RESEARCH INSTITUTE FOR SUSTAINABLE URBAN DEVELOPMENT (RISUD)

News Article for RISUD Emerging Frontier Area (EFA) Scheme

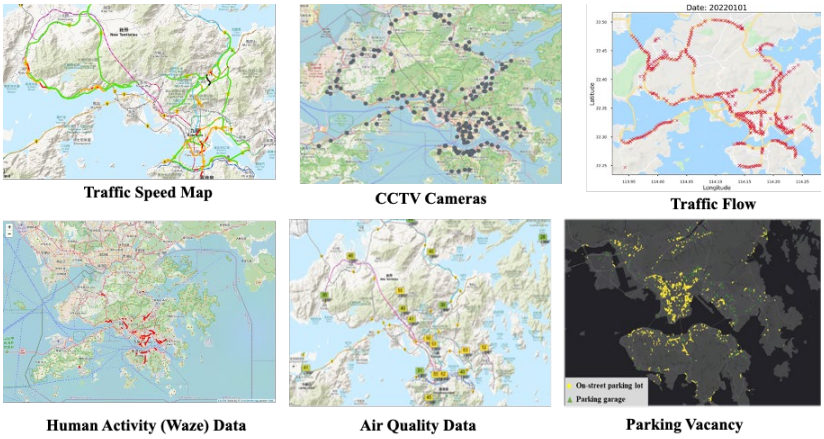
		Name	Department
1.	**Principal Investigator**:	Dr. Wei MA	CEE
2.	**Name of EFA:**	Disaster Emergency Response in Smart Cities	
3.	**Project Title:**	Towards a Smart System for Post-Windstorm Tree Debris Cleanup and Transportation Network Restoration in Hong Kong	

4. **Annual Progress/Achievement (***in layman's language, no more than two A4 pages, pls attach photos***)**

In the first stage of the EFA project, we focus on collecting multi-source urban data and developing spatial-temporal data learning frameworks. We summarize the following main research outcomes for sharing:

1. Multi-source urban data in Hong Kong

We collect the multi-source urban data in Hong Kong, and these datasets are processed and integrated into a uniform geographical format.

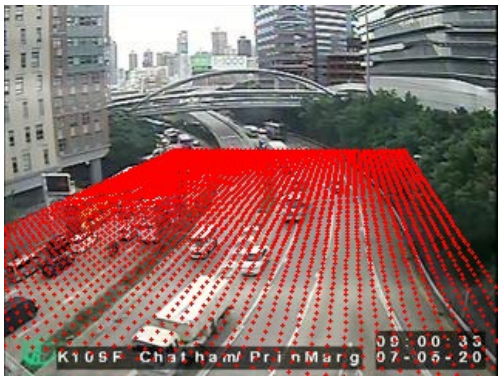


Making use of the multi-source data, we have secured a Smart Traffic Fund Project titled "Development and Deployment of an AI-enabled Parking Vacancy Prediction Framework using Multi-source Data" with a total amount of HKD 1,094,482.

2. Traffic data extraction framework for the CCTV cameras in Hong Kong

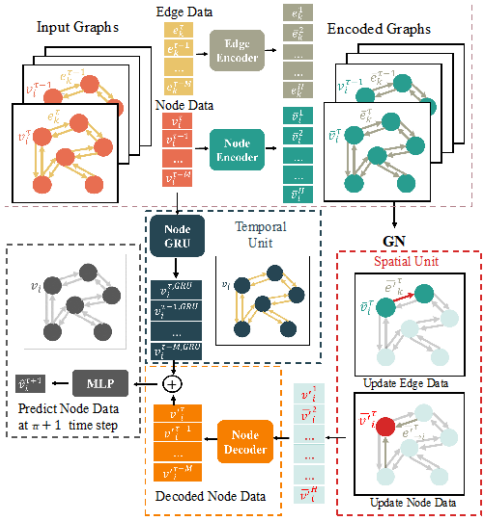
In Hong Kong, hundreds and thousands of traffic surveillance cameras are distributed in the entire realm of the city, providing real-time monitoring of traffic conditions. However, these traffic surveillance cameras are usually not calibrated, meaning that accurate parameters regarding cameras (e.g., location, orientation, etc.) are unavailable. If these cameras can be calibrated accurately, quantitative traffic data such as flow, speed, and density can be extracted from

surveillance cameras, and this can provide substantial information for traffic operators and decision-makers. However, surveillance cameras in different traffic surveillance systems are generally affected by the **4L** characteristics: **L**ack of data, **L**ow frame rate, **L**ow resolution, and **L**ocated in complex road environments. Despite the great potential of the traffic surveillance cameras, the 4L characteristics hinder them from providing useful information. In this paper, we propose a generalized camera calibration method, namely, MVCalib, for calibrating cameras with 4L characteristics.



3. Spatio-temporal traffic data learning with small samples

As the urban data in Hong Kong is limited, we further develop spatio-temporal deep learning models to learn from small samples. In many cities like Hong Kong, the available amount of traffic data is substantially below the minimum requirement due to the data collection expense. It is still an open question to develop traffic prediction models with a small size of training data on large-scale networks. We notice that the traffic states of a node for the near future only depend on the traffic states of its localized neighborhoods, which can be represented using the graph relational inductive biases. In view of this, this paper develops a graph network (GN)-based deep learning model LocaleGn that depicts the traffic dynamics using localized data aggregating and updating functions, as well as the node-wise recurrent neural networks. LocaleGn is a light-weighted model designed for training on a few samples without over-fitting, and hence it can solve the problem of few-shot traffic prediction. The proposed model is examined on predicting both traffic speed and flow with six datasets, and the experimental results demonstrate that LocaleGn outperforms existing state-of-the-art baseline models.



4. A very large-scale traffic simulator for Hong Kong

We have developed a prototype for the dynamic traffic simulation tool that depicts day-to-day traffic flow dynamics on the road networks, and millions of vehicle trajectories can be simulated in Hong Kong. To enable the developed traffic simulation tool to replicate the actual traffic conditions, a data-driven calibration method is developed. With the simulator, we can simulate the traffic conditions after an emergent event and evaluate its impact.