

**Researcher /Post-doctoral researcher  
Computer Science / Computer Graphics / Visual Editing**

**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 WP3 on interactive editing will be supervised by and report to Prof Simon Schubiger and Prof Stefan Arisona from FHNW.

The successful candidate will design, implement and test interactive editing techniques that allow the semantically labelled models from WP2 to be enhanced. A key approach will be to combine interactive editing and procedural modelling techniques in order to develop interactive tools comparable to the ones available in Esri's CityEngine, Trimbal SketchUp or Autodesk Fusion 360. The implemented tools will be tested and validated for efficiency, quality of results, and user experience.

Key tasks include:

- 1) In-depth review of existing techniques in the areas of intelligent interactive geometry editing and in procedural modelling
- 2) Design a comprehensive editing tool/ system, including the workflow and interface elements
- 3) Devise appropriate performance metrics for tool evaluation and comparison with existing solutions
- 4) Implementation of tool either as standalone application or as extension of existing tool
- 5) Testing, benchmarking and validation of tool
- 6) Scientific output of a minimum of 1 journal and 1 conference paper

### **Key Requirements**

The candidate should possess

- Masters or PhD degree in Computer Science, or an equivalent relevant background in a major research university
- Strong C++ and Java programming skills, knowledge of computer graphics, visualisation, and interaction techniques. Industry experience is desired
- Solid knowledge in mathematics, 3D geometry, and statistics
- Knowledge of 3D modelling (Maya, Blender), procedural modelling (CityEngine), and game engines (Unity, Unreal Engine) is desired
- The ability to team well in a team and be open-minded
- Good communication skills, with reasonably fluent spoken English and professional written English

## Singapore-ETH Centre: Future Cities Laboratory Programme

- Track record of publication in high-quality peer-review journals, or renowned computer science conferences (desired)

### **Additional Information**

- The position is primarily a full-time research assistant position. Applicant holding a PhD degree can request a post-doctoral title, subject to mutual agreement on workload.
- The candidate will have the opportunity to make short visits to the Institute of 4D Technologies at FHNW in Switzerland

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

**Duration:** 2 years

**Remuneration:** 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 Dr Zeng Wei via email ([zeng@arch.ethz.ch](mailto:zeng@arch.ethz.ch)). 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 and 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.

### **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.