**(SEC) SINGAPORE-ETH 新加坡－ETH
CENTRE 研究中心**

**Researcher/ Post-doctoral Researcher:
Computer Vision or Geomatics / Semantic modelling**

Future Cities Laboratory, Singapore-ETH Centre

Project Description: to develop an operable system for LoD3 model generation using multi-source data and user-friendly interactive editing

Photo-realistic 3D city models that represent the physical and functional state of the city are necessary components of the nation's digital infrastructure. However, generating accurate and standard 3D city models is a tedious, decisively rich, and complex process. While LoD 3 models include details such as building roof and façade geometry, as well as the functions of its components (windows, doors, etc.), the current practice of LoD3 city modelling is still a manual and time-intensive process. Given the high demand for city-scale model production in the Virtual Singapore programme, we aim to develop an operable workflow that can produce LoD3 with the lowest possible manual involvement.

The project

The objective of the project is to work towards an operationally feasible approach to generate city-scale LoD3 models and provide preliminary proof-of-concept on efficient model maintenance, in order to facilitate the broader mission of the Virtual Singapore programme in developing Singapore as a more intelligent and smart city.

Our team consists of internationally recognised experts in photogrammetry, remote sensing, human-computer interaction and procedural modelling from ETH Zurich, Ohio State University (OSU), University of Twente, Technical University of Northwestern Switzerland, as well as industry partners.

A multi-data approach is used by integrating different sources of data including oblique imagery, aerial images, airborne/mobile LiDAR, and UAV images to produce high quality LoD3 models that meet the CityGML standards.

The workflow of the project consists of three work packages (WP) that develop techniques in:
WP1: geometry modelling
WP2: semantic labeling
WP3: interactive geometric editing

WP1 will develop image-based and LiDAR-based roof topography and façade geometry modelling with automated and semi-automated methods. WP2 will apply data fusion techniques with the latest machine learning methods to perform land-cover classification and façade element attribution. WP2 will also develop a preliminary proof of concept in change detection and model updating. To ensure high fidelity of the resulting models, WP3 will develop novel visualisation-driven editing procedures that efficiently correct errors of the models and integrate

the procedural modelling workflow to the 3D reconstruction of buildings with regular geometric patterns.

The project is part of the Future Cities Laboratory (FCL) programme, which undertakes cutting-edge research in disciplines ranging from material science, engineering and environmental technologies to geomatics, communications technology and architecture. The FCL aims to research and develop solutions and guidelines directed towards the sustainable development of buildings, districts and regions. In this project, ETH Zurich collaborates closely with scientists from the National University of Singapore (NUS) and the Nanyang Technological University (NTU), among other universities.

Key responsibilities

The Researcher/ Post-doctoral Researcher for WP2 on Semantic Labeling will be supervised by and report to Prof Rongjun Qin.

The successful candidate will study and understand the basic processing of various types of geospatial data, including airborne/mobile LiDAR data, mobile mapping images, airborne/oblique images, and UAV images. He/she should be able to perform any geometric processing with these images, including geo-referencing of images, bundle adjustment, and multi-source data registration. He/she will develop algorithms that perform automatic scene labeling, including very high resolution 3D data classification using classical classifiers (e.g. SVM, Random Forest, MLC), as well as content labelling using trained, pre-trained deep convolutional neural networks. He/she may use publically available datasets, or may create own datasets for training, by considering the transferability of the pre-trained classifier. He/she will also develop pilot test program that performs automatic change detection between two sets of 3D data.

Key tasks:
1) Semi-automated/automated land-cover image classification for object recognition using very high-resolution 3D data. Develop new joint feature representation to improve the land-cover classification accuracy to support LoD2 modelling.
2) Semi-automated/automated façade element identification. Use CNN and other hierarchical machine learning method to identify building elements, including doors, windows, balcony etc.
3) Given the I/O protocol of CityGML models, develop a view-independent texture mapping will also be implemented to assign photorealistic textures to the LoD3 models
4) Implement a top-view based change detection algorithm to form a test study
5) Results will be in the form of an operable software systems and at least 2 peer-reviewed journal papers

Key Skills
The candidate should possess
- Masters or PhD degree in Computer Vision, Geomatics, or with an equivalent relevant background in a major research university
- Strong C++ programing skills, proficient in packages such as opencv, gdal and pcl, qt, opengl, etc.
- Strong experience in Caffe or other related deep learning frameworks
- Strong experience and knowledge in 3D Computer vision and photogrammetry
- Solid knowledge in Mathematics and Statsitics

- Knowledge in using relevant softwares, such as LPS, photoscan, pix4D, geomagic, 3D Max, pointtools etc.
- Be a team player, open minded
- Good communication skills, with reasonably fluent spoken English, and professional written English
- Tract recored of publications in high-quality peer-review journals, or renowed computer vision conferences (desired)

Additional Information
- The position is primarily a full-time position of Research Assistant. Applicant holding a PhD degree can request a post-doctoral title, subject to mutual agreement on work load
- The candidate will have the opportunity to make short visits to Geospatial Data Analytics Laboratory (GDA), department of Civil, Environmental and Geodetic Engineering (CEGE) at the Ohio State University, Columbus
- Candidates with good performance holding a Masters degree will have the opportunity to register as a PhD student at the in GDA, department of CEGE in Ohio State University during or after this employment
- Candidate with good performance and holding a Ph.D. degree will have the chance to continue work as a post-doctoral or research scientist in GDA, department of CEGE at the Ohio State University

Work location: 1 Create Way, CREATE Tower, Singapore 138602 (NUS University Town)

Duration: 2 years

Renumeration: Commensurate with ETH Zurich salaries

How to Apply: Send your complete CV, degree certificates, academic transcript, a letter of motivation and intention, and names and contact details of two referees to Prof Dr Rongjun Qin at qin.324@osu.edu. The letter of motivation should describe why you are suited for this position. Please inform referees that they may be contacted if you are considered. Please send shared links if your total file size is larger than 10MB. Failing to provide the required materials may result in rejection without consideration.

Email title format:
[Application for FCL position] --- Your Name ---- Bsc. University ---- MSc/Ph.D. University --- Major.

Upon receipt of your application, we will send an acknowledgment via email. The selection will be made in May 2017 ad preferred commencement date is 1 August 2017.

The Singapore-ETH-Centre is an equal opportunity and family-friendly employer. All candidates will be evaluated based on their merits and qualifications, without regard to gender, race, age or religion.

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About Singapore-ETH Centre

The Singapore-ETH Centre was established as a joint initiative between ETH Zurich – the Swiss Federal Institute of Technology in Zurich and Singapore's National Research Foundation (NRF), as part of the NRF's CREATE campus. The centre serves as an intellectual hub for research, scholarship, entrepreneurship, postgraduate and postdoctoral training.

The centre currently runs two research programmes, the [Future Cities Laboratory (FCL)](), followed by [Future Resilient Systems]() (FRS). It is home to a community of over 100 PhD, postdoctoral and Professorial researchers working on diverse themes related to sustainable cities and resilient infrastructure systems. In the course of their work, researchers actively collaborate with universities, research institutes, industry, and government agencies with the aim of offering practical solutions.