Improved Geo-Visualization Methods

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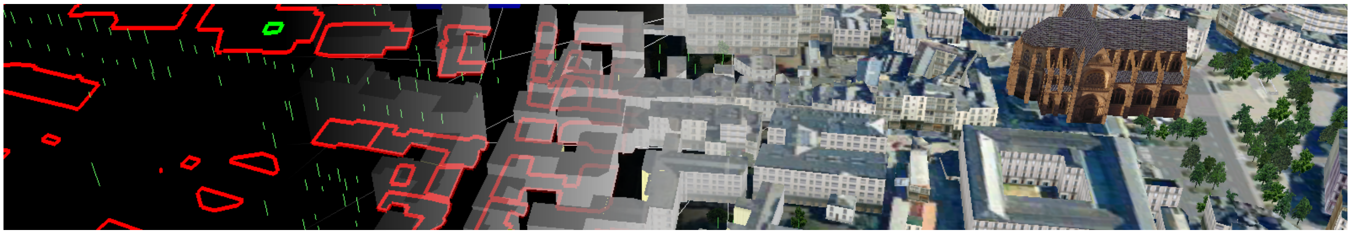

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1 Introduction

The modeling and visualization of large realistic 3D terrain and city models has received significant attention over the last few years. However, the recent progress in 3D data capturing has generated very huge and complex 3D models. This poster presents new methods for geovisualization based on multi-resolution representations of different objects (terrain, buildings, vegetation, etc). Thanks to the proposed scalable and compressed representations, web-based visualization of very large and complex models can now be contemplated. The difficult case of cities flying over is dealt with through a new hierarchical LOD representation covering the entire urban area.

2 Merging different representations

Terrain: The elevation grid representing the terrain is encoded as a mesh, using special second generation wavelets (based on Subdivision Surfaces) very well suited to generic geometry coding. Not only does this representation provides excellent compression, but it also proved to be prone to real-time view dependent adaptation [Gioia et al. 2004]. This full scalability can be exploited locally, while the client application is reconstructing the 3D model, but also for selective transmission. In this case, a dialog can be set up between the client and the server through a backchannel, in order to request only the specific parts of the scene relevant at the time of navigation.

Buildings: A new progressive and hierarchical representation, called *PBTree* [Royan et al. 2003] is used for the transmission and visualization of buildings. This representation is based on a $2D\frac{1}{2}$ building model made up of polygonal footprints associated with height, altitude, and facade texture index (compression of 1:10 compared to $3D$). The LOD hierarchy is contained in a tree-based data structure that describes all appropriate buildings simplifications and mergings. This representation allows an efficient view-dependent model simplification that can be eassily used in a remote client/server visualisation system.

Textures: Terrain textures are extracted from aerial photographs, whereas facade textures are selected from a set of generic textures depending on available geometric and contextual information (surface, height, type: industrial, residential, etc). A view-dependent terrain textures streaming and visualization method is also presented. It takes advantage of the multi-resolution properties of the JPEG2000 wavelet coding algorithm.

3 Conclusions

We have presented new visualization methods that are well-suited to large 3D geographic models (with optimization of the scene depending of the rendering capabilities). They allow flying over dense urban environments in a web-based client-server system thanks to adaptivity features such as scalable compression and view-dependency. Potential applications are numerous: geo-location, geo-positioning, geo-information, virtual tourism, urban planning, crisis management, flight simulators, games etc. Up to now , building models are limited to prisms, but more complex procedural methods could be used to add more details to buildings (roofs, doors, windows) at low bandwidth cost, just by sending to the client few procedural parameters. Finally, walkthrough navigation could be improved by refining only the visible buildings, provided that a prefetch methods is used to compensate for the network latency.

References

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