黃正能教授演講
When 5G Meets with Big IoT Data for 3D World

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黃正能教授，於 1981 和 1983 年在台灣大學取得電子工程學士與碩士學位，並於 1988 年在University of Southern California取得博士學位。在 1989 年在華盛頓大學任職，研究的領域為多媒體訊號處理、多媒體網路、影像處理、電腦視覺及圖形識別，已在國際期刊、國際會議論文集、書籍和書籍章節發表超過 300 篇研究論文。

黃正能教授於 4 月 7 日應邀蒞臨資訊學院演講，講題為：When 5G Meets with Big IoT Data for 3D World，本次演講探討未來高頻寬 5G 為物聯網以及深度學習舉凡物件偵測、物件追蹤、3D 模型重建的影響與改變，旁及一些有趣的研究方向，並討論相關的理論基礎及研究成果。

隨著現今各地大量攝影機普及，深度學習乃至人工智慧的蓬勃發展，以及 5G 核心網路、邊緣嵌入式系統的部署，使得未來講求即時 (Real-Time) 的物聯網世界越發可行，從學術研究發表漸漸走向可落地的商業化技術，其中，3D 物理世界中的動態環境探索得以了解不同位置相機的人、車、物件資訊，這些訊息可被用於各種智慧城市應用，例如安全監控、智慧交通、商業統計收集與社區健康監測等。在本次演講中，黃教授首先展示一個自動化的人車追蹤系統，並能自動校準在 3D 空間中。黃教授也利用近來最強大的深度學習作為輔助，讓這些偵測車輛的位置和速度以及人們的姿勢都可以基於 GPS 坐標進行描述，這樣一來，多個攝像機的追蹤物體就可以在 3D 真實世界空間中有效地集成和重建，適用於更多智慧城市和智慧交通應用。

這次講座黃教授分享了許多關於他的研究領域與成果表現，無論是人物追蹤定位、車子追蹤定位、移動攝影機的物體追蹤與人體姿勢估測，在各項比賽中皆名列前茅，並於 3D MOT Challenges 2015 得到第一名、AI City Challenges 2018 的 Track1:Speed Estimation&Track3:Re-Identification 拿下第一名，其研究方法的穩定性，奠定了未來 5G 世界穩固的物聯網、車聯網基石，其中教授更分享許多在真實世界當中，有別於學術研究，會遇到的問題，譬如當演算法受到天氣或光線影響時，適時地轉換成硬體協助軟體，方能使得整體錯誤率降低，另外，要建構一項如此大的系統，除了軟硬體整合外，教授也指出演算法之間的整合也是研究者可以鑽研的一項題目，目前的相關技術，如物件偵測、追蹤、切割、深度估算，皆未有一端到端的解法，非常可惜。

The Speech of Dr. Jenq–Neng Hwang
When 5G Meets with Big IoT Data for 3D World

Professor Jenq-Neng Hwang received the BS and MS degrees, both in electrical engineering, from National Taiwan University in 1981 and 1983 separately. He then received his Ph.D. degree from the University of Southern California. In 1989, Dr. Hwang joined the Department of Electrical and Computer Engineering of the University of Washington in Seattle. His research areas are multimedia signal processing, multimedia networking, image processing, computer vision, and graphic recognition. He has published more than 300 research papers in international journals, international conference proceedings, books, and book chapters.

Professor Hwang was invited by the School of Computer Science, National Yang Ming Chiao Tung University to deliver a speech: “When 5G Meets with Big IoT Data for 3D World,” on April 7th, 2021. In the speech, He talked about not only the Impact of future 5G on the Internet of Things and deep learning, such as object detection, object tracking, and 3D model reconstruction, but also some interesting research directions as well as the related theoretical foundations and the corresponding research results.

Due to the large installation base of network cameras, the boom of deep learning and even artificial intelligence, as well as the deployment of 5G networks and edge embedded systems, the real-time Internet of Things world is becoming more feasible in the future so that academic research has been propelled into mainstream technologies for business. The exploration of the dynamic environment in the 3D physical world can grasp the information of humans, cars, and objects from cameras in various locations. The collected information can be applied in different smart city applications, such as security surveillance, intelligent transportation, commercial statistics collection, and community health monitoring, etc. Professor Hwang first demonstrated an automatic (human and vehicle) tracking system which can be automatically calibrated in 3D space. With the aid of deep learning, one of the most successful techniques recently, the position and speed of detected vehicles and the postures of humans can be illustrated on GPS coordinates. In this way, objects tracking by multiple cameras can be fused and reconstructed effectively in a 3D virtual world, which can be applied to more smart cities and intelligent transportation applications.

Professor Hwang shared his research findings and achievements in his research areas. His team focuses on people tracking and positioning, vehicle tracking and positioning, object tracking by mobile cameras, and human pose estimation, has won several awards in various competitions, such as a winner of 3D MOT Challenges 2015, as well as a winner of Track 1: Speed Estimation and Track3: Re-Identification at AI City Challenge 2018. His robust research methodology has laid a solid foundation of Internet of Things and Internet of Vehicles in the future 5G world. In addition to academic research, Professor Hwang mentioned many real-life scenarios. For example, when the system is affected by weak/strong lighting or bad weather, the algorithm would adapt system configurations in a timely manner to reduce the overall error rate. Furthermore, integration of software and hardware is no doubt a best practice to build such a system; however, Professor Hwang pointed out that the integration of algorithms would be another topic worth pursuing. It is a pity that the latest technology in this area, such as object detection, tracking, segmentation, and depth estimation, does not have an end-to-end solution.