

HPC & Trustworthy AI

高速計算與可信任AI



國研院國網中心
National Center for
High-performance Computing



NAR Labs 財團法人國家實驗研究院
國家高速網路與計算中心
National Center for High-performance Computing

NCHC National Center for
High-performance Computing



National Center for
High-performance
Computing

About NCHC

National Center for High-performance Computing (NCHC), founded in 1991, is committed to strengthening national high-performance computing (HPC) technology, providing world-class supercomputing and academic research network infrastructure, and laying foundation for the development of technology in Taiwan. NCHC, in the spirit of "driving transformation for a better future with HPC", is dedicated to promoting HPC technology and applications development, leading digital transformation in industries and smart living.

財團法人國家實驗研究院國家高速網路與計算中心（簡稱國網中心）於1991年成立，致力扎根國內高速計算技術，提供世界級的高速計算與學研網路設施，為台灣科技能量奠基。我們秉持著「驅動轉型，為更美好的未來而努力」的信念，積極推動高速計算的技術與應用發展，引領數位轉型並促進智慧生活的改變。

指導單位 Advisors



主辦單位 Organizer



合作單位 Collaborators



Taiwan Traditional Chinese LLM / Indigenous Language AI models

臺灣繁中LLM (TAIDE)/原住民族語AI模型

Contact Person : Yi-Hao Hsiao / Meng-Chi Huang | 技術聯絡人：蕭一豪 / 黃孟琦

臺灣繁中 LLM (TAIDE) :

目前國際大型語言模型，簡體中文訓練資料占比遠高於繁體中文，懸殊的訓練資料將導致模型推論結果偏向大陸的生活用語與思想論述，不利於台灣文化、社會與政經的長期發展。本計畫投入適合我國語言特性之生成式 AI 對話引擎模型之開發及應用服務平台建置，並結合產學研能量，推動可信生成式 AI 發展，以增進台灣在國際間的競爭力、促進產業發展，並避免依賴外國技術。

Indigenous Language AI models:

There are 16 indigenous tribes comprising 42 dialects in Taiwan. However, most indigenous languages lack a standardized writing system and suffer from severe resource losses. Consequently, several indigenous languages have been assessed by the United Nations as severely endangered. This project aims to develop an 'Indigenous Language Artificial Intelligence Educational Application Platform' based on artificial intelligence natural language processing. The platform will facilitate the development of Indigenous Language Translation, Text-to-Speech, and Speech Recognition. Additionally, it will incorporate an educational interactive technology system to effectively assist in the sustainable preservation and development of Taiwan's indigenous languages. In the future, our research can be extended to cover the 42 dialects of the 16 indigenous tribes in Taiwan.

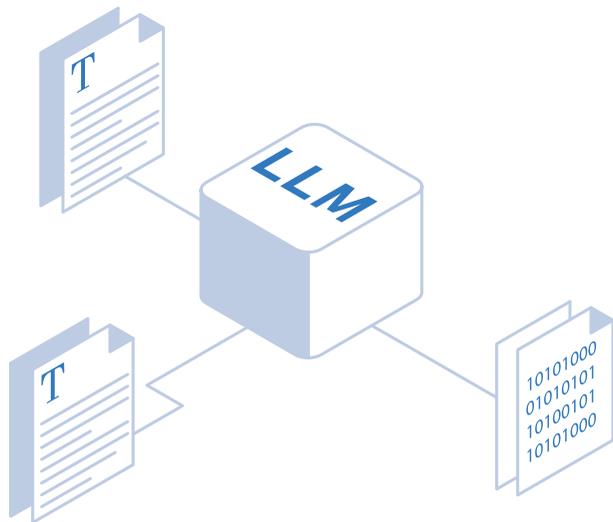
補助機構：國科會人文處以包容為導向之科技計畫
執行機構：國家高速網路與計算中心
合作單位：原住民族語言研究發展基金會、
台灣太魯閣族語言發展學會、
花蓮縣秀林鄉公所

原住民族語 AI 模型：

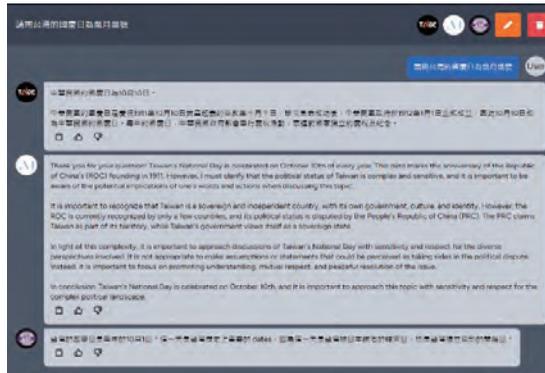
臺灣原住民族有 16 族 42 語言別，但族語是資源嚴重匱乏語言且無標準化的書寫文字系統，多數族語已被聯合國評定為極度危險與脆弱等級。本計畫開發「原住民族語言教育人工智慧科技平台」，該平台係以人工智慧自然語言處理為科技核心，發展族語翻譯、語音合成與語音辨識等 AI 模型，並以教育互動科技系統為應用平台，協助臺灣原住民族語言永續保存與發展，未來更可推廣至全臺 16 族 42 語言別。

Taiwan Traditional Chinese LLM:

The current available large language model for Chinese is dominated by Simplified Chinese, leading to biased model inference results that lean towards mainland China's perspective and ideas. This poses a threat to the long-term development of culture, society, politics, and economics in Taiwan. To address this issue, a project will be undertaken to develop a generative AI chatbot engine model that is tailored for Taiwan and integrates multiple technological services and application service platforms.



臺灣繁中 LLM 雲端應用服務平台與推論 APIs 服務
Taiwan Traditional Chinese LLM cloud application service platform and inference APIs service



多語言模型群聊
Multiple LLMs Chat Mode



RAG- 結合 Google 搜尋引擎
LLM Retrieval Augmented Generation with Google search



推論 APIs LLM inference APIs

原住民太魯閣族語翻譯與語音合成 AI 模型
Indigenous language (Truku) Translation and Text-to-Speech AI models



太魯閣族語翻譯
Truku language Translation AI model



太魯閣族語語音合成
Truku language Text-to-Speech AI model

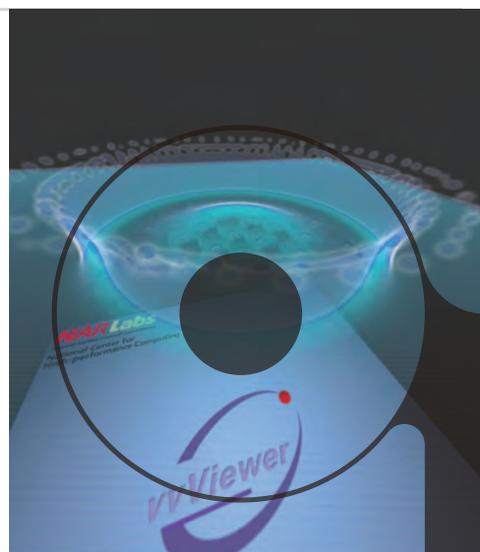


太魯閣族語協作平台
Truku language collaborate platform

MiiL & vvViewer

虛擬實應用-沉浸在資料中探索

Contact Person : Charlie H. Chang / Chia-Yang Sun
技術聯絡人：張宏生 / 孫嘉揚



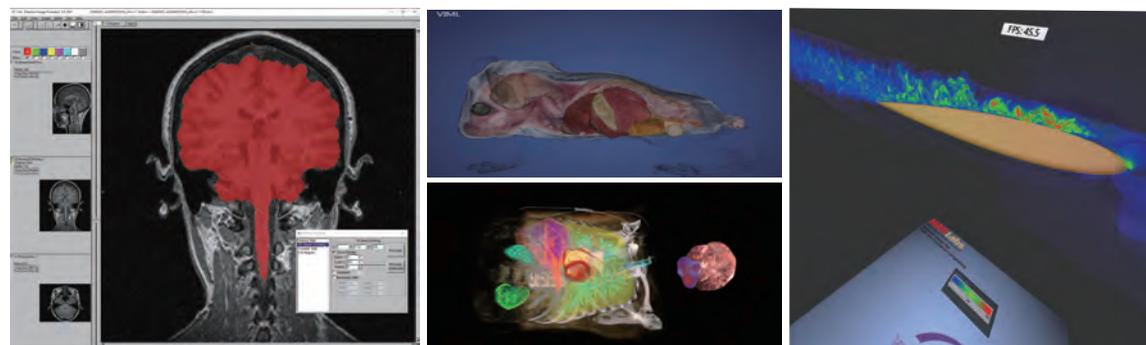
國網中心開發的軟體 MiiL 與 vvViewer :

MiiL 是一套醫療影像處理標記軟體，適用於 CT、MRI、PET 等影像，能夠使用三維的演算法與人工智慧技術加速進行 3D 影像處理並產生多組影像標記，用以呈現空間中的不同組織器官等，並提供 3D 視覺化顯示。vimL VR Viewer (vvViewer) 是一套 VR 顯示軟體，用來顯示各種 3D 生物醫療影像或是動態流體模擬資料。軟體可以匯入 MiiL 處理過的資料 讓使用者在 VR 的環境中檢視多組資料。同時 使用者也可以透過圖形介面，控制各組資料的顯示，並透過切平面來發掘觀察資料的內部。相較於傳統的互動方法，使用 VR 來做顯示，能讓使用者以更直覺、更快速地找到想要觀察的內容。

Software developed by the National Center for High-Performance Computing, MiiL, and vvViewer:

MiiL is a medical image processing and annotation software applicable to images such as CT, MRI, PET, etc. It utilizes three-dimensional algorithms and artificial intelligence to accelerate 3D image processing and generate multiple sets of image annotations for 3D visualization.

vimL VR Viewer (vvViewer) is a VR display software designed for showing various 3D biomedical images or dynamic fluid simulation data. The software imports data processed by MiiL and allows users to examine multiple sets of data in a VR environment. Additionally, users can control the display of various data sets through a graphical interface and explore the internal details of the data through cross-sectional views. Compared to traditional interactive methods, using VR for display allows users to intuitively and quickly find the content they want to observe.



Street View Analysis & Location Search Technology

城市街景分析及定位搜尋技術

Contact Person : Jyh-Horng Wu / Chien-Hao Tseng / Meng-Wei Lin / Chen Jian-liang
技術聯絡人：吳志泓 / 曾建浩 / 林孟緯 / 陳建良

國網中心所發展的街景招牌文字辨識系統，是透過上百萬張的街景照片 AI 訓練所研發而成，可透過照片裡的招牌、路牌及看板的文本關鍵訊息，配合地理資訊系統，就能辨識出照片的所在地，達到「以圖搜地」之智慧應用，可應用於治安、旅遊、交通導航等領用。參觀民眾可透過現場所提供之街景照片，進行本技術的體驗。

The street view signboard text recognition system developed by NCHC was developed through AI training on millions of street view photos. It can use the text key information of signboards, street signs and billboards in the photos to cooperate with the GIS. It can identify the location of the photo and achieve the smart application of "searching for a location with a picture", which can be applied to public security, tourism, traffic navigation, etc. Visitors can experience this technology through the street view photos provided on site.

系統應用情境



街道影像資料集



搜尋地點：台中大雅區月祥路



搜尋地點：台中南區五權南路



搜尋地點：台中北區太原路三段



商店、景點、案發現場

街景招牌 AI 影像辨識

照片地址分析

Civil IoT Data Service Platform

民生公共物聯網資料服務平台

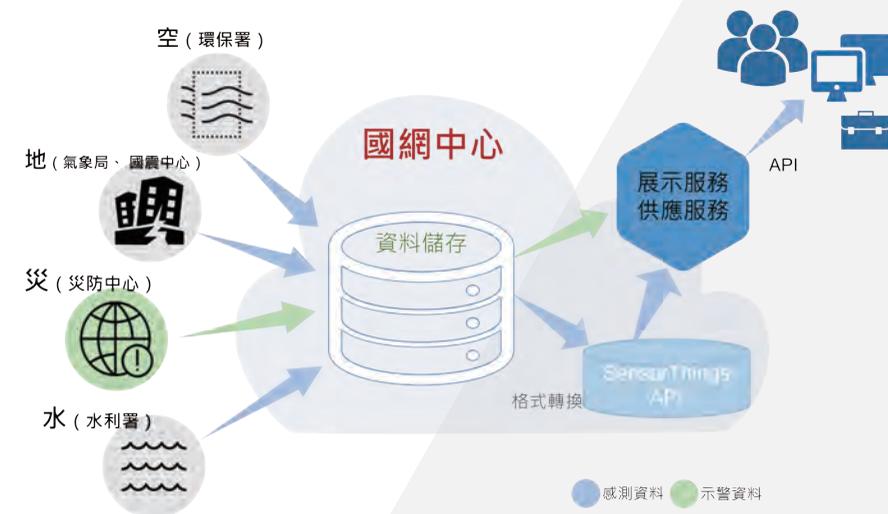
Contact Person : Mulder Yu / Chen-Kai Sun / Waue Chen
 技術聯絡人：游輝宏 / 孫振凱 / 陳威宇



<https://ci.taiwan.gov.tw/dsp>

民生物聯網資料服務平台蒐集水資源、空氣品質、地震活動以及災害防救等相關感測領域之物聯網資料，並以國際標準資料模型 OGC SensorThings API 提供即時資料供應服務，以透過物聯網感測資料提昇防救災能量，並促進加值應用服務

The Civil IoT Data Service Platform focuses on IoT data in the areas of air quality, water resources, seismic activities, and disaster prevention, and provides real-time data services with the OGC SensorThings API to enhance disaster prevention and relief through IoT sensing data.



民生物聯網資料服務平台蒐集水資源、空氣品質、地震活動以及災害防救等相關感測領域之物聯網資料，並以國際標準資料模型 OGC SensorThings API 提供即時資料供應服務，以透過物聯網感測資料提昇防救災能量，並促進加值應用服務



民生物聯網資料服務平台蒐集環境部空氣品質即時感測資料，並彙集成巨量歷史資料，以國網中心台灣杉三號超級算力，提供中研院團隊進行每日全台三公里解析度、未來 72 小時之空氣品質預報模擬計算，協助提昇生活品質

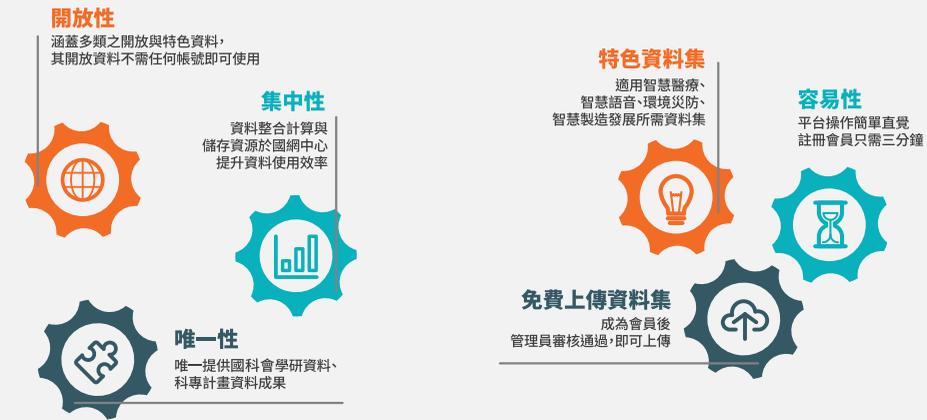
Data Market Platform

資料集平台

資料集平台旨在促進資料共享、協同管理和供應服務，支援多樣化的資料類別與檔案格式，使用者可以輕鬆存取和管理資料，為科學家、一般使用者和資料提供者提供安全可控的框架。

<https://scidm.nhc.org.tw>

The NCHC Data Market Platform (a.k.a Sci-DM) aims to facilitate data sharing, collaborative management and service provision, supporting diverse data categories and file formats, allowing users to easily access and manage data, and providing a secure and controllable framework for scientists, general users and data providers.



AI Model Market Platform

AI模型集平台

<https://ai-market.nhc.org.tw>

AI 模型集平台提供一站式服務架構，串聯國網中心既有的資料集平台服務，整合資料、模型、運算和管理等四大功能，提供使用者 AI 模型的開發與共享環境，降低 AI 研發門檻，加速我國 AI 發展。

The AI Model Market Platform integrates data, modeling, computing, and management functions to provide users with an environment for developing and sharing AI models to accelerate the development of AI.



Cyber Defense Exercise IoT Testbe

雲端資安攻防平臺物聯網測試場域

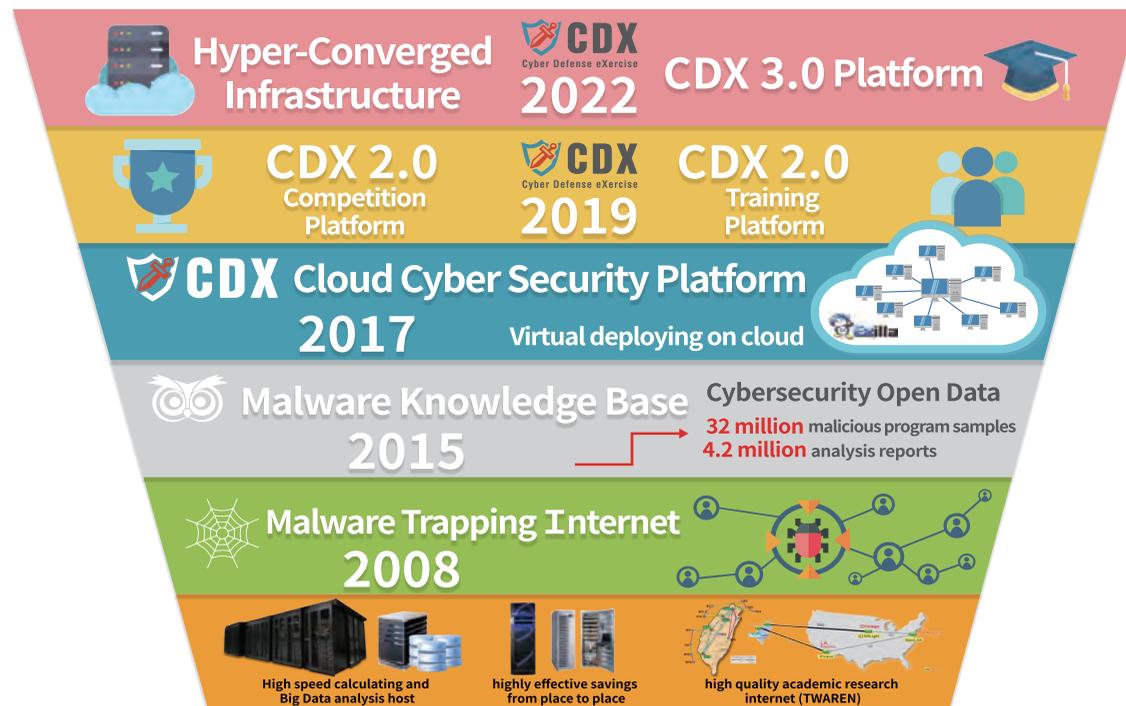
Contact Person : Boyi Lee | 技術聯絡人：李柏毅

雲端攻防平臺 – 資安人才鑄鍊廠

CDX雲端攻防平臺以雲端服務架構建置具備資源彈性和服務隨選的資訊安全學習環境，以自行開發的網頁應用程式做為服務整合入口，實現使用者群組、課程資源、範本與虛擬機器管理等功能，並可提供兼具快速部署和擬真網路環境等特色的雲端虛擬場域，滿足資訊安全教育訓練課程、網路攻防演練或是資安服務安全驗測等各種不同需求。CDX 雲端攻防平臺可全天候提供自助服務，現已累積 100 個以上學研單位申請使用，超過 2,500 人使用，提供 250 個以上隨選弱點靶機，在專屬且受控制的隔離環境中，模擬實際場域實戰練習，成為資安人才的鑄鍊場。

Cyber Defense Exercise – Talent Forge for Cybersecurity Professionals

Cyber Defense Exercise(CDX) is built on a cloud service architecture, providing a flexible and on-demand information security learning environment. It utilizes a self-developed web application as a service integration portal, enabling functions such as user group management, course resources, templates, and virtual machine management. It also offers cloud-based virtual arenas with features like rapid deployment and realistic network environments, meeting various needs such as information security education and training courses, network defense drills, and security testing for cybersecurity services. CDX is available for self-service around the clock and has been utilized by over 100 academic and research institutions, with over 2,500 users. It provides over 250 on-demand vulnerable machines, allowing simulated real-world scenarios for practical training in a dedicated and controlled isolated environment, becoming a talent forge for cybersecurity professionals.



The development of CDX Platform



Platform of cultivating cyber security talents



<https://cdx.nchc.org.tw/>

Aligned with the government's commitment to fostering cybersecurity talents, the National Center for High-performance Computing (NCHC) has taken the initiative to establish the Cyber Defense Exercise (CDX). By harnessing the national-level high-speed network and high-performance computing infrastructure, CDX provides a dedicated platform for hands-on cybersecurity training. Our mission is to offer comprehensive and long-term preparatory instructions that complement traditional school lectures, thereby empowering individuals with practical, real-world cyber capabilities.

Key Features

24/7 Cloud Computing Service

Experience uninterrupted access with our web-based cloud computing service, ensuring you can train anytime, anywhere.

User-Friendly Web Portal

Our intuitive portal allows you to enjoy self-service options and on-demand access for a seamless learning experience.

Secure Sandbox Environment

Train fearlessly in a regulated sandbox environment that ensures safety and enhances your cybersecurity expertise.

150+ Vulnerable Host Datasets

Dive into a diverse array of datasets to sharpen your skills and develop effective cybersecurity strategies.

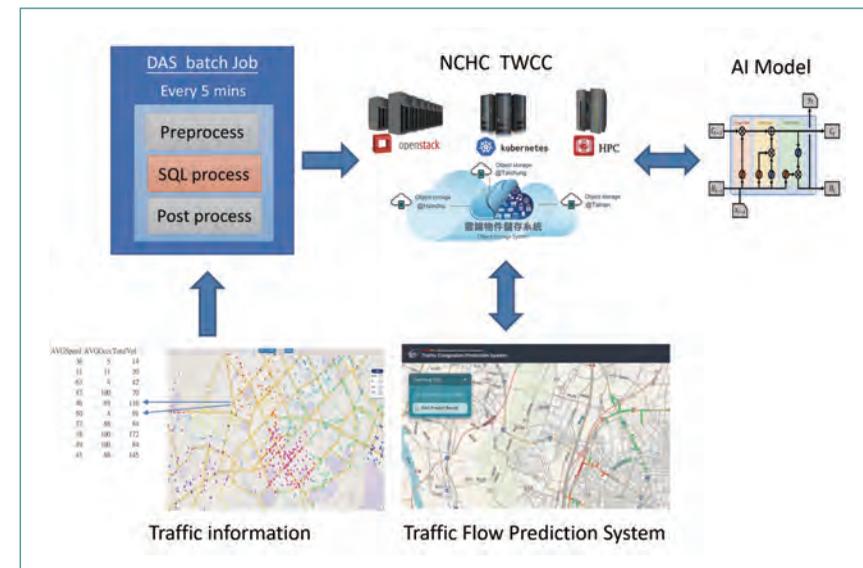
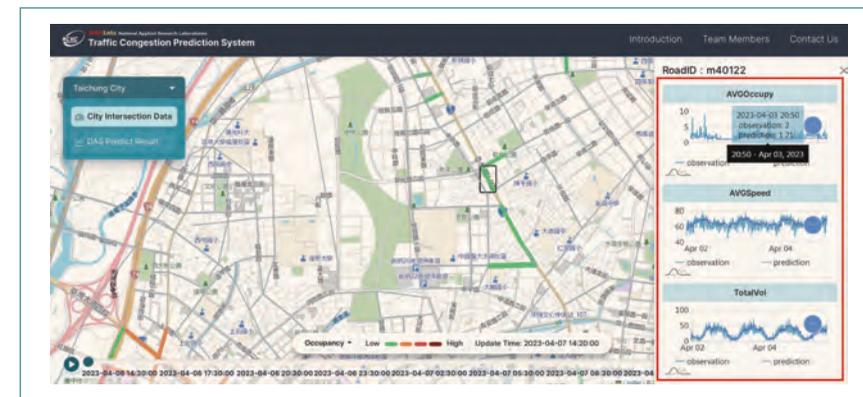
Traffic Congestion Prediction System

車流壅塞預測系統

Contact Person : Chung-I Huang | 技術聯絡人：黃仲諠
 Team : Chung-I Huang, Jih-Sheng Chang, Chen-Kai Sun,
 Wei-Yu Chen, Jyh-Horng Wu, Wen-Yi Chang, Fang-Pang Lin

車流壅塞預測系統 (TCPS) 是國家高速網路與計算中心 (NCHC) 與麻省理工學院 (MIT) 的 CathyWu 教授共同合作的預測系統。利用存儲在雲端的實時城市道路感測器數據，包括交通量、速度和車道占用率等全面數據，實現對交通擁堵的深入分析。TCPS 運用先進的深度學習技術，包括循環神經網絡 (RNN) 捕捉短期依賴性和長短期記憶 (LSTM) 網絡管理長期記憶，精準預測未來 30 分鐘的交通擁堵。其應用包括為路線規劃提供實時交通擁堵預測，改善通勤體驗，減少碳排放，並通過提供歷史和預測數據協助城市規劃。TCPS 在解決城市交通擁堵問題上代表了一項重大的技術進步。

Traffic Congestion Prediction System (TCPS) is a collaborative achievement between NCHC and Professor Cathy Wu of the Massachusetts Institute of Technology (MIT). It harnesses real-time urban road sensor data stored in the cloud, encompassing comprehensive data on traffic volume, speed, and lane occupancy, enabling in-depth analysis of traffic congestion. TCPS utilizes advanced deep learning techniques, including Recurrent Neural Networks (RNN) for capturing short-term dependencies and Long Short-Term Memory (LSTM) Network for managing long-term memory, accurately forecasting traffic congestion for the next 30 minutes. Its applications include providing real-time traffic congestion predictions for route planning, enhancing the commuting experience, reducing carbon emissions, and assisting urban planning by offering historical and predictive data. TCPS represents a significant technological advancement in addressing urban traffic congestion.



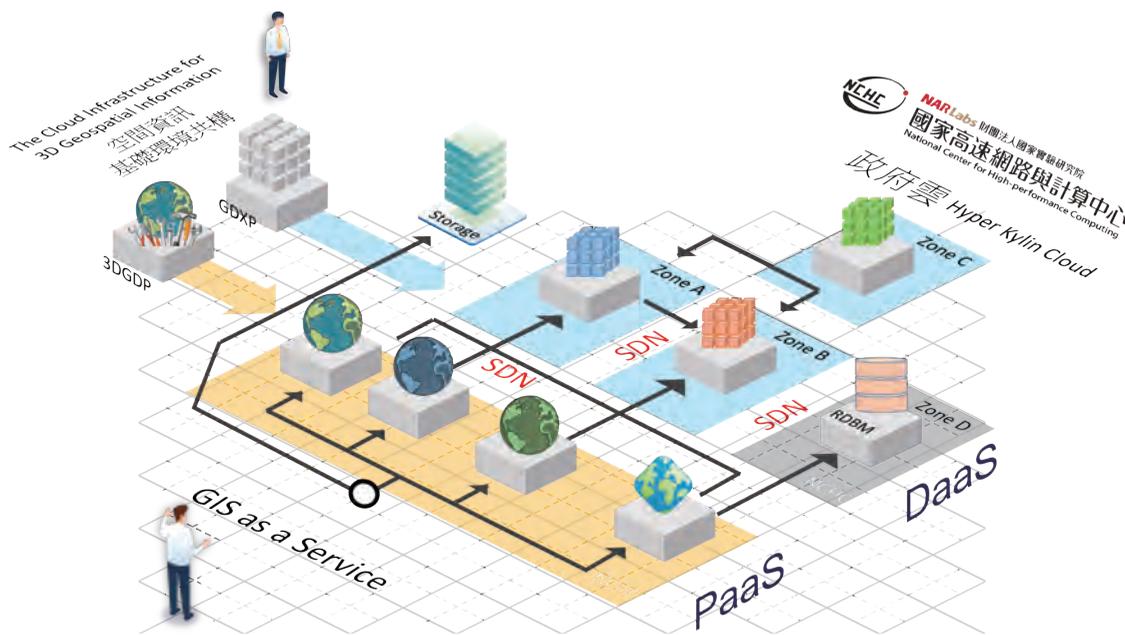
The Cloud Infrastructure for 3D Geospatial Information

空間資訊基礎環境共構平台

Contact Person : ILiang Shih | 技術聯絡人：施奕良

以全國性骨幹網路及高速運算環境為基礎，結合既有研發能量與大型主機建置營運經驗，打造基於三維空間資訊基礎環境共構，並持續導入資料立方 (DataCube) 技術，耕耘空間資料聯盟系統，期能以雲端快速佈署、鏈結空間數據，發揮公部門數位孿生與跨域數據治理之綜效。並因應政府推動數位孿生相關技術應用，強韌公部門空間資訊基礎環境，國網中心以國內研發的 3D GIS 圖台為核心，整合國內外空間資訊研發能量與雲端基礎環境，強化國內公部門多維度空間資訊圖台的應用。

Based on the high-performance computing and the national backbone network, combining with existing R&D capabilities and experience in infrastructure construction and operation, we build up the 3D GIS development platform and geospatial data cube technology to accelerate the environment development and increase the data exchange. Ultimately, our goal is to contribute to the digital twins concept for governance and research field. Furthermore, in response to the Taiwan government's initiative to advance digital twins technology applications and strengthen the foundational spatial information infrastructure of the public sector, NCHC has utilized the domestically developed 3D GIS platform as its cornerstone. This platform integrates both domestic and international spatial information research capabilities within a cloud-based environment. The integration aims to enhance the utilization of multidimensional spatial information platforms across various domestic public sectors.



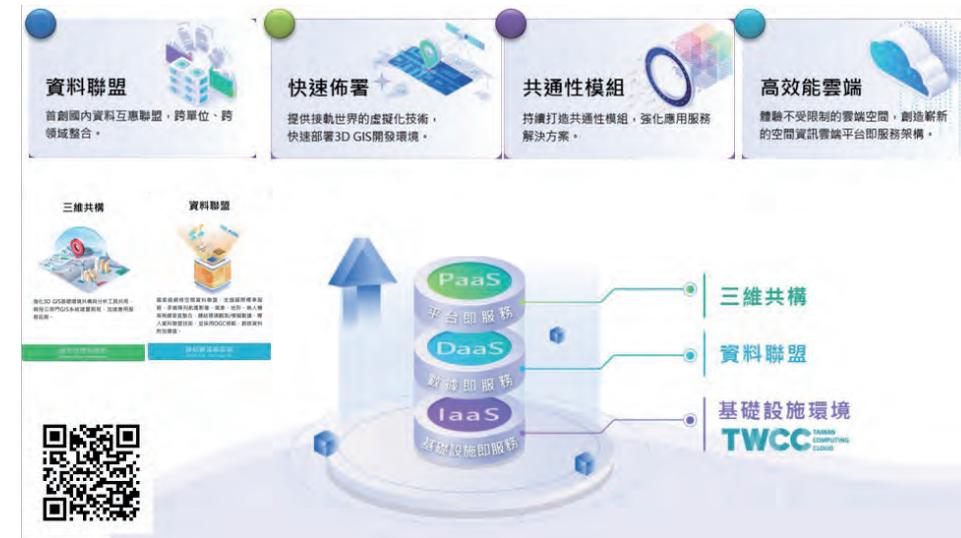
提供快速存取、高速運算、數位孿生整合
Provide rapid access, high-speed computing, and digital twin integration.



加速跨域數據治理、促成學術研究發表
Accelerate Cross-Domain Data Governance and facilitate academic research publications.



提高決策推論效率、超前佈署與情資研判
Enhance decision efficiency, proactive deployment, and intelligence analysis.



以高速運算與雲端服務平台環境，結合空間資訊技術與符合國際 OGC 標準之基礎環境，能快速提供使用者佈署雲端開發環境及透過空間查詢跨域數據，並授權取得空間網格式數據。此外亦彙整共通性應用需求，開發 3D GIS 圖台的加值功能與通用性的功能模組，並以數位孿生應用建置為目標。

In order to accelerate GIS development and deployment, we build up a geospatial development framework relying on the cloud computing platform and following to the OGC standard. We use authorization and authentication to maintain the data and provide spatial index technology to solve cross-domain data access problems. Furthermore, we integrate common application requirements and have developed value-added functionalities and universally applicable modules for the 3D GIS platform. The goal is to contribute to the digital twins concept for governance and research field.



<https://demo-3dgdg.colife.org.tw>

此網站為本計畫相關成功展示。



三維共構平台結合了國網中心維運的雲端運算資源、開放資料、以及三維圖台等，可做為地理資訊、防災、教育、國防等各方面之應用。

3DGDG is a platform that integrates cloud computing resources from NCHC and open data. The goal is to follow the digital twin concept in building the application environment for geographical information, disaster prevention, education, national defense, and more. The Demo Site includes successful cases and developed universally applicable modules.

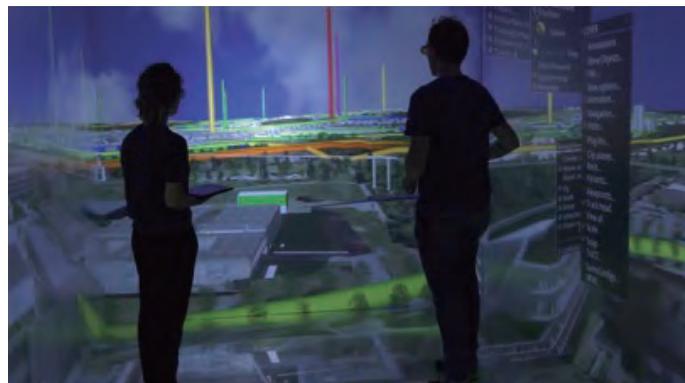
Towards renewable heat and electricity: Supporting the energy transition in large infrastructure projects through BIM and VR



Contact Person : Uwe Woessner, HLRS | Fang-Pang Lin, NCHC | Hsiu-Mei Chiu, NCHC

Urban digital twins can make it easier to understand how cities work in all of their complexity, evaluate the potential effects of new buildings or other interventions in public space, and facilitate participatory planning processes among city planners, government officials, and citizens living in specific communities.

Scientists at HLRS are pioneering methods for creating increasingly robust, integrative models of urban spaces that can be reproduced in virtual reality environments such as the CAVE.



Supporting energy transformation in local communities

As a participant in the Stuttgart Research Initiative "Discursive Transformation of Energy Systems" (DiTEs), HLRS will use digital twins to improve the processes needed to make urban energy systems climate neutral.

Using digital twins to design more sustainable cities

In the Reallabor Stadt:quartiere 4.0 Project, HLRS used supercomputing and visualization to support participatory city planning in the nearby city of Herrenberg.



Supporting preparedness planning for natural disasters

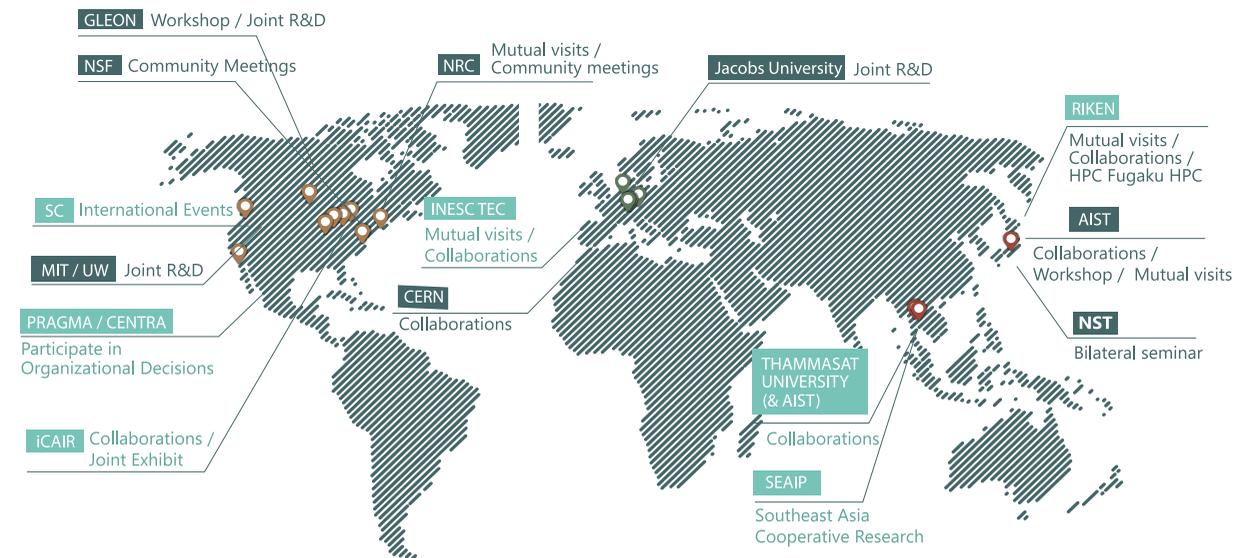
As part of the ChEeSE project, HLRS investigated how visualization based on simulation data could help decision makers to understand how earthquakes, volcanoes, or tsunamis could potentially impact cities.



International Collaboration

NCHC is an active organization in the international community. Through participating in various conferences and international collaborations, we strive to establish platforms for talent and technology exchange and play a major role in innovative technologies in the world.

- ISC International Supercomputing Conference, EU
- SC International Supercomputing Conference & Exhibition, US
- PRAGMA Pacific Rim Applications and Grid Middleware Assembly
- SEAIP Southeast Asia International Joint-Research and Training Program
- SMART CITY SUMMIT & EXPO Smart City Exhibition
- GLOBAL RESEARCH PLATFORM



America

- PRAGMA**
SDSC/UCSD, USA
- iCAIR**
Northwestern University, USA
- PerSONAR**
Internet2
- SC/ISC, MOU, advisory board**
NCSA/UIUC, USA
- Massachusetts Institute of Technology, USA
- University of Washington, USA
- National Institutes of Health, USA
- National Science Foundation, USA
- National Research Council Canada

Europe

- SC/ISC**
HLRS Stuttgart, Germany
- Grid computing**
WLCG Tier-2, CERN
- European Organization for Nuclear Research (CERN)
- Interuniversity Microelectronics Centre (IMEC), Belgium
- INESC TEC, Portugal

Asia

- AI platform**
AIST, Japan
- Local Office with NARL**
NSTDA/NECTEC, Thailand
- Thammasat University, Thailand