Style exploration & interpolation for 3D geovisualization

Keywords

Realtime rendering, Geovisualization, Urban design.

Context and Research Goal

Visualization of spatial data requires being able to manage the graphic representation of potentially heterogeneous and massive data, and to let the user explore various possible renderings, according to the use context. To facilitate the visual reasoning for spatio-temporal analysis, the user should have the possibility to navigate into possible rendering styles in order to design their scene. Realtime rendering techniques for 3D geovisualization combined with interaction techniques have been largely explored, offering interaction and navigation between rendering styles [1,7,9], including photorealistic approaches with image-based rendering techniques [2,3]. Techniques to navigate continuously between color palettes [6], colors and textures [5] assisting an image or a map design, or to handle a modular and extensible shading system [4,8] have been proposed.

The main research goal is to provide techniques to explore interactively and seamlessly the range of geovisualization styles, by orchestrating all those visual parameters, rendering techniques as well as various constraints, offering capacities to manipulate and interpolate all components of a style, to generate the appropriate and satisfactory final rendering.

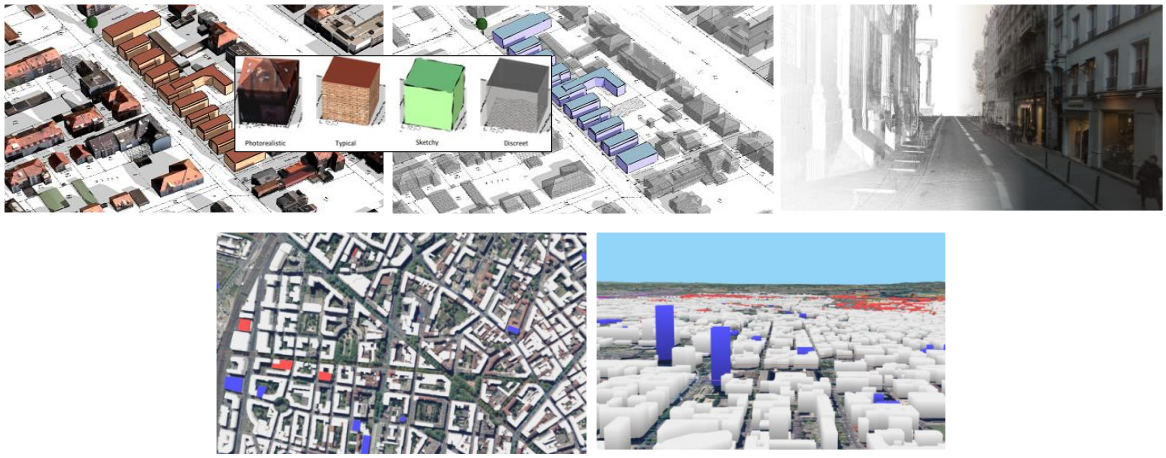

Figure 1: Abstract and photo-realistic rendering styles for 3D urban geovisualization [1,3], iTowns Project.

Approach

The goal of the PhD is to propose:

- an expressive and flexible model for rendering styles adapted for the visualization of spatial datasets enabling an efficient exploration by the user of the space of possible rendering styles, and
- a flexible and modular rendering pipeline enabling the constraint-based orchestration of spatial datasets, visual parameters and rendering techniques, in order to generate or reproduce a given rendering style.

According to some visual properties to preserve in a 3D scene (contrasts, saliency of a spatial arrangement, photo-realism or abstraction level, focus on an object of the scene, etc.), or data properties to enhance (measures, intensity, uncertainty, etc.), the exploration of the space of possible geovisualization styles may follow some optimization strategies, based on various hybridization of rendering operators for instance and guided by an interrelated set of constraints. Continuous navigation between styles, i.e. considering at the same time, scale, dimension and rendering operators, is also at stake, and may be enhanced by interpolation techniques that we have been experimenting on colors [5,6].

Use cases involve urban data and possible related thematic data (meteorological, physical or social data) for urban visualization and urban dynamics analysis.

Advisors

IGN, Paris-Est University, LaSTIG/GeoVIS team,:

- Sidonie Christophe, Senior Researcher, sidonie.christophe@ign.fr doing research on geovisualization design and use.
- Mathieu Brédif, Researcher, mathieu.bredif@ign.fr doing research on processing and real-time rendering of point clouds and images.

Prerequisites

Computer Graphics, Human-Computer Interaction or Data Visualization.
The candidate must have experience in js/WebGL programming (cf our research platform iTowns).

Location

The PhD will take place at IGN, Saint-Mandé, very close to Paris, and the research will be conducted in the LaSTIG/GeoVIS team focusing on issues in geovisualization and interaction with spatial data for visual spatio-temporal analytics.

Please send to both advisors: a detailed CV, an original one-page motivation letter, and marks obtained during Licence and Master degree, or Engineering School degree, before the June, 29th, 2018.

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