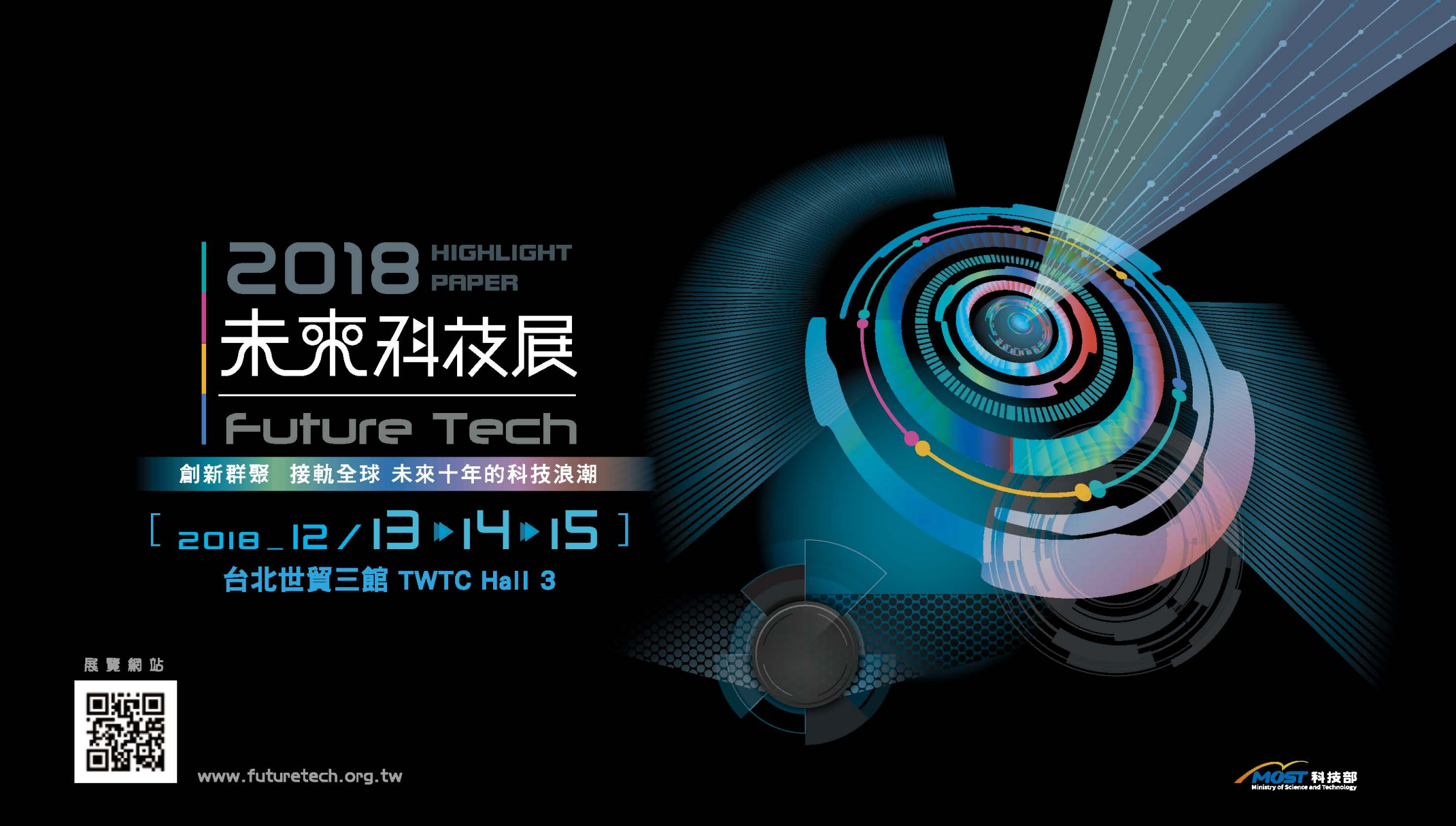
2018 HIGHLIGHT PAPER
未來科技展
Future Tech
創新群聚　接軌全球 未來十年的科技浪潮
[2018_12/13▶14▶15]
台北世貿三館 TWTC Hall 3
展覽網站
www.futuretech.org.tw
MOST 科技部
Ministry of Science and Technology

關於展覽 About

為展現前瞻關鍵技術，聚焦產業及社經需求，科技部舉辦「2018未來科技展」，集結具有未來「產業應用性」、「科學突破性」的學界重點研發計畫、法人、園區的創新技術共同展出。

本活動由科技部主辦，聚焦於人工智慧應用、綠能技術、生技製藥、奈米材料等攸關國家重大社會、民生和產業經濟發展的領域，共計展出123件具突破性的研發項目，並從中精選出22件亮點技術讓您先睹為快。活動將在12月13日(四)至12月15日(六)於世貿三館展出，期望有效搭建產、學、研間技術交易媒合平台，也讓國人瞭解我國創新研發能量。

The Ministry of Science and Technology is hosting the “Future Tech Expo 2018” to exhibit advanced technologies, and to focus on the demands of industrial and socioeconomic fields, which is assembling the leading academic research projects with future industrial applicability and scientific breakthrough, and innovative technologies developed by institutions and science parks.

This exhibition is organized by the Ministry of Science and Technology, and executive by Taipei Computer Association, focusing on the key domains relevant to the country’s social and industrial development interests, including AI, green energy technology, pharmaceutical biotechnology (Biotechnology and Pharmacy), nanomaterial etc. A total of 123 revolutionized R&D projects will be presented at the exhibition, with a selection of 22 highlight technologies. This event will take place from December 13th (Thu.) to December 15th (Sat.), 2018 at Taipei World Trade Center Exhibition Hall 3. We look forward to build a beneficial industry-academia-research networking platform for technology exchange and business matchmaking, as well as introducing innovative research strengths in Taiwan.

123件創新突破 Content

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生技與新藥

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醫材

Medical Device

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AI Intelligent Appliance & Electronics & Optoelectronics

04

金屬化工&新穎材料

Metal Chemical Industry & Innovative Material

05

量子電腦

Quantum Technology

利用 3D 列印及超音波輔助溶解技術製作立體全透明生醫晶片

Fabrication of Nonplanar and Fully-Transparent Microfluidic Devices Using 3D Printing and Sonication-Assisted Dissolution Technique

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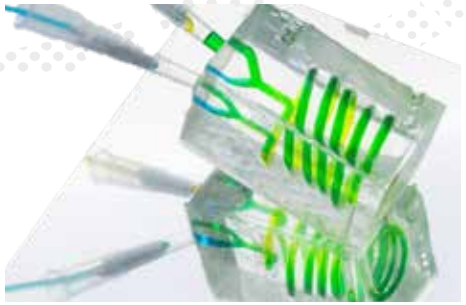

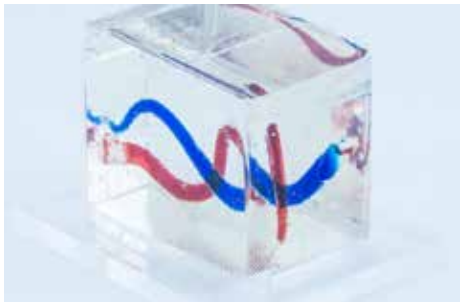

技術簡介 Technology Introduction

平面生醫晶片在近幾十年來是許多新型醫材的測試平台，但近年來許多醫學相關的文獻指出，在平面生醫晶片上的測試結果往往和臨床實驗不盡相同，其中一個重要的原因是在平面生醫晶片上，無法確實探討各參數在三維空間內的效應，因此，本研究的目的是開發新穎製程來製造一體成型的微流道晶片，用來突破目前醫材研究的困境。

Planar microfluidics has played an important platform for novel medical materials for decades, but the medical articles pointed out that the experiment results generated from the planar microfluidics are very different from the clinical trials. Hence the aim of this research is to develop a novel fabrication process to create a truly 3D microfluidic for state-of-the-art medical researches.

科學突破 Scientific Innovation

本製程是利用 3D 列印機製造三維模具，再將 PDMS 澆注於模具中，翻製出三維且全透明的微流體晶片。研究中的兩項挑戰需克服，包括如何降低 3D 列印模具的粗糙度和如何在截面積小且細長的微流道中完全溶解 ABS。我們利用溶液蒸氣來降低 3D 列印模具的粗糙度，也利用兩階段溶解及超音波輔助來加速且提升 ABS 溶解的效率。

A 3D printed ABS mold and PDMS casting were conducted to create a 3D and fully transparent microfluidic device. In the fabrication process, solvent evaporation step was used to minimize the surface roughness of a printed mold for creating a fully transparent microfluidic chip while a two-step dissolution process was used to completely dissolve the embedded and slender ABS inside the PDMS chip.

新穎多靶點激酶抗癌藥物 DBPR114

DBPR114: Multiple-kinase Inhibitor as an Anticancer Agent

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技術簡介 Technology Introduction

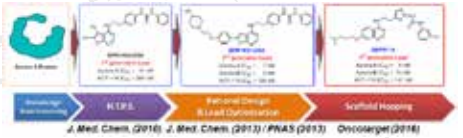
運用激酶蛋白結構與活性最佳化的策略，開發多靶點激酶抑制劑 DBPR114。於裸小鼠異種移植動物試驗中，有效抑制多種不同人體腫瘤的生長，包括血癌、胰臟癌、胃癌、大腸直腸癌、肝癌與膀胱癌等癌細胞。極具臨床治療開發之潛力。DBPR114 已於 2017 年獲得美國和台灣 IND（新藥臨床試驗）核准。

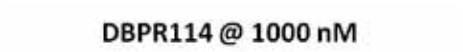
DBPR114 is a novel small molecule multi-target kinase inhibitor. DBPR114 significantly shrank tumor growth of 8 different cancer cells in vivo by intravenous administration. These results indicate the potential of DBPR114 as a novel development candidate for various cancers, including AML, pancreatic, liver and gastric cancers, and all important cancers currently without very effective treatments. DBPR114 was approved for IND by US FDA and TFDA in 2017.

科學突破 Scientific Innovation

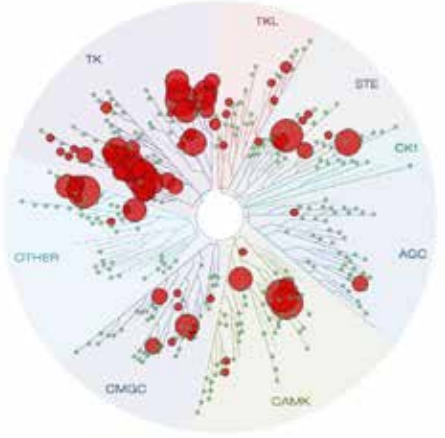
DBPR114 之多靶點激酶抑制組合與目前上市著名多靶點激酶抑制劑 (sorafenib 和 sunitinib) 並不相同；分別在 Hep3B（肝癌）及 MIA PaCa-2（胰臟癌）的裸小鼠異體移植動物試驗，DBPR114 抑制腫瘤生長效果優於目前臨床一線用藥 sorafenib 及 gemcitabine。

DBPR114 has demonstrated broad spectrum antitumor activities against a variety of human cancer lines both in vitro and in vivo.
DBPR114 is superior to sorafenib in Hep3B (Liver cancer) xenograft study.
DBPR114 is superior to gemcitabine in MIA PaCa-2 (Pancreatic cancer) xenograft study."



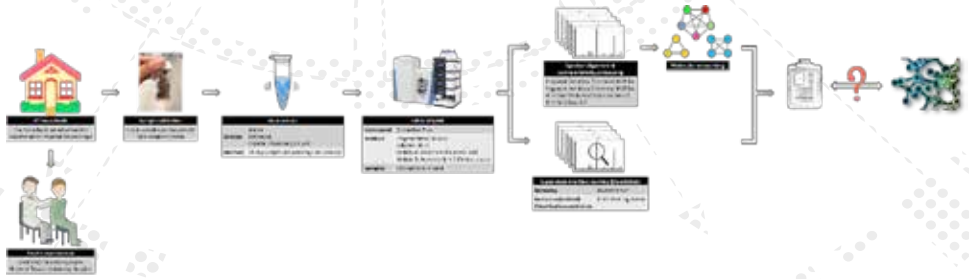


DBPR114 @ 1000 nM



機器學習結合質譜數據應用在疾病診斷

Machine Learning and Mass Spectrometry in Disease Diagnosis



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技術簡介 Technology Introduction

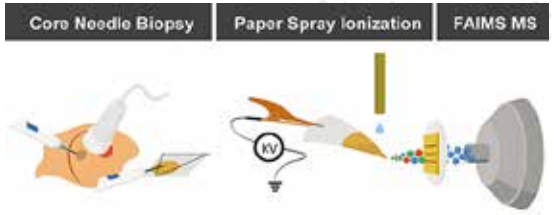
質譜儀可以得到生物體中豐富的化學資訊，亦常用於臨床醫學。本研究團隊結合質譜技術與機器學習，將此技術平台應用於多項領域中，包含診間即時乳癌診斷、以居家灰塵成分做為潛在疾病診斷指標、超高空間解析質譜影像、以及用脂類不飽和雙鍵作為快速腫瘤邊界標定的方法等。從化學分子的角度，建構新一代快速、準確的醫學診斷流程。

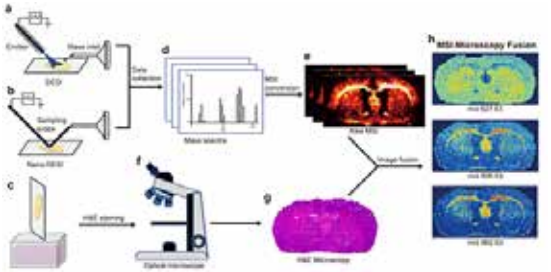
Mass spectrometry (MS) provides a wealth of chemical information. We combine MS with machine learning to multiple applications: breast cancer diagnosis, finding potential biomarkers in house dust, imaging fusion for high resolution MS image, and tumor margin determination by lipid isomers. In summary, our techniques provide an insight into the next-generation clinical panels.

科學突破 Scientific Innovation

開創以質譜數據與機器學習結合並應用於疾病診斷之技術先驅，以紙噴霧質譜建立乳癌預測模型，準確率達八成、獨創以居家灰塵的代謝體指紋模型預測住戶的疾病與生活型態、將影像融合技術用於常壓質譜影像圖，應用於腫瘤組織顯影技術上，獲得的生物標記物大幅提升近七成，以及首創以細胞中脂類不飽和雙鍵的位置做為癌症的標記，用於腫瘤邊界的判讀。

We developed an innovative technique coupling mass spectrometry data with machine learning to have breakthroughs in fields including 1) breast cancer prediction, giving an accuracy up to 80%, 2) linking health status with environmental chemicals of dust, 3) Imaging fusion, giving 70% increment of biomarker discovery, and 4) cancer margin determination by lipid isomer.





華陀精算

AIP4

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技術簡介 Technology Introduction

華陀精算 (AIP4)，首創以疾病檢測至藥物開發之全方位整合性平台。本團隊研究發現以交互作用構築元件 (Interaction Building Blocks, IBB) 發展突破性成果為基礎，並建立生物大數據資料庫，結合 AI 智慧計算核心，提供從生物標記、疾病亞型辨識到藥物開發之一站式服務，將可提高檢測準確度，縮短藥物開發時程，成為精準醫療之先鋒。

AIP4 is the first comprehensively integrated platform from disease diagnosis to drug development. Our team based on our breakthrough research findings, the Interaction Building Blocks (IBB). We construct the biological big data database and integrate artificial intelligent core technologies to provide the one stop service from biomarker identification, disease subtype recognition to drug discovery. This would increase the accuracy of diagnosis, shorten the period of drug development and become the pioneer of precision medicine.

科學突破 Scientific Innovation

華陀精算 (AIP4) 累積 20 年近百篇的研究成果，發現數百種分子交互作用基本構築元件 (Interaction Building Blocks, IBB) 為形成生命現象的基本要素，相當於 DNA 的四種鹼基及蛋白質的二十個胺基酸，基於此科學突破技術結合系統生物與臨床大數據庫 (跨多物種之藥物－蛋白質－生物網路－疾病的臨床大數據資料庫)，探討生物體內動態網路模型，達到客製化精準醫療。

AIP4 has accumulated about a hundred publications. We found that hundreds of molecular Interaction Building Blocks (IBB) are the basic elements to form biological phenomena, equivalent to four types of nucleobase in DNA and twenty types of amino acids in protein. Based on this scientific concept, we overcome technical hurdles and integrate systems biology and clinical big data databases (cross species drug-protein-network-disease clinical big data database) to investigate biological dynamic network models and to achieve customized precision medicine.

小腦腦波：臨床新技術及顫抖症致病機轉的突破

Cerebellar electroencephalography: a new technology and the breakthrough in the pathophysiology of essential tremor

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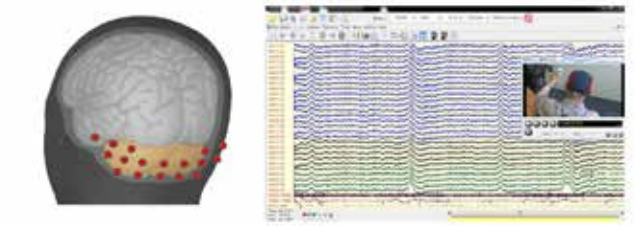


Figure 1. Cerebellar EEG in clinical settings

技術簡介 Technology Introduction

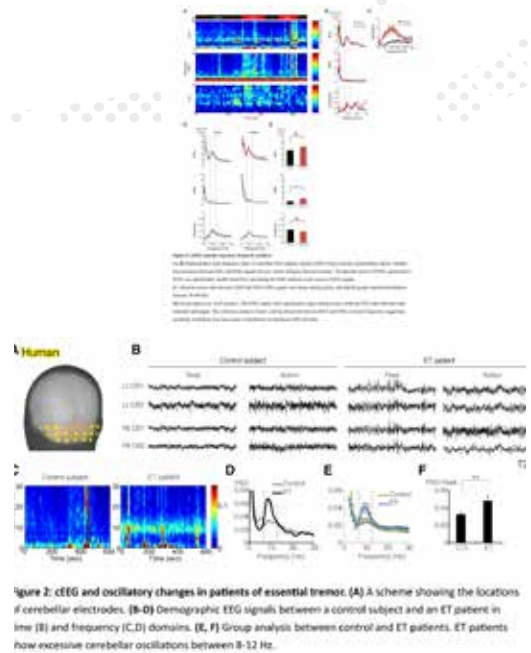
小腦腦波是非侵入性的臨床電學新技術，用以測量小腦的神經放電行為。過去腦波技術，僅限於大腦的訊號擷取。在小腦部分，由於對其神經訊號的基礎特性缺乏了解，再加上小腦附近的肌肉電訊號干擾，造成小腦研究及臨床應用的技術瓶頸。敝團隊藉由動物跨臨床的顫抖症小腦研究，找出小腦神經訊號的特徵並開發出臨床小腦腦波技術。

Cerebellar electroencephalography (cEEG) is a new technique in clinical electrophysiology and measures cerebellar electric activities non-invasively. Classical EEG only records signals from cerebellar cortex. With animal-to-human translation in our tremor research project, we developed cEEG technique that may impact the research field and clinical diagnosis in cerebellar disorders.

科學突破 Scientific Innovation

此技術根源於原發性顫抖症之基礎跨臨床研究。原發性顫抖症是最常見的動作障礙疾病，佔 4% 成人及 20% 老年人。小腦腦波是該病第一個也是目前唯一的生物標記，對臨床診斷、人類顫抖原因的了解及小腦功能的認識，具重大意義。藉由小腦腦波技術，臨床電生理的研究可由大腦延伸到小腦，在研究上具重要的科學價值。

Abnormal cerebellar activities in patients with essential tremor (ET) were discovered in our tremor project, and can be detected by the newly developed cEEG technology. To date, this cEEG-detectable abnormality is the first and the only clinical biomarker of ET, a disease affecting 4% of adults and up to 20% of elderly population. Moreover, cEEG opens a window to clinical cerebellar researches.



以高特異性組織標靶奈米粒子包覆抗小分子核糖核苷酸治療自體顯性多囊腎病

Integrate site-specific target therapy of both nanoparticle and anti-miRNA strategy to treat autosomal dominant polycystic kidney disease

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技術簡介 Technology Introduction

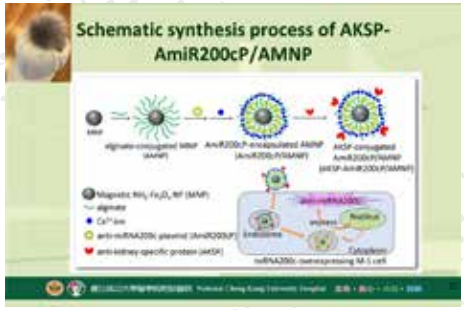
特定微小核醣核酸可結合 PKD-1 基因的 3 端非編碼區導致細胞增生與囊泡形成，此機制與類胰島素生長因子訊息有關。後續結合腎臟專一性標靶特性與氧化鐵奈米粒子包裹抗微小核醣核酸質體治療顯性多囊腎病證實奈米粒子包抗微小核醣核酸質體可避免質體體內降解且能專一性提高腎組織多囊腎蛋白質以抑制細胞增生與囊泡形成。

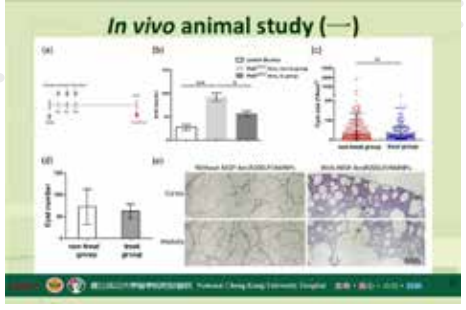
The specific miRNA can bind to 3' non-coding region of PKD-1 gene, leading to kidney cell proliferation and cyst formation, relates to IGF-1 signal pathway. We adhered anti-kidney specific protein with Fe3O4 nanoparticles to pack anti-miRNA plasmid. It can prevent the degradation of miRNA and increase the concentration of polycystin 1 in tissue to inhibit cell proliferation and cyst formation.

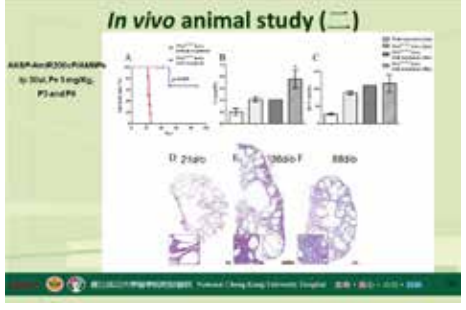
科學突破 Scientific Innovation

1. 抗微小核醣核酸於臨床上是可運用於遺傳發育異常疾病的治療。
2. 以修飾的奈米粒子包裹抗微小核醣核酸質體並結合標的組織蛋白抗體得以避免抗微小核醣核酸質體在體內被降解且更能提高抗微小核醣核酸質體在腎臟組織之專一性，進而增加腎細胞內抗微小核醣核酸之濃度以達精準治療的目的。

Anti-miRNA has been proved feasible to treat congenital developmental disease. This modified nanoparticle, encapsulated with anti-miRNA plastids and bound with target tissue protein Ab to avoid degradation, can improve the specificity of the anti-miRNA plastid in kidney. Finally, the concentration of anti-miRNA in renal tubule cells will increase significantly as the purpose of precise medicine.







干擾性 RNA 藥物用於治療近視

RNA interference drug for the treatment of myopi

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技術簡介 Technology Introduction

近視是最常見的眼睛疾病（亞洲國家的盛行率達 85%），會導致眼軸增長，且為亞洲國家失明的首要因素。眼軸過長引起高度近視，導致併發症，包括視網膜剝離、黃斑部病變、青光眼甚至失明。阿托品是治療近視唯一有效的眼藥，但由於副作用而不受市場歡迎。眼鏡或雷射只有矯正視力，不能阻止近視惡化，也不能防止近視引起的併發症。本團隊為全世界第一個設計核酸干擾藥物，以點眼藥水的方式，可讓眼軸恢復正常，療效勝過目前唯一治療近視的藥物 - 阿托平（散瞳劑），且沒有觀察到任何副作用或毒性。利用這個全新的機轉，申請全球專利，朝新藥發展。預計在 2019 年開始進行人體實驗。

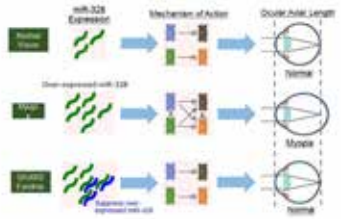
Myopia, as a result of abnormal elongation of the eyeball, is a common eye disorder worldwide, especially being prevalent (~85%) in Asian countries. High myopia leads to severe complications such as retinal detachment, macular degeneration, glaucoma and even blindness. Atropine is the only effective drug to slow down myopia. Eye glasses or LASIK surgery can only correct refraction but cannot stop myopia progression or prevent myopia complications. We developed novel eye drop to treat myopia and reverse elongated eyeball. Our eye drop is more effective than atropine in animal studies. No side effect or toxicity was observed. We have filed worldwide patent and plan to conduct the first-in-class human clinical trial in 2019.

科學突破 Scientific Innovation

我們是全世界第一個發現眼睛 microRNA-328 過度表現會導致近視。藉著細胞生物學及誘發近視的實驗動物，我們證實這個新的分子機轉。本團隊發展出一系列可以溶解“小核酸干擾藥物“做成眼藥水 (SHJ002)，來中和過多 microRNA-328，成功治療已有近視老鼠及兔子，療效勝過目前的阿托平，且沒有觀察到副作用。為阻止近視度數增加和近視的治療帶來突破性的發展。

Our team first ever reported that over-expression of microRNA-328 in the eyes is a major risk for myopia development. We proved this novel mechanism via cell biology and animal studies. We have developed a series of “small anti-sense oligonucleotides” in eye drop form to neutralize over-expressed microRNA-328. By utilizing our eye drops (SHJ002), we successfully treated myopic mice and rabbits. Additionally, our eye drops were shown better therapeutic effects than Atropine (the only clinically used anti-myopic eye drops). Our product is expected to effectively strop the progression of myopia and even cure myopia. It bring a breakthrough in curing myopia.

SHJ002 Mechanism of Action



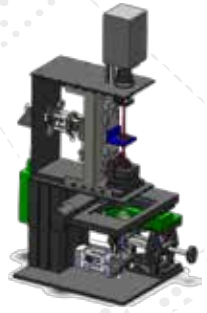
Efficacy Results

Conclusions

多尺度生物顯微影像技術

Multiscale Bio-Imaging Technology

國立清華大學 National Tsing Hua University
江安世 / aschiang@life.nthu.edu.tw



技術簡介 Technology Introduction

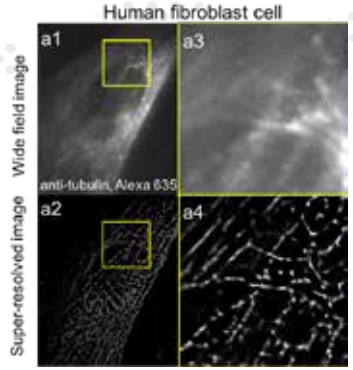
多尺度生物顯微影像系統是一個能夠做大範圍超解析掃描的新技術。系統涵蓋螢光顯微鏡本體、大組織自動切片及超解析取像技術，搭配組織澄清技術，使用者可在無損的大組織，例如腦組織或是癌症組織中獲得蛋白質分子層級的超解析影像。

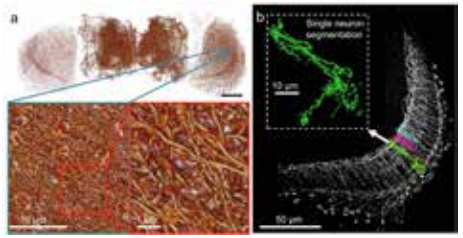
The developed multiscale microscopy is a patented new technology for super-resolution large-field imaging. The system includes con-shell illumination microscopy, single-molecule localization algorithm, and automated tissue sectioning. Combining with FocusClear tissue clearing, our technology can analyze spatial distribution of any proteins of interest within an intact tissue such as brain/tumor.

科學突破 Scientific Innovation

目前市場上商用超解析顯微鏡大多都只能用於細胞層級的顯微影像，無法達到在大組織中取相的能力，並且價格昂貴難以維護。本中心設計新式超解析顯微模組結合組織澄清技術，可將一般光學顯微鏡升級為超解析顯微鏡，並可搭配全自動切片掃描技術，以達到完整大組織取樣同時達到超解析顯微鏡的解像力。

Over 95% current super-resolution microscopy can only focus on single-cell level imaging, which cannot be used in large tissue, also very expansive. Our newly patented super-resolution large-field imaging system can work independently or easily integrated onto regular florescent microscopy. Work with sample clearing methods and automated imaging/sectioning system, multiscale bio-images in one specimen can be achieved.





具有表面電位轉換多導程數的即時心臟血管功能評估系統及其心電訊號分析方法

System and method for evaluating cardiovascular performance in real time and characterized by conversion of surface potential into multi-channels

國立臺灣大學醫學院 National Taiwan University College of Medicine
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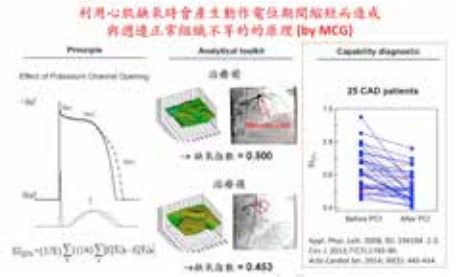


技術簡介 Technology Introduction

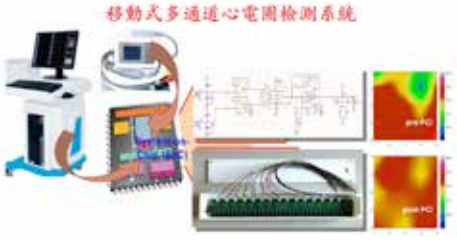
利用再極化離散度大於正常水平的原理來早期診斷冠心病 (CAD)，我們新開發了一具最佳表面電位轉換多導程數之即時心臟血管功能評估系統，利用調整電極位置數量和訊號重建參數以達到量測與分析效能的最佳化設計，可提供再極化離散度等衍生數據以應用於冠心病人之即時分析及早期診斷。

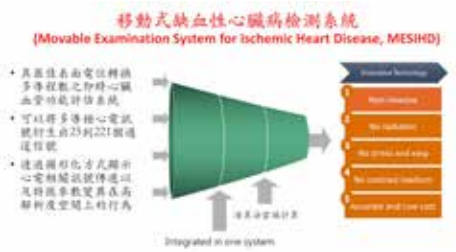
Spatial repolarization heterogeneity greater than normal may allow early diagnosis of coronary artery disease (CAD). Traditional 12-lead ECG has some limitations. This is a newly developed multichannel ECG (MECG) system, which could detect low-amplitude high-frequency potentials and repolarization heterogeneity from the adjusted recording channels and derived data for early detection of CAD.

科學突破 Scientific Innovation

利用傳統靜態 12 導程心電圖來量化 QT 離散度，因診斷準確性低而有其局限性，目前已幾乎被放棄了。我們設計了一多導極心電圖儀，能衍生出 25 到 221 個通道信號，利用調整電極位置數量和訊號重建參數以達到量測與分析效能的最佳化設計，並提供再極化離散度等衍生數據以應用於冠心病人之即時分析及早期診斷。

Traditional 12-lead ECG has limitation to quantify QT dispersion due to its low spatial accuracy. We have designed a multi-channel ECG machine, which could derive 25 to 221 channel signals from adjusting the numbers and locations of electrodes. The derived data such as smooth index of QT interval (kind of repolarization dispersion) could be used for early diagnosis of coronary heart disease.





心智危機解密

Cracking the mind's code

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技術簡介 Technology Introduction

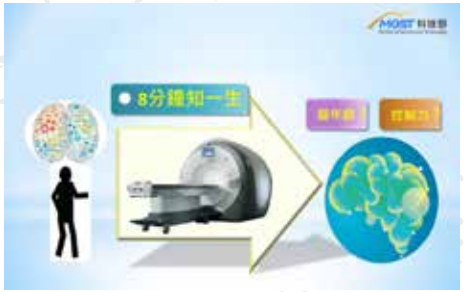
透過 GE MR750 3T 的腦磁振造影儀器，蒐集個體 8 分鐘靜息態的腦磁振造影資料，然後進行功能性連結的運算，並配搭人工智慧機器學習的算則，與個體的年齡以及其認知功能作業的表現進行學習與預測。

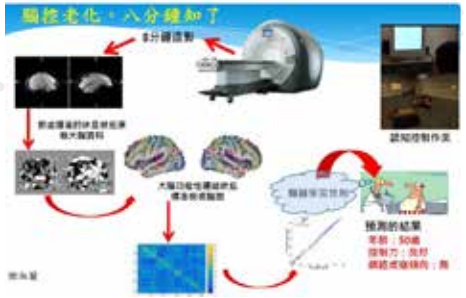
The MRI images were acquired using a GE MR750 3T scanner. For each participant, a resting-state functional connectivity (RSFC) matrix was created. These matrices were entered as features into multivariate pattern analysis and machine learning to predict an individual's age and his/her cognitive performance.

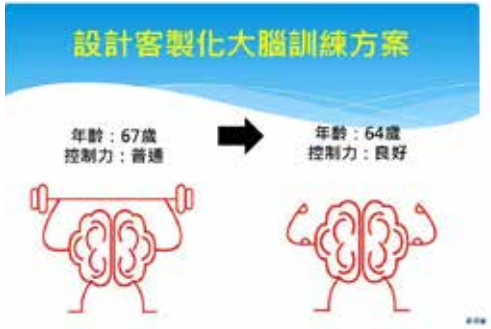
科學突破 Scientific Innovation

靜息態快速造影與分析，準確預測年齡與認知功能。本實驗室所發展的機器學習預測模型，對於年齡的預測準確度和目前的國際研究相比，排名全球第二；而對於認知控制能力的預測，目前則是獨步全球。

Our technique can accurately predict an individual's age and cognitive performance based on the fast resting-state imaging acquisition and analyses. The prediction accuracy of our age model ranks 2nd in the world. As for cognitive control prediction, our model is unique in the world.







半導體射月計畫 - 智慧終端（AI Edge）關鍵技術

Semiconductor Manufacturing and Design for AI Edge

國立中興大學、國立清華大學、國立成功大學
National Chung Hsing University, National Tsing Hua University, National Cheng Kung University
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技術簡介 Technology Introduction

半導體射月計畫共有 20 群研究團隊致力開發智慧終端關鍵技術，此次展出其中三群研究團隊技術：

1. 語音指令識別系統與低功耗深度學習硬體加速器。
2. 智慧終端光譜晶片技術及其製造方法。
3. 具可攜式無線尿液檢測與預防心血管疾病之晶片系統與平台。

Twenty academic R&D teams of Semiconductor Moonshot Project will develop key technologies for AI edge. Three teams show their technologies this time.

1. Speech Command Recognition System with Low-power Deep Learning Accelerator.
2. SpectroiEdge and method of manufacturing.
3. Portable and wireless urine detection system and platform for prevention of cardiovascular disease.

科學突破 Scientific Innovation

1. 整合神經網路設計與訓練、語音處理、影像處理、神經網路硬體加速器設計等多項技術，實現低功耗語音指令識別系統。
2. 攜帶型光譜儀可產生足夠現場解讀的分析結果；智慧型手機光譜技術應用於隨地醫學檢測。
3. 檢測尿液中心血管疾病生物標記物評估心血管疾病風險；心血管疾病生物標記物之電流式微流道感測晶片。

1. Integrate neural network design/training, speech/image processing, and accelerator design to realize low-power speech command system.
2. Portable spectrometer algorithms to get actionable answers in the field. Smartphone Spectroscopy for field-based medical diagnostics.
3. Evaluating user's risk of cardiovascular disease by detecting biomarkers in urine. Amperometric microfluidic sensing chip design.

啟動照明文藝復興類燭光 OLED

Candlelight OLED Triggering Lighting Renaissance

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技術簡介 Technology Introduction

此技術集整油燈與蠟燭無藍害的優點，及近一百五十年電力照明節能的優點，加上原創高波段類自然光 OLED 光源專利技術，研發出第一個由電力驅動高能效、高光質、柔和、無藍害且無 PM2.5 與溫室氣體排放的類燭光，可供長期看書使用而不傷眼，入夜使用而不傷身，可讓褪黑激素自然分泌，兼顧照明與健康需求，是次世代最佳照明選擇。

Our innovative technology has integrated the advantage of blue-hazard free oil lamps and candles. In addition, we also combine the feature of energy saving nature of electric lighting that started 150 years ago. With these characteristics and our original patents of high band-number pseudo natural light OLED. we here develop the first electric-driven pseudo candlelight which is high efficiency, soft and blue-hazard free. It is comfortable for long-term reading and not hurting the eyes.

科學突破 Scientific Innovation

此項技術之科學突破性在於，它是全球第一個無藍害平面光源技術，被全球影響因子最高臨床醫師癌症期刊綜評文章譽為對抗婦女乳腺癌的創新光源；多次榮獲國際大獎，並深獲國際太空站照明計畫主持人喬治 • 布蘭納教授的重視，突顯了它在多元應用上的重要性，除了取代油燈、蠟燭，甚至可以取代目前低功效或各種富含藍光的電子照明。

The scientific breakthrough of this technology is that it is the first blue-hazard free planar light source around the world, which is indicated as an innovative light source for women's breast cancer by Cancer Journal for Clinicians (CA) with the highest impact factor. Moreover, this technology had won many international rewards and received the attention of Professor George Brainard, the host of International Space Station Lighting Program, highlighting its importance in multi-applications.

可見光寬頻消色差介電質超穎透鏡成像

Visible Broadband Achromatic Dielectric Metalens for Imaging

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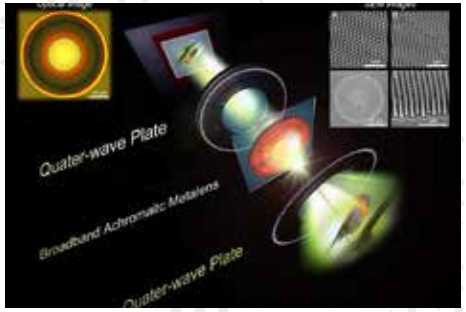


技術簡介 Technology Introduction

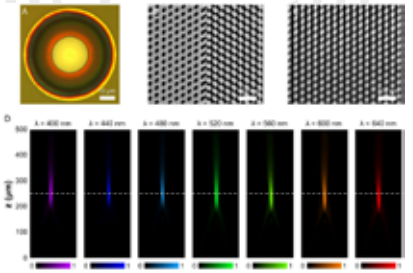
本技術是一種具偏振調控的穿透式可見光寬頻消色差超穎透鏡，設計概念是採用介電質奈米天線，針對不同的可見光波長，以不同相位補償的奈米結構，實現將寬頻可見光波長，聚焦於固定的空間平面上的消色差功能，是世界上第一個成功製作出來，在可見光區域中能實現全彩成像的消色差超穎透鏡。

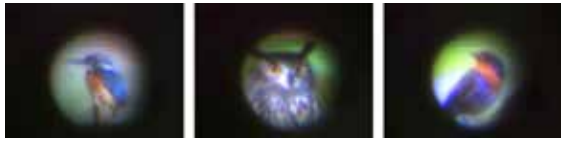
Metalenses consist of an array of optical nanoantennas on a surface capable of manipulating the incoming light for focusing. We propose an achromatic dielectric metalens working in a visible region. Various geometrical designs are utilized to compensate the phase requirement for different wavelengths. It's able to focus the waves onto the same focal plane. We also show full-color imaging by using achromatic metalenses to demonstrate its potential for full-color optical applications.

科學突破 Scientific Innovation

奈米技術製成的超穎透鏡雖比一般透鏡具有更多功能延展性與超薄體積等優點，此研究採用具有波導共振的介電質奈米天線，因此提供了極佳的效率，排列對於不同波長有不同相位補償的奈米天線結構後，可將各色光聚焦於一點，也是世界上首次將超穎透鏡用於全彩成像。

We demonstrate a broadband achromatic metalens working in the visible light region. A lossless semiconductor material is used to construct unit elements to access waveguide-like resonant modes which exhibit high conversion efficiency. Various geometrical designs with different resonance modes are utilized to compensate the phase requirement for different wavelengths.The achieved continuous achromatism in visible region enables us to obtaining the first metalens-based full-color imaging.





結合深度學習與巨量資料技術之智慧性疾病風險早期偵測系統

Intelligent Disease Risk Early Detection System using Deep Learning and Big Data Techniques

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技術簡介 Technology Introduction

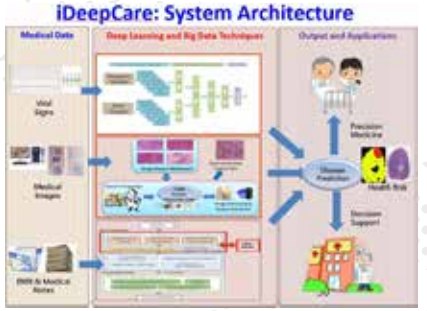
本系統 iDeepCare 以人工智慧深度學習及大數據分析方法為基底，結合影像處理、多變數時間序列探勘、文字探勘等多重技術發展出創新之智慧性疾病辨識及風險預測技術，可由醫療影像、生理訊號、病歷醫囑等多面向資料進行探勘分析及學習建模，對多種疾病進行智慧性之早期風險預測及自動辨識，同時兼具高準確性及即時效率性。

This system iDeepCare integrates deep learning and big data analytics methodologies, coupled with various techniques of image processing, time-series mining and text mining to provide intelligent disease risk prediction functions by analyzing medical data like the medical imaging, vital signs, and medical records. The system carries the merits of high accuracy as well as real-time response for early detection of disease risks in smart medicine applications.

科學突破 Scientific Innovation

本系統所發展之疾病辨識與預測技術於智慧醫療具高度突破性，以本系統所發展之醫學影像判讀技術為例，可由內視鏡影像自動辨識大腸瘜肉腫瘤化之良惡質性，預測準確性 Sensitivity 可達 97% 之高，判讀速度可達 0.5 秒以下之即時性，已發表於消化內科全球排名第一之期刊 Gastroenterology，並獲美國路透社專欄越洋採訪及高度肯定兼具技術突破性及臨床應用潛力。

The developed disease risk prediction techniques carry high degree of innovation in smart medicine. For example, the image recognition technique can identify the property of colectral polyps from endoscope images with high accuracy of 97% and real-time response time (< 0.5 second). This technique has been published in the top journal Gastroenterology and reported by Reuters Health with high recognition in technical innovation and clinical application potential.



用於無人載具之深度學習物件辨識 / 行為預測及 360 度視訊定位技術

Deep-learning-based object recognition, behavior, and 360-degree video SLAM technology for autonomous driving

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技術簡介 Technology Introduction

ezLabel 以自動路徑規劃與自動符合演算法，減少人工工時、確保樣本品質，並收集世界各地資料，助於深度學習模組的發展。深度學習後方超車行為預測使用 C3D 深度學習網路，輸入 16 張後方鏡頭影像偵測後方車輛超車行為，可用於未來電子照後鏡產品，另外，360 度視訊定位技術，解決單一視角視訊定位技術的缺點，提供準確的視訊定位，加快 3D 視訊圖資建立。

ezLabel features automatic route prediction and fitting algorithm, which reduces the time to label and ensure the quality, collects various samples, and help to customize AI function. Rear vehicle overtaking prediction uses C3D-based deep learning network with 16 rear camera images. It can be applied in E-mirror products to ensure safer driving. Besides, a 360-degree video SLAM technology solves the drawback of finite FOV video SLAM, achieves better accuracy, and speeds up 3D map establishment.

科學突破 Scientific Innovation

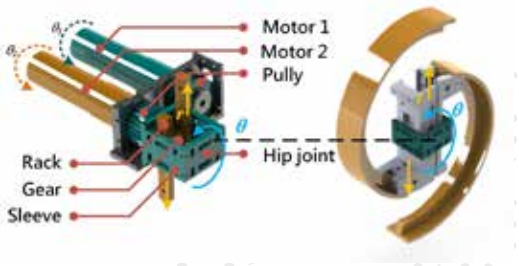
- ezLabel：1. 路徑預測：2 張畫面可標記；2. 貼邊：保證品質並提升速度。
- 後方超車預測：1. 熱像圖示意超車；2. 3D CNN 實現；3. 日夜間準確度達 95% 以上；4. 同時物件偵測與行為預測。
- 360 度視訊定位技術：1. 支援可變鏡頭數量；2. 全景畫面定位；3. 節省 50% 建立地圖時間；4. 增加純旋轉之定位穩定。"

- ezLabel:
  1. Route prediction: label object with 2 frames;
  2. Fitting: speed up and guarantee data quality.
- Rear vehicle overtaking prediction:
  1. Heat-map shows overtaking;
  2. 3D CNN implementation;
  3. Achieve 95% accuracy rate at day and night;
  4. Detect object and recognize behavior at the same time.
- 360-degree video SLAM:
  1. Supporting different amount of cameras;
  2. Positioning with panoramic image;
  3. Saving 50% time of establishing map;
  4. Increasing stability of pure rotation positioning.

多地形上輪腳複合移動載台

A leg-wheel transformable mobile platform

國立臺灣大學 National Taiwan University
林沛群 / peichunlin@ntu.edu.tw



技術簡介 Technology Introduction

一個可在室內外、自然或人造環境中移動的基礎載台，其上可依需求與應用來架設感測器或機械手臂。技術包含：

1. 創新輪腳複合機構設計，搭配仿生控制架構，使平台可在移動運行中圓滑順暢的切換不同運動模式，以達到穿越不同崎嶇地形的需求。
2. 具備日夜間環境偵測功能，並智慧自主進行運動模式切換與行進方向選擇。

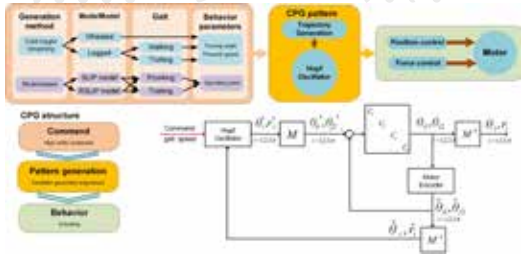
A mobile platform, which can get adapt to various terrains, such as indoor, outdoor, natural and artificial environments, is presented.
The techniques included are as follows:

1. The innovative leg–wheel transformable mechanism with bio-inspired control architecture is designed.
2. The platform is able to switch to different operating modes and select an optimal moving direction automatically.

科學突破 Scientific Innovation

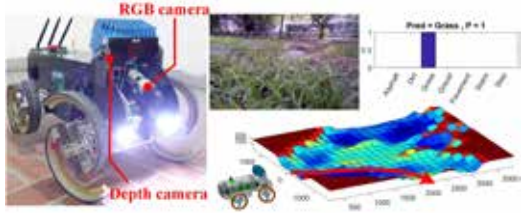
本技術於國際間機器人界中立足的特色為：

1. 創新的輪腳複合設計，使機器人在輪模式和腳模式均由同一組驅動系統帶動，減少機器人結構與系統的體積重量和複雜度。
2. 以單一中控的仿生控制架構來達到各模式的驅動和切換，可簡化控制系統，也可使運動過程不因模式變換而需先終止再啟動。
3. 可在多種地形上快速和動態的運動。



The techniques that make the mobile platform is unique to the international robotics area are stated as below:

1. The innovative leg–wheel transformable mechanism, which makes the system on platform is simplified.
2. By using central bio-inspired control system, the control system can be streamlined.
3. The platform performed is capable of agile and robust motion on multiple kinds of surfaces.



全自動海(廢)水採鋰礦之方法與設備

The method and device for automatically recycling lithium from the sea/wastewater

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技術簡介 Technology Introduction

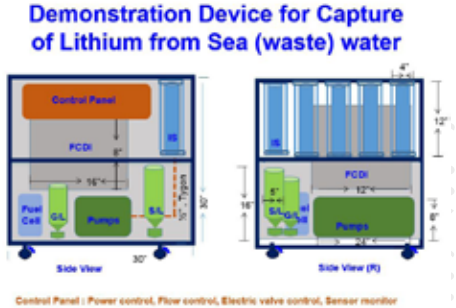
本新穎技術有關施加低電壓於新型光活性鈦氧鋰離子篩，加速選別海(廢)水中微量鋰嵌入離子篩中，再施以反電壓釋出鋰離子，達到回收與富集鋰之目的。因不需添加化學藥劑，可減少衍生污泥清處費用，其自動化設計，有別於既有思維，確屬技術突破。本低成本離子篩也具光催化活性，在選別鋰離子回收時，可光催化分解水產生氫氣，以供自身能源需求。

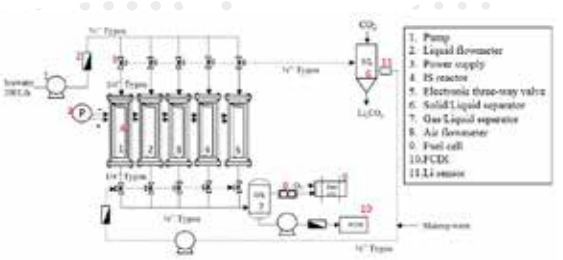
Here, we report a simple method for capture of lithium from sea/waste water by the new ion-sieves with additional photocatalytic abilities for splitting of water to hydrogen during the lithium capture processes. The ion-sieves can maintain 85% of its best performance in the cycles of Li capture and enrichment. The new photoactive ion-sieves have many promising applications in the areas of selective capture and recycling of metal ions from waste and contaminated waters.

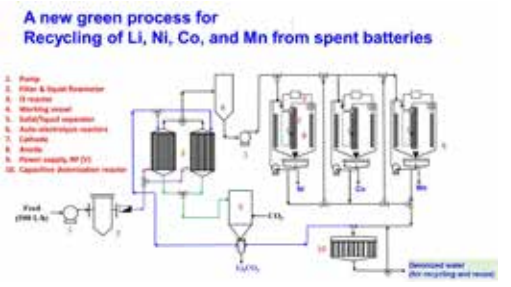
科學突破 Scientific Innovation

本技術關鍵是施加離子篩低電壓加速選別海(廢)水中鋰離子或施以反電壓釋出鋰離子，達成回收與富集鋰之目的。因不需添加化學藥劑，可減少衍生污泥清處費用，其自動化設計，有別於既有思維，又可光催化分解水產氫，以供自身能源需求，易應用於回收鋰(廢鋰電池)與貴重金屬(例如電鍍廢水)及其水回收再利用，確屬技術突破。

The key technologies in the new device for the automatic lithium mining from sea/wastewater include: (1) High shape-selectivity for desired ion recycling; (2) Low-cost, simple and high-automatic operation. (3) Lithium can be captured by precipitation with CO2 to yield Li2CO3 for direction utilization; (4) Economically attractively and environmental friendly; (5) Photocatalytic ability for splitting of water to hydrogen for self-supported electricity.







連結居家、社區、診所和醫院之區塊鏈導向智慧健康構築方案

Block chain oriented smart health architecture bridging home, community, clinics and hospital services

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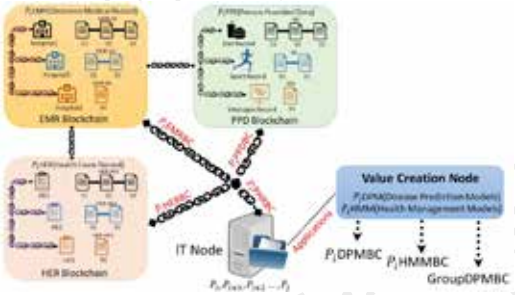

技術簡介 Technology Introduction

成為未來醫院、診所、社區、居家全方位智能系統合作發展的基礎，在信任區間從事個人電子病歷交換，獲得泰國政府評估並部分採納，並延伸泰國和週邊國家的合作計劃（緬、寮、柬），亦獲得柬國政府和企業合作，將於金邊建立醫學中心及醫學院，有機會透過實質體驗和高端客群的經營，將技術延伸至東協國家與中國。

These smart technologies/solutions will serve as a collaborative foundation bridging hospitals, clinics, communities and home care services in the future. Block chain based personal health record will allow trust-based health information exchanges. These have been adopted by Ministry of Public Health, Thailand, as part of National Industry 4.0 Projects, further extending Myanmar, Lao and Cambodia.

科學突破 Scientific Innovation

可配合東協地區醫療資訊和社區健康的應用，發展多重模式，除了融入泰國與柬國衛生法規和機構社會情境脈絡，具有協助衛生部導引完整醫療體系發展的可能性，更重要的是與商業鏈接，創造無分公私立醫療院所的服務體系屬性模式，類似的設計也正贏得中國與其它東協國家的重視。

Our solutions could accommodate medical informatics and community heath applications in ASEAN region and develop multiple layers business plans/models. More importantly, by linking into commercial supply chains, we could create service oriented system development solutions for either public or private institutions. Such designs are also attractive to China and other Southeast Asian countries.

大規模無人機物件偵測卷積網路技術

Drone-based Object Counting by Spatially Regularized Convolutional Neural Networks

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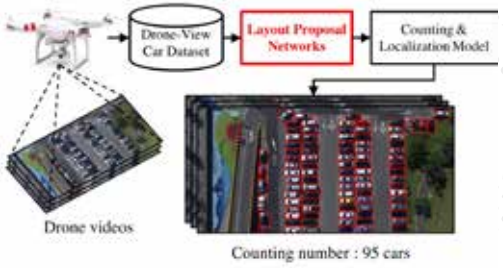
徐宏民 / whsu@ntu.edu.tw



技術簡介 Technology Introduction

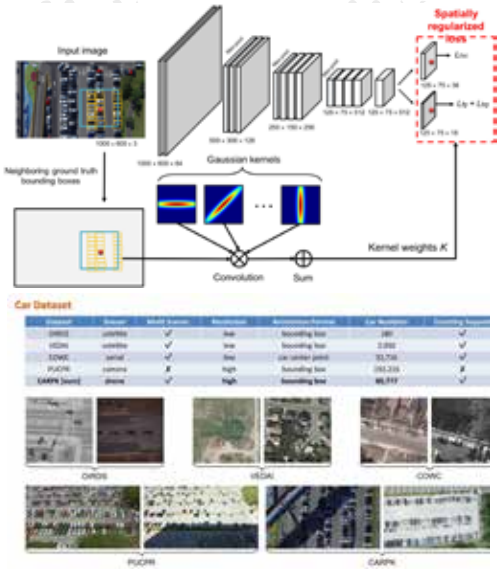
針對無人機自動偵測大規模物件，我們提出了全新的深度學習卷積網路，在飛行中同時計數及定位目標物體，如車子、農作物、軍事目標等。我們利用空間布局資訊，設計了全新的卷積網路，善用物件間的相對位置，大量提昇正確率。我們更提供了資料集(CARPK)，包含九萬台車輛。為第一個能支持相關研究的無人機視角資料集。

Drone-based object counting is vital due to the prevalence of drones. We propose Layout Proposal Networks (LPNs) to simultaneously count and localize target objects (e.g., cars) in drone-view videos. The method can be extended to other valuable objects such as cows, tanks, etc. We leverage the spatial layout cues (e.g., cars often park regularly) to augment the network design. We also present a new large-scale dataset (CARPK) that contains nearly 90K cars captured from different parking lots.

科學突破 Scientific Innovation

1. 首位提出在無人機上進行自動大量物件偵測定位。
2. 設計全新深度學習網路 , 相關技術並在頂尖電腦視覺會 ICCV 2017 中發表。
3. 全新收集的資料集含九萬個物件標註 , 並已公開給全世界的研究社群使用。
4. 在多個資料集中評估 , 勝過相關物件偵測工作如 Faster-RCNN、YOLO 等。

To our knowledge, this is the first work that leverages spatial layout cues for drone-view object region proposal. We improve the average recall of the state-of-the-art region proposal methods on a public PUCPR dataset. We contributed the large-scale dataset (CARPK) containing more than 90K cars, the first drone-view dataset. Moreover, it out performs state-of-the-art object detection methods such as Faster RCNN, YOLO, etc., in terms of MAE (counting error, from 156 to 22).



機械加工單元作動量測暨虛擬實境視覺化模擬應用

3D Reconstruction and Virtual Reality Visualization System Development for the Motion Simulation of Machine Equipment

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技術簡介 Technology Introduction

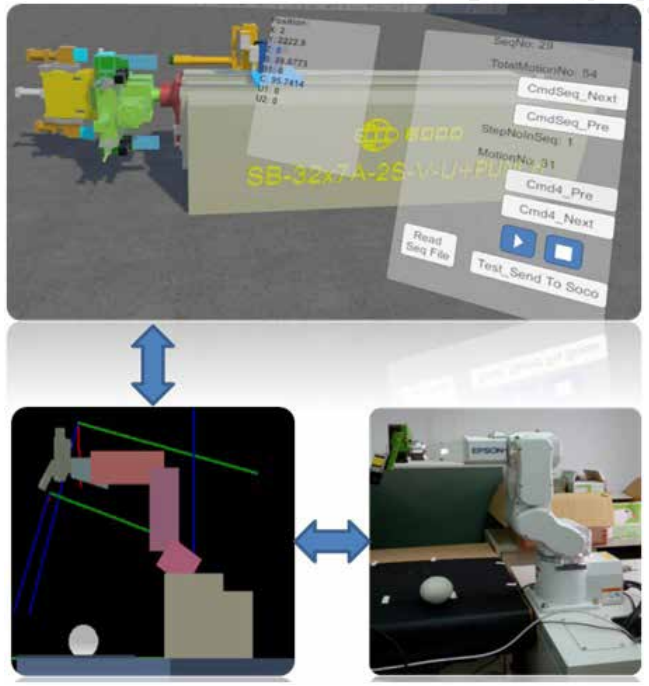
機械手臂結合三維結構光掃描重建技術可免除工件量測時從機台拆卸的麻煩，而工件表面點雲與 CAD 模型比對的誤差，則可幫助了解工具機內部實際擺設狀況，之後再以 3D 可視化擬真方式，結合沉浸式虛擬實境技術，模擬 3D 運動、加工件的變形以及碰撞偵測，呈現更逼真之 3D 加工模擬。

The technique of mechanical arm and 3D structure light scanning reconstruction of the workpiece can be directly applied to the scanning of the machine tool online. The developed algorithm improves the speed of the scan. Combined with immersive virtual reality technology, it simulates 3D motion, deformation of workpieces and collision detection.

科學突破 Scientific Innovation

1. 以 3D 可視化技術提供有趣且具有互動性的 3D 體驗。
2. 讓客戶可以自由地從不同觀察視角觀看機械設備。
3. 可以展示多種機械設備，不再受限於展場大小。
4. 可免除工件尺寸量測時從機台上拆卸下來的麻煩。
5. 可透過 3D 模型比對了解相對形狀誤差所在。
6. 開發的姿態演算法，降低傳統掃描所需的姿態數，提高精度。

1. Let customers freely view mechanical equipment from different perspectives.
2. Various mechanical equipment can be displayed, no longer limited by the scale of the exhibition.
3. Capable of 3D measurement in situ without the need of unloading the workpiece.
4. Capable of geometrical error analysis through comparison of CAD and reconstructed models.



廢氣處理與生質沼氣純化之新技術應用

Application of biotecnology for waste gas removal and biogas purification

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技術簡介 Technology Introduction

現今臭味去除以物理吸附 (水、活性碳) 或化學洗滌法為主，最大缺點是二次污染與維護耗材成本昂貴。本團隊開發之創新生物淨氣系統具有耗能少、效率高、長期維護成本低及無二次污染等優點，能有效用於臭味去除、有機廢氣減量及沼氣純化等用途，可提昇國內環保技術與產業發展，達到永續發展目標。

The physical absorption or chemical scrubbing to remove odors and volatile organic compounds (VOCs) have high cost of consumptive supplies and produced pollutions. Thus, we have developed a novel bio-filtration system which can remove odors, reduce VOCs emission and for biogas purification. The advantages include lower energy consumption, high removal efficiency and low cost for maintenance.

科學突破 Scientific Innovation

相關技術發表 24 篇 SCI 論文，被引用達 1400 次以上，被多本專書與 review article 引用。2012 年受國際卓越科技雜誌 IEEE Spectrum 報導，本團隊建立之示範場為全球以生物技術處理半導體廢氣最大場域。我們是首次以專屬生物菌株處理臭味與廢氣，效能較傳統活性汙泥提升十倍以上。

The new technics have been published on peer review journals. The total citations by other papers are more than 1400 times. This bio-filtration system has been reported by IEEE Spectrum in 2012 which was the largest bio-system in the world to reduce VOCs waste gases. Also, the specific microorganisms used for bio-filtration system are ten times efficiency higher than active sludge.


生質沼氣純化系統


汙水處理廠臭味去除系統


電子業有機廢氣去除系統

前瞻量子電腦技術研發

Advanced Quantum Technology Innovation

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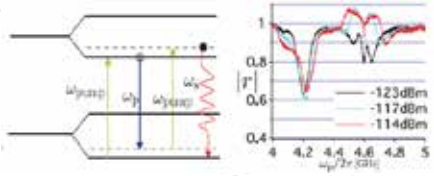
技術簡介 Technology Introduction

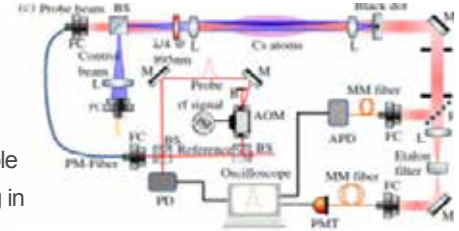
- 量子位元光放大器：使用量子電腦的基本單位 - 量子位元 - 放大用以超控量子位元之微波，可以做為量子電腦讀出放大使用。
- 超高儲存效率同調光記憶體：利用超冷原子團實現了高儲存效率的同調光記憶體。
- 高純度室溫單光子光源： 我們發展了以半導體量子點受激產生超純度單光子的技術，可用以作為在常溫下量子通訊之純度最高的單光子光源。
- Qubit as microwave amplifier: the basic unit of quantum computer, qubit, is shown to be able to amplify microwave. This can be potentially used to amplify the out signal of quantum computers.
- High storage efficient optical quantum memory: Use ultra cold atoms as the medium to store the coherent light pulse with high efficiency to retrieve the state of the light pulse.
- Highly purified single photon source at room temperature: technique based on semiconductor quantum dots is developed to create highly purified single photons. This can be potentially used as the single photo source for quantum communication.

科學突破 Scientific Innovation

- 量子位元光放大器：與一般雷射不同，利用量子位元做無粒子數反轉、透過四光子過程將強微波的能量轉換成弱微波的能量，而將微波放大。
- 超高儲存效率同調光記憶體：利用超冷原子團中電磁波誘發透明機制去實現同調的光記憶體，實現了儲存效率高達 92% 的同調光記憶體；儲存效率掉至 50% 時，儲存時間對光脈衝寬度的比值達到 1200（最高世界紀錄）。
- 室溫單光子純化技術：常溫下的半導體奈米晶體因為螢光中多光子的頻譜分布非常寬、無法去除，致使雷射激發後產生的單光子的純度一直無法與低溫的量子點相比。透過以聲波塑形單光子之技術，可以純化量子點受激產生的單光子，實現常溫下純度最高的量子點單光子光源。
- Qubit as microwave amplifier: Unlike the amplification mechanism of laser, the mechanism does not involve population inversion. Instead, 4-wave mixing is able to convert pumped microwave energy to the probe microwave energy, resulting in the amplification.
- High storage efficiency optical quantum memory: By using the mechanism of the electromagnetic induced transparency (EIT), we realize coherent light quantum memory with world record of the storage efficiency 92% and storage time to pulse width ratio 1200.
- Purification technique of single photon source at room temperature: Single photon sources generated by semiconductor quantum dots at room temperature have been plagued by low purification in comparison to the same technique at low temperatures. By using an acousto-optic modulator, we are able to generate single photons at room temperatures with highest purification.



量子位元放大器強微波的能量轉換成弱微波的能量顯示圖



量子記憶體裝置配置及光脈衝圖

2018 未來科技展 Future Tech

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