Volume XXXVIII-5/W16

Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XXXVIII-5/W16, 191-197, 2011
www.int-arch-photogramm-remote-sens-spatial-inf-sci.net/XXXVIII-5-W16/191/2011/
doi:10.5194/isprsarchives-XXXVIII-5-W16-191-2011

A RANGE BASED METHOD FOR COMPLEX FACADE MODELING

A. Adami[1], L. Fregonese[2], and L. Taffurelli[3]
[1]Photogrammetry lab, Lab Systems, University Iuav of Venice, Italy
[2]Larifo, BEST Group of Politecnico di Milano, Italy
[3]Larifo, BEST Group of Politecnico di Milano, Italy

Keywords: range map, height map, displacement map, 3d modelling,

Abstract. 3d modelling of Architectural Heritage does not follow a very well-defined way, but it goes through different algorithms and digital form according to the shape complexity of the object, to the main goal of the representation and to the starting data.

Even if the process starts from the same data, such as a pointcloud acquired by laser scanner, there are different possibilities to realize a digital model. In particular we can choose between two different attitudes: the mesh and the solid model. In the first case the complexity of architecture is represented by a dense net of triangular surfaces which approximates the real surface of the object. In the other -opposite- case the 3d digital model can be realized by the use of simple geometrical shapes, by the use of sweeping algorithm and the Boolean operations. Obviously these two models are not the same and each one is characterized by some peculiarities concerning the way of modelling (the choice of a particular triangulation algorithm or the quasi-automatic modelling by known shapes) and the final results (a more detailed and complex mesh versus an approximate and more simple solid model). Usually the expected final representation and the possibility of publishing lead to one way or the other.

In this paper we want to suggest a semiautomatic process to build 3d digital models of the facades of complex architecture to be used for example in city models or in other large scale representations. This way of modelling guarantees also to obtain small files to be published on the web or to be transmitted.

The modelling procedure starts from laser scanner data which can be processed in the well known way. Usually more than one scan is necessary to describe a complex architecture and to avoid some shadows on the facades. These have to be registered in a single reference system by the use of targets which are surveyed by topography and then to be filtered in order to obtain a well controlled and homogeneous point cloud of the complex architecture.

From the point cloud we can extract a false colour map depending on the distance of each point from the average plane. In this way we can represent each point of the facades by a height map in grayscale. In this operation it is important to

define the scale of the final result in order to set the correct pixel size in the map.

The following step is concerning the use of a modifier which is well-known in computer graphics. In fact the modifier Displacement allows to simulate on a planar surface the original roughness of the object according to a grayscale map. The value of gray is read by the modifier as the distance from the reference plane and it represents the displacement of the corresponding element of the virtual plane. Similar to the bump map, the displacement modifier does not only simulate the effect, but it really deforms the planar surface. In this way the 3d model can be use not only in a static representation, but also in dynamic animation or interactive application.

The setting of the plane to be deformed is the most important step in this process. In 3d Max the planar surface has to be characterized by the real dimension of the façade and also by a correct number of quadrangular faces which are the smallest part of the whole surface. In this way we can consider the modified surface as a 3d raster representation where each quadrangular face (corresponding to traditional pixel) is displaced according the value of gray (= distance from the plane).

This method can be applied in different context, above all when the object to be represented can be considered as a 2,5 dimension such as facades of architecture in city model or large scale representation. But also it can be used to represent particular effect such as deformation of walls in a complete 3d way.

Conference Paper (PDF, 1004 KB)

Citation: Adami, A., Fregonese, L., and Taffurelli, L.: A RANGE BASED METHOD FOR COMPLEX FACADE MODELING, Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XXXVIII-5/W16, 191-197, doi:10.5194/isprsarchives-XXXVIII-5-W16-191-2011, 2011.

Bibtex EndNote Reference Manager XML