Efficient Geo-Visualization Tools

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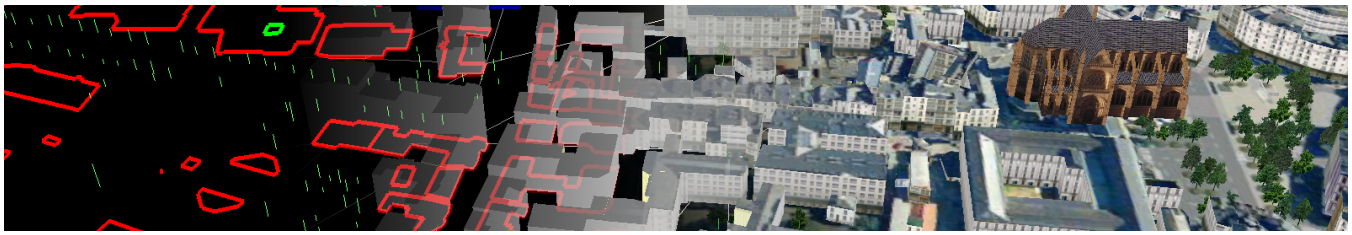

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1 Introduction

The establishment and visualization of large, reality-based 3D terrain and city models has received significant attention over the last few years. However, the recent progress in 3D data capturing generated very huge and complexe 3D models. This poster presents tools for geo-visualization based on multi-resolution representations of different objects (terrain, buildings, vegetation, etc). Thanks to these scalable and compressed representations, web-based visualization can now be envisaged. We describe here one of the first solutions to fly over very huge urban environments in real-time, i.e. adapted to network-based visualization.

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 provide 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 $2D\frac{1}{2}$ representation of building composed of their footprints associated with their height, altitude, and facade texture index (compression of 1:10 compared to $3D$). Furthemore, this representation is based on a tree containing the merging and simplifications of buildings. This representation allows a view-dependent and scalable transmission and visualization of buildings.

Textures: Terrain textures are extracted from aerial photographes, when facade textures for each building are selected from a generic facade texture library, depending of building context as surface, height, type (industrial, residential, etc). As textures needs different resolutions, depending of the position of the texture from the viewpoint, they are encoded in JPEG2000 for a incremental transmission to the client.

3 Conclusions

We have proposed new tools for geo-visualization on local machines (with optimization of the scene depending of the rendering capacities). Furthermore, these representations are well-adapted to fly over terrain and buildings on a client-server system (scalability, view-dependence, compression). These solutions allow the creation of new $3D$ applications on network like geo-location, geo-positioning, geo-information, virtual tourism, urban planning, crisis management, flight simulators, games etc. Up to now , building reconstruction is limited to prisms, but procedural methods could be used to add more details to buildings (roof, doors, windows), just by sending to the client few procedural parameters, that will not overload the network bandwidth. Finally, the LOD selection could be optimized by refining only the visible buildings during a walk-through navigation, provided that anticipation methods is used to take into account the network latency.

References

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