**Researcher/ Post-doctoral researcher
Photogrammetry / Geometric 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 WP1 on geometric modelling from images will be supervised by and report to Prof. Armin Gruen.

The successful applicant will study and evaluate current methods of generating reality-based 3D city models with the purpose of identifying shortcomings and promising solutions. He/she will, based on existing methodology and software like Image Matchers, CC-Modeler and others, design, develop, and test new approaches, which will take us beyond the current state-of-the-art.

Emphasis will be on the development of semi-automated procedures, that allow us, based on the results of a previous image matching process, to generate city models with minimal operator interference. Being a highly interdisciplinary team, it will be important to keep in close contact with the work of the other team members, who will look into the problems of generic and semantic modelling and of updating and maintaining of 3D city models (4D city modelling), and the design and development of appropriate user-interfaces.

Key tasks
- Analyse the current market of methodology and software with the goal of adopting what may be useful for the project
- Design a semi-automated procedure for city modelling from images (and to a lesser extent from LiDAR point clouds)
- Implement and test this approach, using available raw data of Singapore
- If the raw data is incomplete in some places, use UAVs to fill the gaps
- Consider and integrate work and results in generic and semantic modeling
- Scientific output of at least 1 journal and 1 conference paper

Besides, the position is also responsible for coordinating and managing the operations of the team, including (but not limited to) budget planning, report preparation, and attending FCL weekly meeting.

Key Skills
The candidate should possess
- Master or PhD degree in Geomatics, or with equivalent relevant background

- work experience in the field of photogrammetry, especially in geo-referencing, image matching, feature extraction and object modeling
- knowledge in generic and semantic modeling and in point cloud processing
- good programming skills
- Be a team player and be open-minded
- good communication skills and speak reasonably fluent English

Your Profile
You are interested in working in a large research project and you have the ability to conduct innovative and high-end research that results in concrete tools and instruments applicable in real-world and industry-relevant scenarios. You are a highly motivated candidate with initiative and enjoy working in an interdisciplinary and multinational team. A degree in geomatics or a related field is required. A strong background in applied mathematics, estimation theory and statistics is mandatory. Experience in programming, image analysis, simulation, and/or visualisation is desired.

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

Duration: 2 years
Preferred starting date is 1 August 2017.

Renumeration: Commensurate with ETH Zurich salaries

How to Apply: Send your complete CV, degree certificates, publication list, a letter of motivation and intention, and names and contact details of two referees to Prof Dr Armin Gruen via email to agruen@geod.baug.ethz.ch).

The Singapore-ETH-Centre is an equal opportunity and family-friendly employer. All candidates will be evaluated on their merits and qualifications, without regards 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.