered Healthcare Solutions	姚智清副總裁 Jyh-Ching Yaur
11:00-11:25	***Panel Discussion (Sessions 1 & 2)***	***座長：高壽延教授、曾新穆教授***

Session 3：智慧醫療臨床使用

座長： 侯明志 教授 (Ming-Chih Hou)
唐德成 教授 (Der-Cherng Tarn)

11:25-11:37	以機器學習模型辨識大腸鏡影像定位與病灶分類 A Novel Machine Learning-Based Algorithm to Identify and Classify Lesions and Anatomical Landmarks in Colonoscopy	盧俊良教授 Ching-Liang Lu
11:38-11:50	大腸直腸癌的精準醫學：以病人相似度演算的研究 Precision Medicine of Colorectal Cancer: A Patient Similarity Based Approach	姜正愷教授 Jeng-Kai Jiang
11:50-12:30	***Lunch Time***	
12:30-13:30	***醫路同行共創智慧醫療未來式***	***Philips***

Session 4：從學研、協會、醫政和醫院的面向探討 FHIR 的現況與未來

座長： 王大為 研究員 (Da-Wei Wang)
孫英洲 醫師 (Ying-Chou Sun)

13:30-13:42	FHIR 的時代，您準備好了嗎？ Are You Ready for FHIR?	李麗惠助理教授 Li-Hui Lee
13:42-13:54	以 FHIR 為基礎的健康資料研究聯盟 FHIR-based Health Data Research Consortium	許明暉教授 Min-Huei Hsu
13:54-14:06	利用 FHIR 促進衛政健康資訊的交換並與國際接軌 Using FHIR to Promote the Exchange of Health Information and Connect with the International Community	龐一鳴處長 I-Ming Parng
14:06-14:18	臺中榮總導入 FHIR 應用經驗 Adopting FHIR Standard in Taichung Veterans General Hospital	賴來勳主任 Lai-Shiun Lai
14:18-14:35	***Panel Discussion***	

Session 5：聯邦學習：從可行性評估研究到國際合作

座長： 施鑫澤 總主筆 (Corey Shih)
吳育德 教授 (Yu-Te Wu)
郭萬祐 教授 (Wan-Yuo Guo)

14:35-14:47	從產業觀點看聯邦學習 Viewing Federated Learning from the Industrial Point of View	施鑫澤總主筆 Corey Shih
14:47-14:59	腦瘤磁振影像自動圈選的聯邦學習實例分享 A federated-learning example of automatic segmentation of brain tumors on MR images	吳育德教授 Yu-Te Wu
14:59-15:11	台大 TW-CVAI 團隊心臟 AI 開發聯邦學習經驗分享: Yin and Yang The Yin and Yang of Federated Learning for AI Development: Experience Sharing from TW-CVAI Group of NTUH	王宗道教授 Tzung-Dau Wang
15:11-15:23	各類臨床醫學資料的聯邦學習探討 Federated Learning in the Medical Scenario – An overall survey in various clinical medical data	塗明達顧問 Ming-Ta Tu
15:23-15:40	***Panel Discussion***	
15:40-15:55	***Break***	

Session 6：醫學影像 AI 模型的臨床導入與效能優化

座長： 吳秀美 主任 (Hsiu-Mei Wu)

盧鴻興 教授 (Henry Horng-Shing Lu)

15:55-16:07	醫學影像 AI 模型的優化、落地與推廣 From DeepMets® to DeepMets-Plus and Beyond	郭萬祐教授 Wan-Yuo Guo
16:07-16:19	AI 時代的臨床工作與研究設計：以 DeepMets-Plus 為例 Clinical Work and Study Design in the AI Era：An Example of DeepMets-Plus	李政家醫師 Cheng-Chia Lee
16:19-16:31	肺癌的臨床情境和 AI MODEL 的深度整合 The Deep Intergration of AI Model and Lung Cancer Management in Our Hospital	趙恒勝醫師 Heng-Sheng Chao
16:31-16:50	模型效能優化、臨床導入與推廣 Model Optimization, Clinical Implement and Promotion	與談人： 劉庭祿教授/孫英洲醫師 Tyng-Luh Liu / Ying-Chou Sun
16:50-17:10	***Panel Discussion***	

Big data and new opportunities of NHI

健保大數據 醫療新契機

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National Health Insurance (NHI) is a single-payer and mandatory program in Taiwan, as well it offers a comprehensive and uniform benefits package to all those covered by NHI. Meanwhile, there are over 90% medical care facilities contracted and reimbursed medical fee to NHIA in Taiwan. All these reimbursement detail was cumulated and constructed as so-call NHI research database (NHIRD), then biomedical data and images has also begun to be included from 2015 and 2018 individually. If these data could be used for diagnostics or treatment, it might be of great value for medical understanding and development but also has potential for predicting healthcare trends.

In 2020, COVID-19 has caused a major impact on people lives and healthcare providers in worldwide. Meanwhile, Taiwan has excellent performance in prevention and control by its advanced technology and creative. NHIRD played an important role to monitor and control the spread of COVID-19 pandemics in Taiwan. MedChex, organized by Dr Chiang, is one of the artificial intelligence (AI) applications which can identify the features of COVID-19 in chest X-ray. NHIA set this function and provided in virtual private network (VPN) to preliminary categorize suspected patients in providers. Besides, we have proposed a pilot program and there are 15 teams to join in and develop some interesting AI applications. For example, brain tumor detection or evaluation of cardio-ankle vascular index and so on.

Although this pandemic brought us lots challenges and suffers, we still went on to eliminate this virus and return life to normal. We would have great optimism that it would be an opportunity for NHIRD to provide substantial improvements and contribution in areas of precision medicine and applications of AI.

The trend & challenge of Taiwan smart hospitalsl

台灣智慧醫院之趨勢與挑戰

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In this talk, I will disclose how the National Taiwan University Hospital (NTUH) has been building up the information infrastructure for smart hospital gradually since 2016. A smart hospital is a hospital that relies on optimised and automated processes built on an information and communication technology (ICT) environment of interconnected assets, particularly based on Internet of smart things (IoST), to improve existing patient care procedures and introduce new capabilities.

What makes a hospital smart is, therefore, the availability and use of meaningfully interconnected systems and devices that lead to overall smartness. While legacy systems may indeed be an integral part of end-to-end smart processes, the emphasis of this study will be on new technologies, and particularly IoST components.

Precision health and data governance challenges

精準健康與數據治理挑戰

Ethan Tu
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台灣人工智慧實驗室

Precision health integrates information from various sources, including multi-omics, daily lifestyle behavior, social media, and medical records, with AI/ML algorithms to achieve personalized care. These algorithms will be fueled with data from the real world. As analytic methods continue to improve, these approaches will affect the healthcare industry, such as providing the risk prediction for chronic diseases, enabling greater personalized life coaching, and democratizing access to this enhanced clinical care. Although the medical data is growing faster than ever before, the cross-boundary learning is still facing trust, privacy, and security issues. To solve these problems, the experts from computations, laws and medical fields are now working together illustrating the policies for data governance. Data governance is standardized and structured methods organizations use to manage and protect their data. With these methods, the data interoperability between different institutes, populations, or countries could be improved to provide benefits to diagnosis, disease management and treatment, clinical trials, and personal well-being. This talk will introduce how the world-leading experts work and what Taiwan AI Labs has done. It demonstrates Taiwan can help in growing AI/ML healthcare solutions with good data governance policy.

Win-Win of academic-industrial cooperation: Future development strategy for AI digital pathology

創造學產雙贏：智慧數位病理的未來發展策略

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Pathology has been and continues to be the cornerstones of almost all of the medical care events. Treatments start with pathological diagnoses and a precise treatment relies on a precise pathological diagnosis. Facilitated by digital pathology inauguration, the integration of artificial intelligence (AI) will be one of the biggest transformations for medicine in the coming decades.

The cooperation (and collaboration) between the academic side and the industrial side is becoming critical in integrating AI into the medical practice and creating benefits, both medical and financial, for the health care business. The application of AI resulting from the cooperation not only accelerating but also improving the quantity and quality of the AI algorithms developed for the diagnoses and analyses of daily pathology samples and therefore promote the persistent improvement of the patient management in the very near future. A win-win situation for both the academic and the industrial would be enthusiastically anticipated.

Along with the prosper of the AI application in digital pathology, a success in establishing a precision medicine-based digital pathology daily practice would generate huge impact to our training of future pathologists. To combine knowledge-based and professional-oriented education with inputs from the AI industry will be another seminal issue that deserves delicate design and preparation from now.

5G and its medical applications

5G 及其在醫療體系的應用

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It is envisioned in the future that not only smartphones will connect to cellular networks, but also all kinds of different devices, sensors, vehicles, etc. However, since the characteristics of different devices differ largely, people argue that future 5G communication systems should be designed to accommodate these different scenarios elastically. In this talk, we will first present the characteristics of 5G networks, including enhanced mobile broadband (eMBB), ultra-reliable and Low latency communications (URLLC), and massive machine type communications (mMTC). We will then discuss the free5GC, which is an open-source project for the 5th generation (5G) cellular core network based on the specifications of 3GPP Release 15 and beyond.

The ultimate goal of free5G is to implement a full commercial operational core network including Operation, Administration and Management (OAM), orchestrator, and network slicing. The cellular core network is very expensive, and it is not easy to access the source code. For people doing research in this area, they usually could only conduct mathematical analysis and simulation to verify their ideas. With free5GC, researchers not only can get the source code for free but also can realize their own ideas in a real core network environment. The free5GC can also help ICT industry to develop and test 5G products. It will be important and essential for the development of the 5G industry.

In addition to new features of 5G, private 5G networks is emerging to address critical applications. Unlike public networks, private networks are customized to specific fields, such as medical and industrial applications, to ensure security, guarantee quality of service, and so on. With the characteristics of eMBB, URLLC, and mMTC in 5G, there are also many new medical applications. For example, high-resolution medical images can be transmitted much faster than that using 4G. Remote diagnosis and remote surgery would also be possible by using 5G. Medical training could also leverage AR/VR and be transmitted by using 5G. Private 5G networks with medical sensors and devices could enable novel applications as well. We will discuss them in the talk.

AI-empowered healthcare solutions

人工智能賦能的健康醫療解決方案

Jyh-Ching Yaur
姚智清
Research and Innovation Hub Shanghai, Philips Greater China
飛利浦大中華區研發 及 上海創新中心

Philips China Innovation Hub is one of the four innovation hubs at Philips, and we are the corporate research center and innovation engine for Philips in Greater China. Our focus is on breakthrough technologies development aiming to make a difference to people's health and wellbeing across healthcare continuum, with special attention to the challenges in the greater China market.

With the theme of AI, I would like to start first with some background on how digital technology has enabled the healthcare transformation. We can see nowadays, and especially in this post-COVID era, the meaning of Cloud, Internet of Things, AI, Sensorization have played and will also play more important roles in various healthcare scenarios, across the health continuum. For example, continuous health tracking, population health, context-aware patient monitoring, real-time care, advanced visualization, augmented reality, image-guided therapy, computational pathology, genomics, quantification, adaptive interfaces and so on…

At Philips, we have been applying intelligent healthcare in various aspect of our products, solutions and services, and I would like to take one use case of Philips collaboration with TPEVGH to elaborate – AI application in ICU and Adult ARDS Subgroup. More than 1/3 of patients admitted to the ICU in circulatory shock, Mortality: 40–59 %. But single vital sign indicator, e.g. SBP, can deteriorate in very late stage of hemodynamic deterioration. Philips has built a Hemodynamic stability index with multiple indicators. Not only systolic blood pressure, heart rate, as well as lab results like lactate, ventilator parameters, etc. to early detect the deterioration that drives interventions and other care processes and deliver lower ICU mortality, LOS, and cost. This Philips AI-based model, i.e. Hemodynamic Stability Index (HSI) can increase 15% of AUC than benchmark indicators in US & EU cohort, and can show better performance hours before intervention.

Today, AI still has challenges in healthcare, especially for the challenges on deviation of data distribution over the cohort. To address the challenges of deviation, we extend our HSI model to validate and optimize in TPEVGH cohort. First deviation, is on label of shock, another is on deviation of feature distribution. After address these problem, we optimized the model, and in the draft of manuscript. Here would like to show how to screen out the high risk of shock patient in TPEVGH by using HSI model.

At Philips, we are turning data into actionable insights for precision health. Internet of Things, Data and AI enable and ecosystem of connected medical and personal care devices and services, that can ingest, analyze and exchange data to empower users (consumers, patients, care providers, and payers) by optimized workflows, automation and support of timely, better informed decision. We look forward to having more meaningful collaborations with our partners together, to achieve our goal of improving 2.5 billion people’s lives every year by 2025.

A novel machine learning-based algorithm to identify and classify lesions and anatomical landmarks in colonoscopy

以機器學習模型辨識大腸鏡影像定位與病灶分類

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Colonoscope is extensively conducted worldwide for the optical and histologic diagnosis of suspected colon lesions, resection of adenomatous polyps, and hemostasis of bleeding. Application of the concept and technology of computer-aided diagnosis (CAD) for colonoscopy has also gained much attention recently in the detection of colon polyps. However, the application of this artificial intelligence (AI) to identify normal colon landmarks and differentiate multiple colon diseases, such as diverticulum, colon cancer and ileocecal valve, has not yet been established. We aimed to develop a convolutional neural network (CNN)-based algorithm (GUTAID) to recognize different colon lesions and anatomical landmarks. Colonoscopic images were obtained from the databank in the Endoscopy Center for Diagnosis and Treatment of Taipei Veterans General Hospital to train and validate the AI classifiers. An independent dataset was collected for verification. The architecture of GUTAID contains 2 major sub-models: the Normal, Polyp, Diverticulum, Cecum and CAncer (NPDCCA) and Narrow-Band Imaging for Adenomatous/ Hyperplastic polyps (NBI-AH) models. The development of GUTAID was based on the 16-layer Visual Geometry Group (VGG16) architecture and implemented on Google Cloud Platform. In total, 7,838 colonoscopy images were used for developing and validating the AI model. An additional 1,273 images were independently applied to verify the GUTAID. The accuracy for GUTAID in detecting various colon lesions/landmarks is 93.3% for polyps, 93.9% for diverticula, 91.7% for cecum , 97.5% for cancer, and 83.5% for adenomatous/hyperplastic polyps. By seeking the collaboration with local industry, we further collected and labelled more lesions and photos from our database to improve the accuracy in identifying lesions and anatomic locations. With the help from the engineers of local industry, we set up a prototype of user interface (UI) design and add more functions such as, bowel cleanness and warning system of abnormally rapid withdraw during colonoscopy. In summary, we successfully build up a CNN-based algorithm (GUTAID) to identify colonic abnormalities and landmarks with high accuracy. With the optimization of this AI system by increasing accuracy by labelling more lesions, building up friendly UI, and incorporating more functions, we hope to initiate a clinical trial of this novel GUTAID system to prove its clinical effectiveness.

Precision medicine of colorectal cancer: A patient similarity based approach

大腸直腸癌的精準醫學：以病人相似度演算法的研究

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Colorectal cancer (CRC) has been the most common cancer in Taiwan since 2006. Although most of the patients were treated following the NCCN guideline, a portion of patients developed recurrence and mortality unexpectedly. Most of the previous works were focusing on identifying risk factors, however, none of them can explain all the events.

Patient similarity metrics can quantify the degree of similarity between the index patient and a past patient recorded in electronic medical data and, thanks to big data management, may provide an algorithm for risk prediction. Owing to high dimensional attributes for each patient, it is rather challenging for the clinical researchers to match similar patients according to different clinical contexts. Therefore, on the basis of global existing patient similarity prototype, we try to build up a visual unsupervised patient similarity system to facilitate the downstream clinical practice, leading to improve patient care and outcomes.

We established a population-based CRC cohort by collecting from the Taiwan Cancer database (TCDB) Registry, which is managed by the Bureau of Health Promotion (BHP), Department of Health. This study consisted of a consecutive series of 6,844 patients who were diagnosed with CRC and treated at TPEVGH during the period of January 2011 to December 2017. We first prioritized the first batch of data features as the input of unsupervised algorithm. When inputting a new patient, the unsupervised algorithmic module will take advantage of k nearest neighbor (kNN) search to seek the most similar patients in the dataset. With the fundamental Patient Similarity package, physicians can quickly have the sense of treatment strategy and outcomes, thus shortening the learning curve of young physicians and share the decision-making process with patients. The Patient Similarity can be further expanded by adding potential attributes and explore novel treatment modality, which is believed as the next step for personalized treatment.

Are you ready for FHIR?

FHIR 的時代，您準備好了嗎？

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Why does Health Level Seven International (HL7) International develop the latest standard FHIR (Fast Healthcare Interoperability Resources)? There are at least three reasons. Firstly, tooling for previous HL7 standards, e.g., Clinical Document Architecture (CDA), has always been an issue, as these tools generally need to be explicitly designed for HL7 and do not always provide in time. Also, there are new use cases especially involving mobile devices, where the current standards were not a good fit. Thirdly, the use of a REST-based architecture for webspace is widely used in other domains. To respond to these and other issues. Fast Healthcare Interoperability Resources (FHIR) is designed for easy to develop, implement, semantically robust, human-readable, validate electronically, and embed modern web-based communication technologies (HTTP, XML, JSON, etc.).

However, what is the international trend of FHIR adoption? How many countries are adopting or promoting FHIR? How many FHIR-related projects and applications are there? What are FHIR-related events frequently held internationally?

As medical data exchange within and across countries begins to be based on FHIR. If people in Taiwan want to collaborate with international organizations in (bio-)medical informatics research, sell medical information systems and applications to other countries, or purchase the most advanced medical information products abroad. In that case, can they interface with the corresponding FHIR-based medical information? Stakeholders such as researchers, physicians, IT engineers, medical institutions, and government agencies who want to adopt FHIR always ask the first question: How do we start? How to start with international or Taiwan policies and regulations? What is a correct adoption of FHIR?

To respond to these questions, Dr. Lee has collated her observations and learning from the past few years to provide the audience with the current international practices and the latest information. She hopes to alleviate the audience's doubts, encourage the audience to sense and accept FHIR and prepare early for FHIR. When organizations and individuals have FHIR capability, they can develop contemporary technical capabilities, enhance the international applicability of intelligent medical research & development (R&D) artifacts and products, and maximize their qualitative and quantitative contributions.

FHIR-based health data research consortium

以 FHIR 為基礎的健康資料研究聯盟

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The medical image standard Digital Imaging and Communications in Medicine (DICOM) is well established and routinely used both in healthcare and biomedical research. There is still no such standard for electronic medical record. While Health Level Seven International (HL7) standard is increasingly used for communication, EHR-based data sharing, analytics and machine learning, the self-defined and study-specific data models are still commonly used in research. Clinical Data Interchange Standards Consortium (CDISC) is used with some extend for medical research but has never reached the level of an international standard for others than clinical trials for regulatory approval. Particularly in academic medical research, where study subjects have also a treatment relationship with the institution, the current interoperability issue between healthcare and research is error-prone, laborious, and is the main barrier for the employment of existing data resources for research. Therefore, a common communication standard is of high interest to enable seamless data sharing between different systems.

The National Institutes of Health (NIH) in the US launched a health database construction plan for the development of medical AI in 2018. This plan adopted the Health Level 7 (HL7) data exchange standard FHIR (Fast Healthcare Interoperability Resources) and data sharing policy -FAIR (Findable, Accessible, Interoperable, Reusable).

The major technology change embodied in Fast Healthcare Interoperability Resources (FHIR) is a fundamental move away from a document-centric approach to a data-level access approach using application programming interfaces (APIs). Specifically, FHIR features a concept called “Resources” meaning a basic set of structured data.

FHIR technology represents a major opportunity to accelerate health care data interoperability across a wide range of currently disparate systems. Ultimately, FHIR will become a critical technology driver for increasing health care quality, increasing patient access and facilitating biomedical research.

In this presentation, I will introduce the initiative to build a FHIR-based health data research consortium.

Using FHIR to promote the exchange of health information and connect with the international community

利用 FHIR 促進衛政健康資訊的交換並與國際接軌

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The concept and framework of Health Level Seven International (HL7) have existed more than 30 years. Taiwan introduced HL7/CDA standard for electronic medical record exchange has lasted for more than 10 years. Since NHI adapted both the med-cloud and my health bank, the effectiveness of Electronic Medical Record Exchange Center (EEC) for localized reference became an issue for the department of information in Ministry of Health and Welfare (MOHW), especially after the WannaCry event in 2019. The FHIR is a well developed standard in many countries under the situations of insurance reimbursement, patient reference, cross bound health claim and etc. Clinical Document Architecture (CDA), FHIR is tiny, simply and more interoperable. According to the following reasons, we are glad to add on FHIR standard in Taiwan. First, we got lesson from EEC and decided to improve the efficacy of health data exchange between ourselves and hospitals/health providers. Second, the covide-19 pandemic creates the chance for international health data exchange and verification. Third, the SI cooperation for health service should can offer cross boundary business. Introducing and implementing FHIR standard is a triple win strategy for health information development in Taiwan. We need the cooperation and support from government, academy, health provider and information industry.

Adopting FHIR standard in Taichung Veterans General Hospital

臺中榮總導入 FHIR 應用經驗

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Fast Healthcare Interoperability Resources (FHIR) is a standard describing data formats and elements and an application programming interface (API) for exchanging electronic health records (EHR). The standard was created by the Health Level Seven International (HL7) health-care standards organization.

FHIR is a platform specification that defines a set of capabilities use across the healthcare process, in all jurisdictions, and in lots of different contexts. It also provides an alternative to document-centric approaches by directly exposing discrete data elements as services.

One of its goals is to facilitate interoperability between legacy health care systems, to make it easy to provide health care information to health care providers and individuals on a wide variety of devices from computers to tablets to cell phones, and to allow third-party application developers to provide medical applications which can be easily integrated into existing systems.

In Taichung Veterans General Hospital, we try to adopt FHIR standard for connecting various medical devices. The Goal is to provide seamless integration of medical devices, such as Physiological measurement devices, Respirator devices, and etc.

In this session, we will present the experimental results and future plans. The facts in Taichung Veterans General Hospital confirm that FHIR is very suitable for connecting various medical devices in Hospital.

Viewing federated learning from the industrial point of view

從產業觀點看聯邦學習

Corey Shih
施鑫澤
CIO IT Manager Magazine, Taipei, Taiwan, ROC
CIO IT 經理人月刊

Federated Learning has gradually emerged, and its benefits are self-evident. However, from an industrial perspective, the follow-up development and the problems to be faced may affect the effectiveness of future popularization.

In addition to the medical cases seen today, Federated Learning has the ability to achieve larger, but more detailed and personalized models.

From the perspective of the industrial ecosystem, in addition to overcoming the technical level, formulating a game rule acceptable to all parties will be an important key. In this regard, it may be necessary to conduct research through specialized agencies, collect relevant international cases, and formulate a transparency. For the platform contract of the company, we will add a few articles according to the industry. In this way, it will hopefully open up the development momentum of Federated Learning.

In addition, how to formulate a profit sharing mechanism acceptable to all parties will also affect the willingness of the industry to accept it.

A federated-learning example of automatic segmentation of brain tumors on MR images

腦瘤磁振影像自動圈選的聯邦學習實例分享

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Manual delineation of brain rumors by magnetic resonance (MR) imaging is required for diagnosis, radiosurgery dose planning, and follow-up tumor volume measurement. A rapid and objective automatic segmentation method is required to assist physicians to alleviate their laborious annotation. In this talk, a two-pathway U-Net model learned from MR images (T1-weighted with contrast images.) for effectively segmenting tumors, including brain metastases, glioma, meningiomas, schewannoma, and pituitary adenoma will be introduced followed by our preliminary results of federated learning.

Federated learning is a framework for distributed machine learning. Compared to traditional models that collect data from hospitals to a central location for model training, the concept of federated learning is based on privacy and security considerations, allowing models to be trained at local hospitals, and then the trained models are encrypted and sent to the central location for aggregation. In our federated learning architecture, the environment was built with NVIDIA Clara Train SDK v3.0 and NVIDIA VT100 with VRAM 24GB. In the first example, the data was from Taipei Veterans General Hospital (VGHTPE) and the training data was randomly assigned to two clients, each with the same number of training data. The same testing data was used to evaluate the performance of centralized learning and federated learning and their results were comparable. In the second example, the two-pathway U-Net model was trained locally at VGHTPE, Tri-Service General Hospital (TSGH) and National Taiwan University Hospital (NTUH) and trained using federal learning for brain tumor segmentation. We used the testing data at each hospital to evaluate the individually trained models and federated model, the sensitivities resulted from federal learning were superior to those only using in-house data for model training, which were VGHTPE: 0.79 versus 0.74, TSGH: 0.58 versus 0.48, NTUH: 0.62 versus 0.53, respectively.

The Ying and Yang of federated learning for AI development: Experience sharing from TW-CVAI Group of NTUH

台大 TW-CVAI 團隊心臟 AI 開發聯邦學習經驗分享 : Ying and Yang

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Federated learning is a strategy to facilitate the applicability of artificial intelligence (AI) models by incorporating relevant information from training materials of different research/medical centers while preserving the integrity of ethical and proprietary requirements of the data within centers. It has been widely advocated to apply in areas where information is of high proprietary and ethnical requirements, like medical information. Through this mechanism, the developer could collect large amounts of training data with different ethnic/regional characteristics and improve the generalizability of models developed. The downside of federated learning is that data with poor-quality could spoil the model and reduce its accuracy. Therefore, a set of standards should be established to keep the quality of data/information provided. Strategies to optimize the process of federated learning both centrally and locally to improve the performance of AI models should be developed and standardized.

Since 2017, researchers with Cardiology and/or Radiology expertise from National Taiwan University Hospital and 8 medical centers, together with researchers specialized in medical imaging and AI, joined together to initiate the Taiwan CardioVascular Artificial Intelligence (TW-CVAI) consortium. Under the funds from MOST, the TW-CVAI group established a well-annotated big medical imaging databank of coronary computed tomography (CT) angiography, invasive coronary angiography, and various functional and invasive images, which could be accessed in the LIONS platform of NARLabs. Based on the multi-institutional images, we examined the efficacy and limitations of federated learning in our developed AI model, HeaortaNet, which is the only AI model being validated by Nvidia and openly available in Nvidia GPU Cloud. The capability of HeaortaNet is to segment the pericardium and aorta in non-contrast chest CT scanning. It had been validated in the big imaging bank of National Health Insurance Database. Details of our evaluation of the pro and cons of federated learning will be reported in the Talk.

Federated learning in the medical scenario: An overall survey in various clinical medical data

各類臨床醫學資料的聯邦學習探討

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Federated Learning - A state-of-the-art decentralizing machine learning way for enhancing the quality of medical data. The impact of data quality and quantity (on modeling) is always critical, no matter in traditional statistics or machine learning (deep learning).

In detail, federated learning (also known as collaborative learning) is a machine learning technology that can train algorithms across multiple scattered edge devices or servers that store local data samples without exchanging them. This method is contrary to traditional centralized machine learning technology, which uploads all local data sets to a server, while traditional decentralized methods often assume that the distribution of local data samples is the same.

Federated learning enables multiple participants to build a universal and robust machine learning model without sharing data, which can solve critical issues such as data privacy, data security, data access permissions, and access to heterogeneous data.

Moreover, Data privacy is always the top consideration for digital health and health informatics. However, it becomes a significant obstacle for AI model development, protected and restricted by regulations such as “right to explanation” from GDPR.

Join us in discovering a new way to develop better interpretable AI while keeping data privacy in various clinical medical data in this seminar. Mainly use VGHTPE’s medical images and open data to carry out some related federated learning verification and comparisons and present the results of various clinical data using federated learning in a summary manner.

From DeepMets® to DeepMets-Plus and beyond

醫學影像 AI 模型的優化、落地與推廣

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This is a work resulted from joint efforts of Taipei Veterans General Hospital and Taiwan AI Labs. We acknowledge the strong supports granted by MOST (Ministry of Science and Technology) and NHIA (National Health Insurance Administration) of the country to conduct the work.

Background: Imaging variations of MRI from different vendors and protocols could restrict full-fledged usage of an AI model. We leverage a nationwide medical database and aim to alleviate the concern and enable the resulting AI system to achieve inter-device as well as inter-hospital generalizations and, eventually, land AI models to clinical use in real world.

Methods: A segmentation model (DeepMets®) for brain metastasis was initially trained developed on a homogeneous labeled MRI dataset at Taipei Veterans General Hospital (VGHTPE) jointly with Taiwan AI Labs. The initial imaging model reached 87.68% DSC (dice similarity coefficient) in the in-house test set. To improve generalization across various MRI settings, we iteratively refine the model by employing vertical federated learning over a nationwide population-based medical imaging database (collected from Feb. 2018-June 2019) at NHIA, Taiwan. With similar enrollment criteria as of the initial dataset at VGHTPE, 3153 patients are filtered out from 3,174,155 MRI series of the database. In each active learning cycle, 200 data points with the highest entropy values are manually annotated and added to the labeled training set. We evaluate our approach using the 2.5D ResNext101 U-Net architecture with Squeeze-and-Excitation block and self-attention mechanism. The network is trained on a combination of multiclass binary cross-entropy and DSC loss. Furthermore, a test set with 120 patient-examinations is formed and categorized according to MRI vendors (three major manufactures on the global market) as well as different diagnostic difficulties. Both initial (DeepMets®) and refined models (DeepMets-Plus) are evaluated on the test set to demonstrate the robustness.

Results: DeepMets® suffers from severe performance degradation, 48.55% DSC (Precision: 45.11%, Recall: 78.67%), in the test set. After refining the model with the nationwide medical database at NHIA for three active learning cycles, its best performance yields 83.84% DSC (Precision: 88.97%, Recall: 87.99%). The results are also shown to be coherent across MRI from different vendors except for the difficult cases.

Conclusion: We demonstrate the development of a device-agnostic AI model for brain metastasis segmentation by exploring a nationwide medical database. The current study is a hybrid work of combining centralized and federated learning for imaging AI model development. The upgraded imaging model is currently further tested among multiple users and institutes. From the work, we have demonstrated that the method is one of the efficient ways to increase model generalization across MRI vendors and settings. The model achieves great generalization on MRI of various vendors and settings across the country and is applicable globally.

Clinical work and study design in the AI era: An example of DeepMets-Plus

AI 時代的臨床工作與研究設計：以 DeepMets-Plus 為例

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Artificial intelligence (AI) has been applied with considerable success in the fields of radiology, pathology, and neurosurgery. It is expected that AI will soon be used to optimize strategies for the clinical management of patients based on intensive imaging follow-up. Our objective in this presentation is to establish a clinical algorithm and design the study by which to automate the tumor detection and volumetric measurement of brain metastasis (BM) using DeepMets-Plus.

The presentation outlines an approach to the evaluation of treatment responses following GKRS for brain metastasis. The proposed deep learning AI scheme is applicable to clinical assessments and related clinical research following a variety of therapeutic interventions.

The deep integration of AI model and lung cancer management in our hospital

肺癌的臨床情境和 AI MODEL 的深度整合

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Lung cancer is the major cause of cancer-related death in both men and women, not only in Taiwan, but also worldwide. The diagnosis of lung cancer requires the cooperation of multiple experts in thoracic oncology, radiology, nuclear medicine, pathology and neurosurgeons. In order to treat lung cancer patients, it is very important to interpret medical images of different modalities in a timely manner and integrate the opinions of a multidisciplinary team.

AI in medical imaging may have its potential to give clues of abnormality. However, applying AI into daily clinical practice is another story. From 2018, Taipei Veterans General Hospital has developed several medical AI modules in cooperation with universities and companies. We tried to combine three of them for the diagnosis and treatment of lung cancer. That include nodule detection in the plan chest film, nodule detection of chest CT and metastasis lesion detection of brain MRI.

We have developed several clinical scenarios for the integration of AI modules into daily lung cancer care. These include revalidation of initial x-rays, rapid calibration of small lung nodules on low-dose computed tomography, and confirmation, labeling and validation of brain metastases from lung cancer. All clinical scenarios are designed to reduce the time waste of patients, whether they are waiting for a doctor's decision in outpatient clinic or waiting for a radiology report. These settings allow lung cancer treatment to be more immediate and reduce errors.

Although each module operates independently and the entire clinical scenario needs to be initiated by a physician, it still provides significant boost in our current lung cancer treatment. Further research will be required to provide accurate and data-driven results. Deeper integration to routine clinical practice needs the support of the hospital and all the information system in hospital.

Reference:

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