



MINOLTA

3D DIGITIZING

Reshaping the Colosseum in Rome - University of Ferrara, Polytechnic of Milan

1



Colosseum, Rome, Italy

2



Ionic column base, distance to object 100cm.
 Location: north-west facade (size ca.130x80x50cm)

3



VRML model in 'Cosmo Player'.
 Zoom step 4, resolution x,y =1.25mm,
 res. z = 0.61mm. Field of view ca.
 25 x 25cm. Total number of scans
 = 41, each shot max. 10.000 3D
 points. Accuracy ±1mm.

This project describes the process of building Internet-transmittable, 3D digital virtual models of ancient heritage monuments from on-site data, focusing especially on 3D dimensional acquisition techniques and colour processing methods.

Introduction

As a large ordered database of spatial information, a 3D model can be added to and altered over time, provide a more accurate representation of the real life of the monuments than a 2D drawing and can also be a powerful tool for complementary analyses.

Recent improvements in digital technology in the fields of 3D imaging, 3D data capture and colour images, in addition to methods developed at Nub-Lab University of Ferrara for combining 3D vector files and colour images, can now reliably and accurately digitize the external shape and reflectance of parts, ornaments or whole architectural complexes. The resultant restitution as a 3D digital photorealistic model is suitable for use as a working tool for restoration planning.

The Minolta VI-700 is portable and designed to work in difficult environments, making it particularly suitable for architectural applications.

Range Processing Pipeline

Given the sensors limited field of view, complex environments might require a large number of views. Each 3D sensor view provides an ordered set of 3D points in a camera centered Cartesian coordinate system.



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Survey of decorative frieze. Distance to object 100cm.
An engraved frieze located in the hypogeum,
(size ca. 80x90x10cm)

5



6



VRML model in 'Cosmo Player'.
Zoom step 4, resolution x,y = 1.25mm, res. z = 0.61mm
Field of view ca. 25 x 25cm, Total number of scans =34, each
shot max.10.000 3D points. Accuracy ±1mm.

Model reconstruction is obtained by systematic application of this Cartesian coordinate system to every view taken. This process is known as registration and aligns the scans.

The Minolta VI-700 laser scanner allows multiple scan registration from the digital colour pictures saved with the range image using homologous points on pairs of views of the same subject. The intensity values measured by the range sensor are used to constrain the matching of sensors between views. The labeling of points is then used to identify common portions of surfaces between images to allow for registration. Finally the algorithm is applied globally to merge multiple scans into a single point cloud, without overlapping or discontinuities.

Colour Processing Pipeline (Texture mapping)

Proper geometric fit of the image from the photometric camera onto the 3D geometric model is essential. We used commercial software from Alias/Wavefront 'Studio' to apply the orthographs from the digital images taken with a Minolta RD175 camera and a Minolta 800 si as projection textures over the model like planar projection. The final visual result, even when several images are collated into a mosaic, are excellent, even by time consuming criteria.



The University of Ferrara's Architecture Department Nub Lab focuses on innovative technologies. 3D Laser scanners and active experimentation, applied to architectural and artistic structures are used to create new digital documentation and filing methodologies.

Research is dedicated to the creation of integrated systems of precise dimensional, shape and surface for restoration and analysis of architectonic, archaeological and artistic heritages, which is organised as a 3D hypertextual database available on network.

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