Ph.D. Topic 2015

Interactive Reconstruction and Navigation in 3D Cities Models

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Presentation of the Ph.D. topic

We are interested in the modeling, exploration, and understanding of large visual datasets. In the context of Smart Cities, one such interesting dataset is 3D models of buildings and cities. Such models have interesting applications at various levels. For example, having a 3D representation of a building, or at least a 2.5D reconstruction, augmented with semantic annotations can be used to, along with thermal modeling, estimate the energetic consumption of the building. 3D models of streets, districts, or entire cities would allow for innovative applications in tourism, city planning, or gaming.

We propose to follow these two avenues and to study how to build and explore 3D models of cities.

We aim to design an interactive algorithm for building reconstruction, which would involve a step of facade parsing [1] in order to bring the semantic information necessary for some applications. The whole process would follow the human-in-the-loop paradigm [2]. We want to minimize the required interactions as well as the expected level of expertise from the user. This method should run on a mobile device, like a tablet, and with some more interaction should allow to go from facade parsing of each wall of a building to a 3D (or alternatively a 2.5D) reconstruction of the building. As a second step, we want
to apply this 3D reconstruction algorithm to reconstruct entire streets or blocks in a city.

As a result, we would obtain heavy and complex 3D models that open several avenues for research. We are particularly interested in studying how to ease navigation for a non-expert user in such a model accessed through a network. 3D navigation is not very intuitive for a non-expert user. We wish to design easy-to-use recommendations to help exploring such 3D models. The recommendations should take into account the current state of downloaded data, in order to avoid recommending non-available data to users.

**Expected deliverables**

The candidate is expected to extend existing techniques or propose new ones that would allow almost any user to be able to reconstruct a building with a mobile device. Our team is keen to drive high-quality research with rigorous evaluation. Proposed techniques should be implemented and evaluated through user studies, and written up for publications at reputable conferences and journals. We also value open research with publishable data sets.

**Keywords**

Interactive facade parsing; Building reconstruction; Human-in-the-loop; 3D models streaming and navigation

**Applicant profile**

Applicant should demonstrate strong computer science and mathematical background; strong critical thinking, analytical thinking, and out-of-the-box thinking ability; independent, self-discipline and organized; enjoy working with a team; good English communication skills in both oral and writing.

**Gratification:** Compliant to French Regulation on Ph.D. students (Doctoral contract / contrat doctoral)
References
