THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

Otto Poon Charitable Foundation
Smart Cities Research Institute
潘樂陶慈善基金智慧城市研究院

Smart Geospatial Engineering by Laser Scanning and AI

Prof. John SHI
Smart Cities Research Institute

Seminar on Latest Surveying Technology and Solution 15/12/2022

Smart City (Shi, 2020)

PolyU Smart Cities Research Institute

- Vision
  - To be a center of excellence in urban informatics worldwide and a living laboratory of Smart City development for Hong Kong and the Guangdong-Hong Kong-Macao Greater Bay Area (GBA).
- Mission
  - To develop cutting-edge Smart City technologies;
  - To translate the developed technologies to industry; and
  - To provide and demonstrate Smart City solutions to Hong Kong and the GBA.

1.Metaverse – Digital Twin

Digital Twin

Generate digital twin by *SpaceScanX*

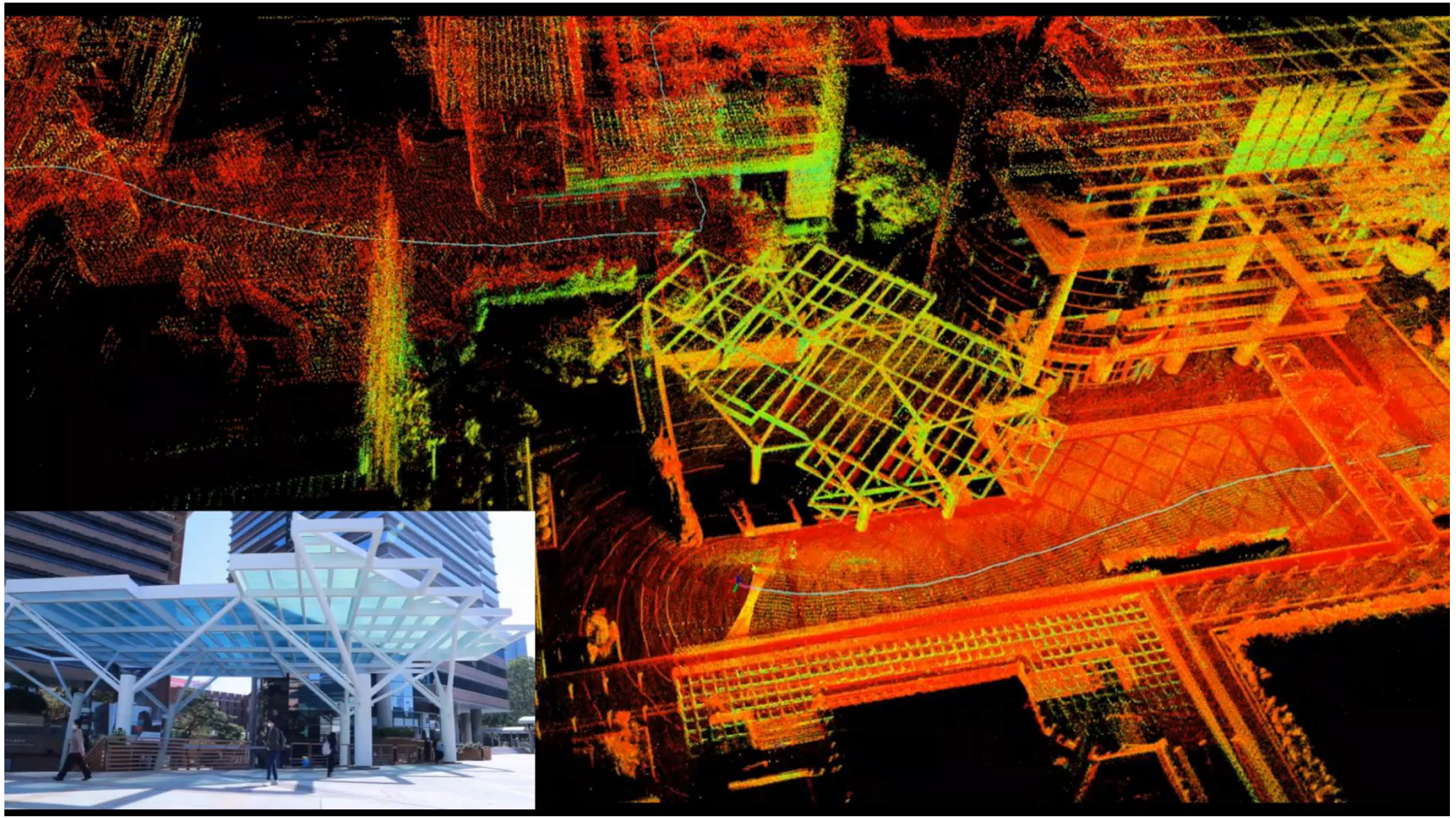
Gold Medals
2021 Int. Inventions Geneva

Features

Features

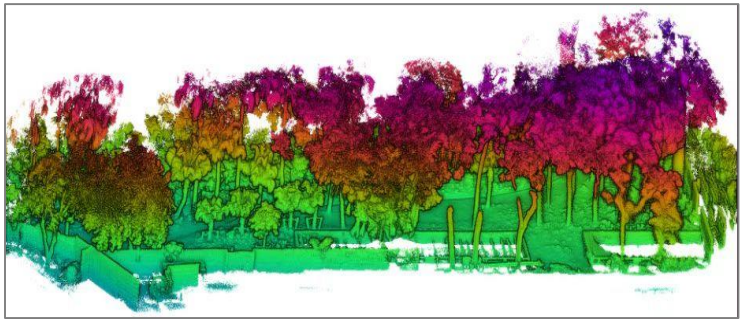
- Indoor and outdoor continuous seamless mapping
- Centimeter-level high accuracy
- Lightweight, 7 kg
- Range: up to 200 meters
- Point density: 900,000 points per second
- Flexibility: mapping in GPS-denied complex environments
- Real-time 3D data acquisition
- Geo-referenced point cloud by RTK
- Products: registered point cloud, colorized point cloud, street view, BIM Model, objects extracted from point cloud etc.

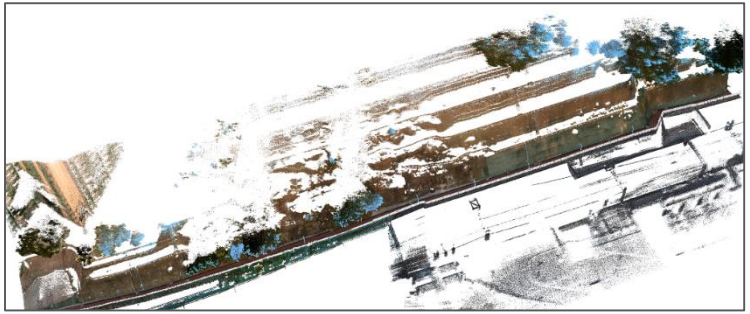
3D scanning by *SpaceScanX*



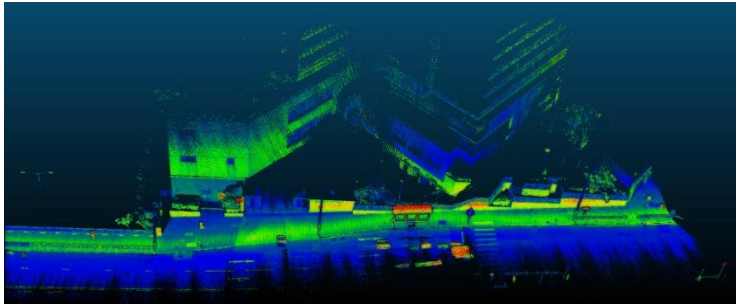
Applications: tree, slope, highways

Forest mapping and slope management



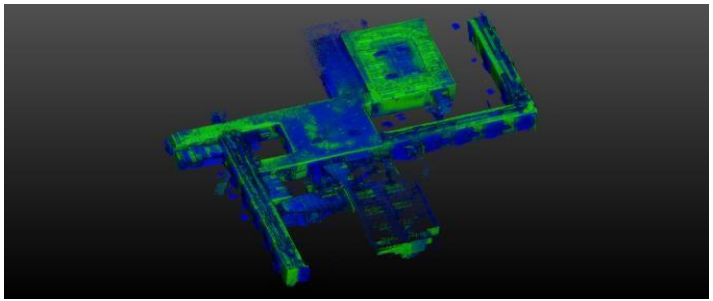


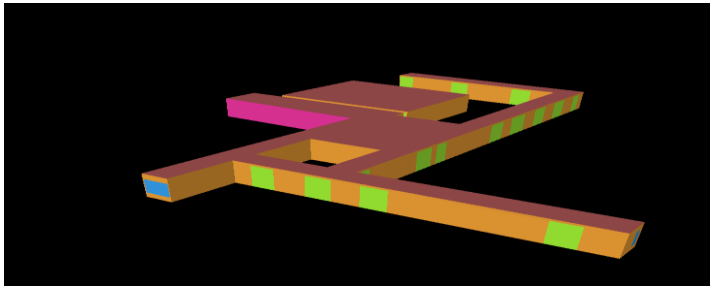
Highways and HD mapping: detection objects on roads



Generating BIM

BIM generating from LiDAR data





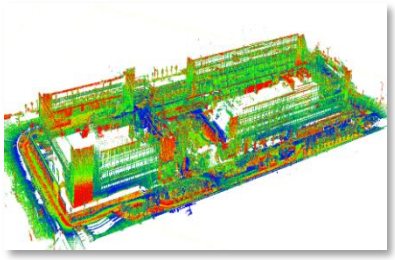
2. Smart City Platform

An effective system for handling digital twin data

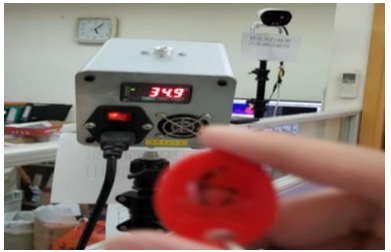
Multi-source Spatial Data Handling

- 2D, 2.5D, 3D model

- Mesh model

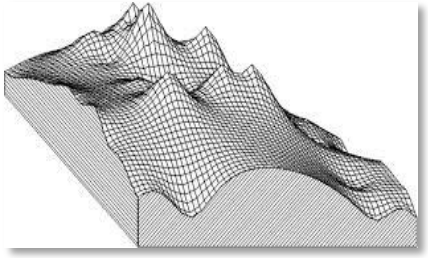


- Lidar point cloud



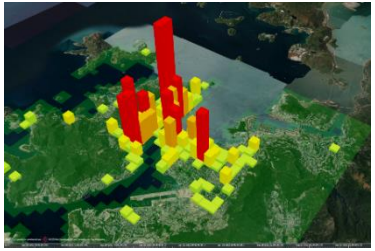
- IoT data

- Base maps – iB1000



- Digital elevation models

- Geo-rectified images

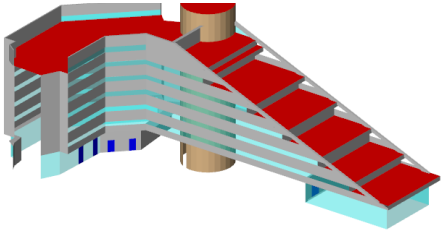


- Geo-social media data

@ SST

Geo-visualization and Data Conversion

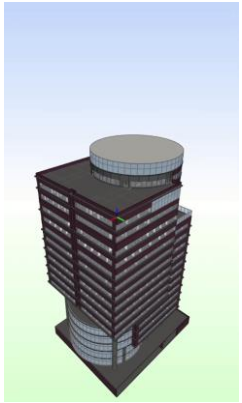
3D model in BIM and GIS

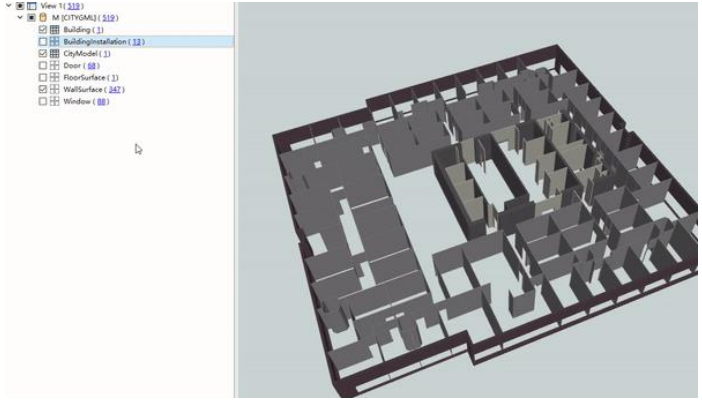


- CityGML with color

- CityGML with texture

- CityGML model on the platform

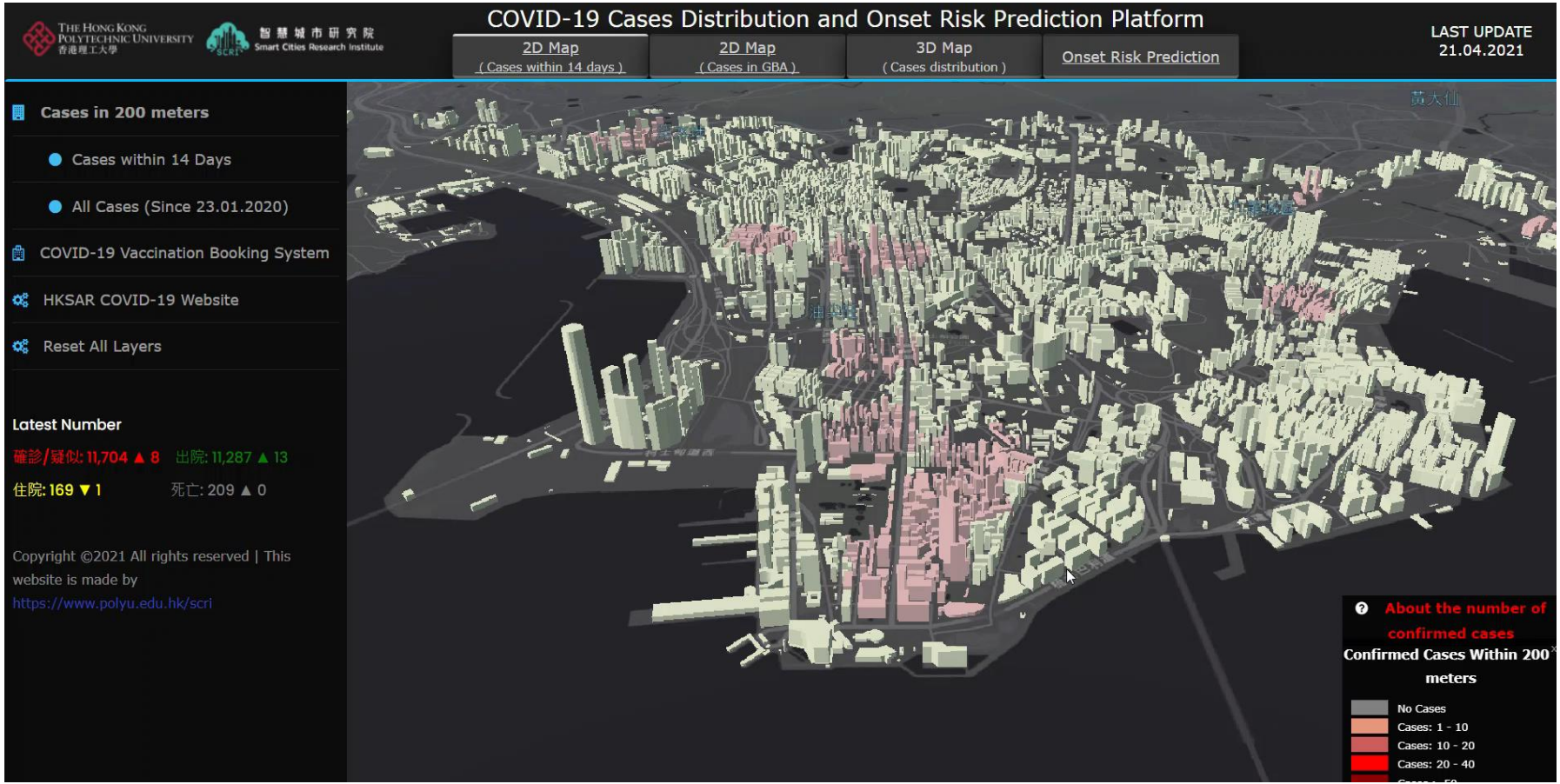




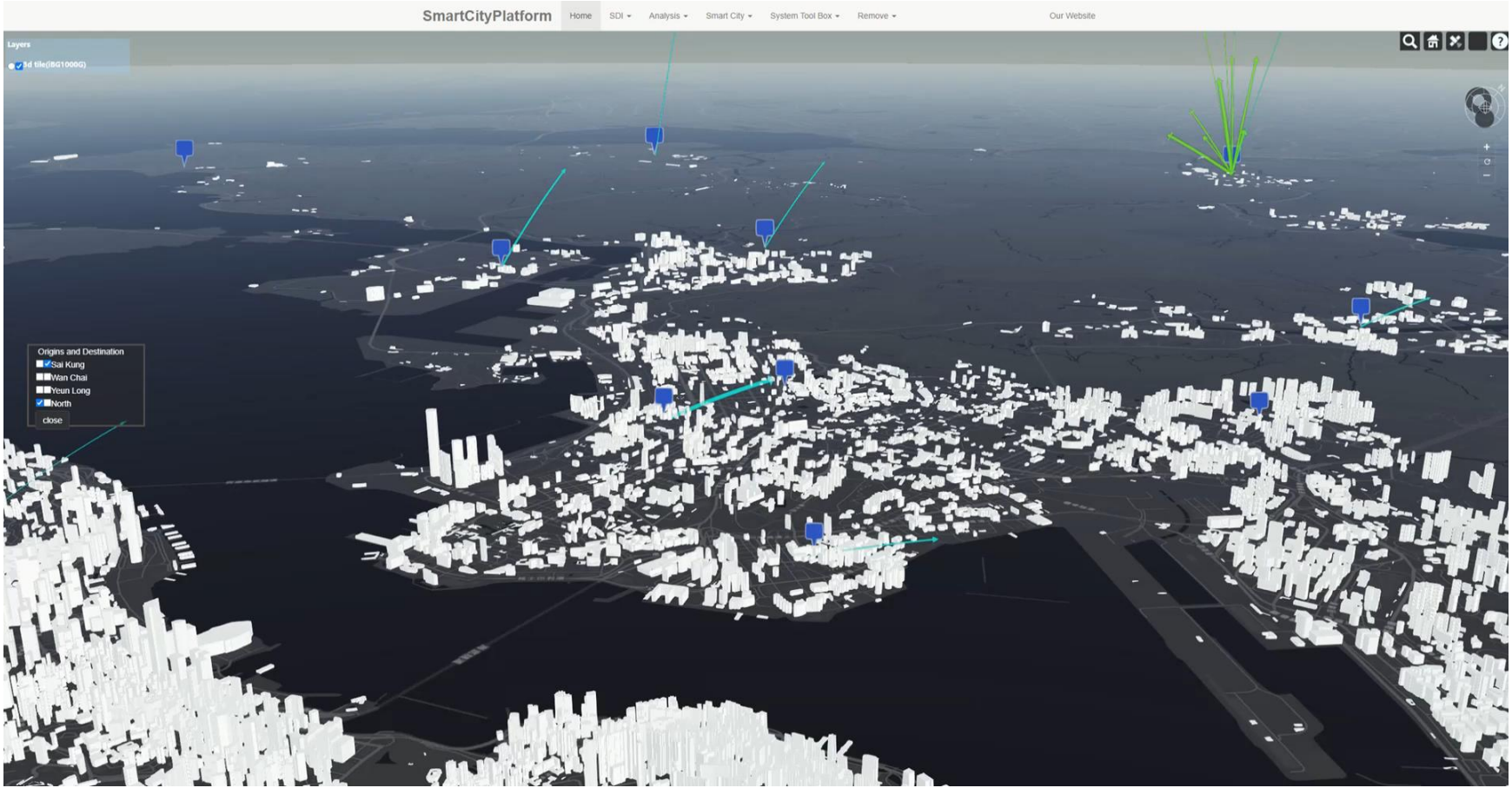
- CityGML with building parts

- Selection by floor ID in the system

COVID-19 Symptom Onset Risk Prediction Platform



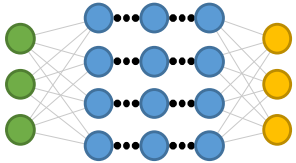
Smart Mobility



3. geoAI

GeoAI

Multi-source, multi-scale, high-dimensional, dynamic-state, and heterogeneous big data set



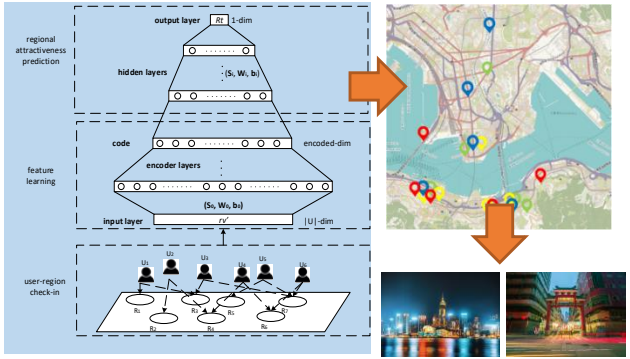
RAID

AI Server

AI Server

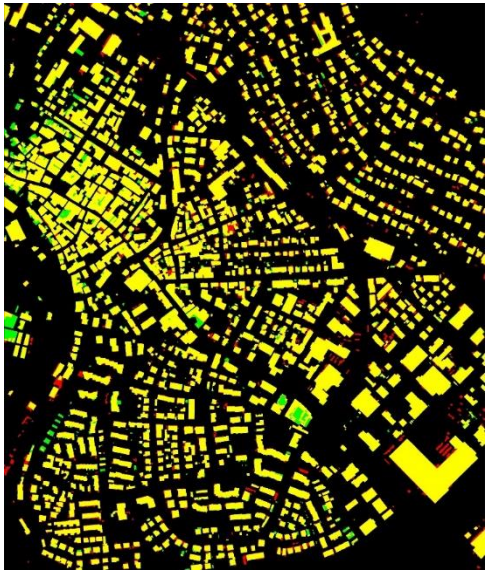
Urban object recognition

Fine-resolution remote sensing



Urban social computation

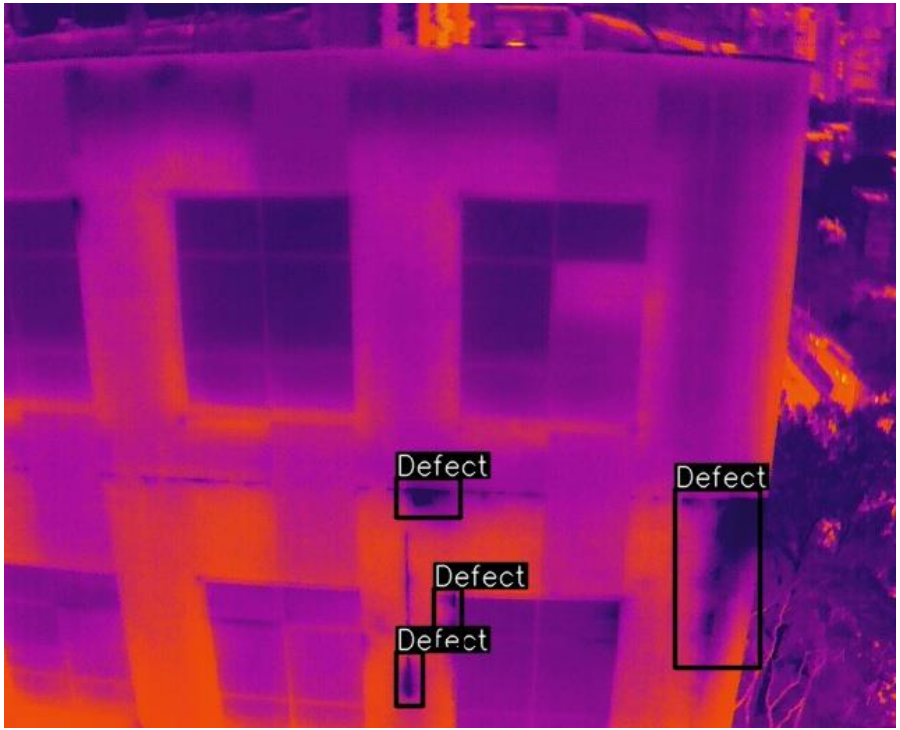
Building Recognition - Using LiDAR and satellite Images



Experiments were conducted on the ISPRS Vaihingen benchmark dataset. Evaluation results show that the proposed method achieved a completeness of 94.1%, a correctness of 90.3%, and a quality of 85.5% over the whole Vaihingen dataset, indicating that the method is robust, with great potential in practical applications.

AI for TIR image sensing

Face detection and temperature measurement



Building defect detection

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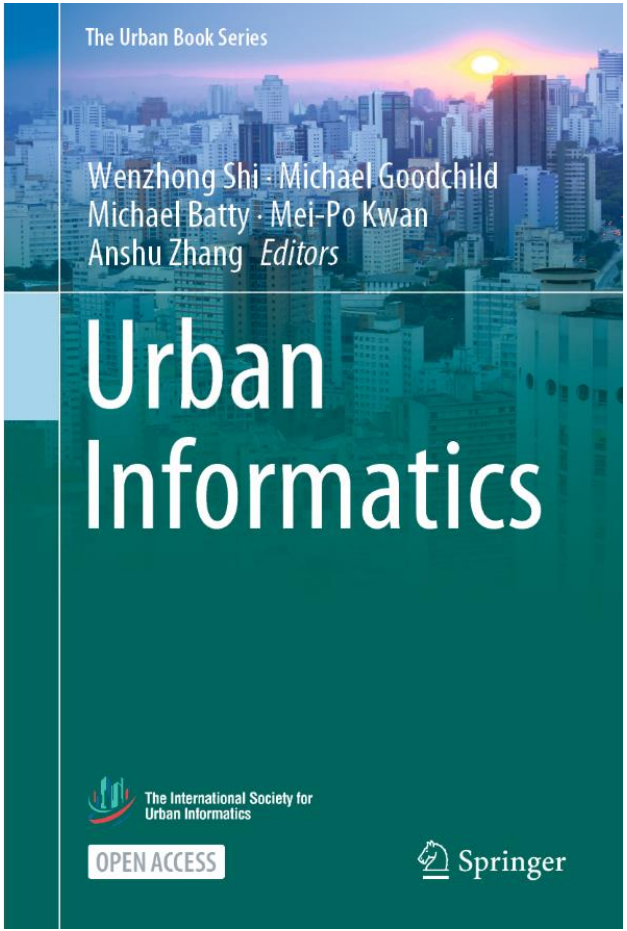
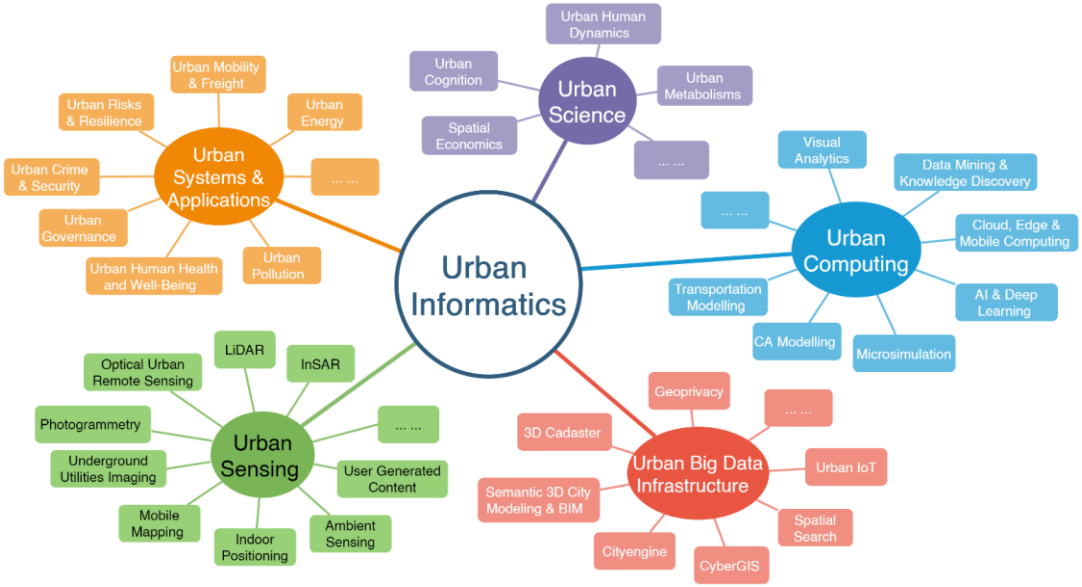
4.Urban Informatics

Urban Informatics





- Access: over 1 million within 1.5 years
- Used as referenced/ text book by many universities worldwide, including MIT

Unban Informatics Conference Series and Webinar

The Webinar attracted 200,000 views

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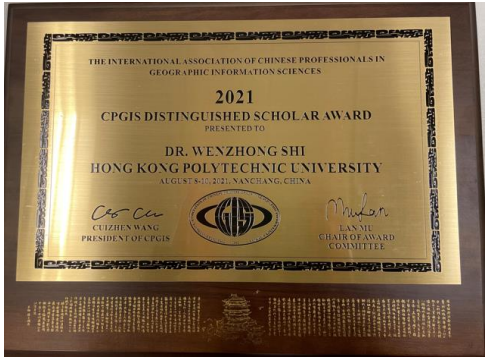
5. International recognition

Awards and Honors

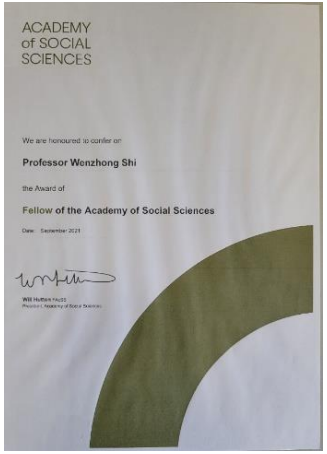
Gold Medals at 2021 Inventions Geneva

SMART 50 AWARDS

2021 Smart 50 Awards (US) by Smart Cities Connect



CPGIS Distinguished Scholar Award 2021



謝謝！

史文中 教授

香港理工大学 智慧城市研究院

lswzshi@polyu.edu.hk