8:30 – 9:00

Refreshments

1

9:00 – 9:30

CATIA Reverse Engineering of Digitized Shapes

Yona Riven
CATIA-IBM

The CATIA Reverse Engineering Digitized Shape Editor is applied at the beginning of the reverse engineering cycle, immediately after digitizing machines have been employed and before the application of several other CATIA V5 processes. The product handles digitized data by importing a cloud of points as a set of points in 3D space, thus facilitating the following functions: sampling - importing only a percentage of the points in the cloud; filtering - the cloud of points is filtered to create a working context that is less dense; tessellation - which can be used to check the quality of the points or can be processed in other CATIA V5 applications; clean-up; checking of cross-sections, character line, shape and quality with real-time diagnosis.

Complementary CATIA V5 applications include: classifying a surface reconstruction (using FSS), direct machining on polygons (using CATIA Machinist), space analyzing a digitized mock-up in a CAD environment (using SPA), checking feasibility during the styling refinement cycle (using GSD), and early manufacturing process simulation of a mock-up. Our demonstration illustrates how CATIA can read, visualize and edit high-density points clouds, thus turning them into data that can be used by other CATIA applications and therefore creating a bridge between the physical and the digital world.

2

9:30 – 9:55

Variational Classification for Visualization of 3D Ultrasound Data

Raanan Fattal
School of Computer Science,
The Hebrew University, Jerusalem

We present a new technique for visualizing surfaces from 3D ultrasound data. 3D ultrasound datasets are typically fuzzy, contain a substantial amount of noise and speckle, and suffer from several other problems that make extraction of continuous and smooth surfaces extremely difficult. We propose a novel opacity classification algorithm for 3D ultrasound datasets, based on the variational principle.

More specifically, we compute a volumetric opacity function that optimally satisfies a set of simultaneous requirements. One requirement makes the function attain nonzero values only in the vicinity of a user-specified value, resulting in soft shells of finite, approximately constant thickness around isosurfaces in the volume. Other requirements are designed to make the function smoother and less sensitive to noise and speckle. The computed opacity function lends itself well to explicit geometric surface extraction, as well as to direct volume rendering at interactive rates. We also describe a new splatting algorithm that is particularly well suited for displaying soft opacity shells. Several examples and comparisons are included to illustrate our approach and demonstrate its effectiveness on real 3D ultrasound datasets.
Joint work with Dani Lischinski.

3

9:55 – 10:20

3D Mesh Compression Using a Fixed Spectral Basis

Zachi Karni
Computer Science Department, Technion

In SIGGRAPH 2000 we presented a spectral method for 3D mesh compression. The method calculates an orthogonal basis from of the mesh connectivity, and uses the projection of the geometry on it as the code. We showed that using such a basis allows us to use only a small prefix of the projected coefficients for a reasonable reconstruction of the original mesh. One of the major drawbacks of this method is its time and space computational complexity. This drawback arises from the need to calculate the spectral basis for each individual mesh. In order to improve the above complexities and avoid eigenvector computation, we present a method that preserves the spectral qualities, but uses a fixed basis. The method uses a pre-computed basis, derived from a six-regular mesh (the host), and includes efficient mesh augmentation and the generation of a neighborhood-preserving mapping between the vertices of the host and the input mesh. After applying the mapping to the input mesh, the same procedures as in the original method are used, only with the basis of the fixed host. The decoder only needs to compute the same mapping as in the encoder and to use the same fixed basis for the reconstruction. These operations can be done in linear time, and are suitable for the weak client machines.
Joint work with Craig Gotsman.

10:20 – 10:50

Coffee Break

4

10:50 – 11:15

Fast 3D Laser Scanner

Gil Zigelman
Computer Science Department, Technion

We present a simple method for scanning an object and retrieving its 3D coordinates. Our algorithm is motivated by Bouguet and Perona `3D photography on your desk' in that we search for similar objectives, efficiency and low cost. It is based on analyzing a sequence of images that contain a projection of a laser line. By providing two measurements - the distance between a laser line source and a video camera, and the distance between the camera and a wall located behind the object, we retrieve a range image representing the surface. This range image is then processed in order to create a 3D model of the surface. The algorithm's efficiency and accuracy are demonstrated by a real-time implementation.

Joint work with Ron Kimmel.

5

11:15 – 11:40

Topology Recognition of 3D Closed Freeform Objects Based on Topological Graphs

Dvir Steiner
Dept. of Mechanical Engineering, Technion

Surface reconstruction of freeform objects is based on geometrical and topological criteria. Current fitting methods reconstruct the object using a bottom-up approach, from points to a dense mesh and, finally, into smoothed freeform surfaces. This type of reconstruction can cause topological problems that lead to undesired surface fitting results. Such problems are particularly common with concave shapes. To avoid problems of this type, we propose a new method that automatically detects the topological structure as a base for surface fitting. The topological reconstruction method is based on two stages: (1) creating 3D non-self-intersecting iso-curves from the 3D triangular mesh and (2) extracting a topological graph.

Joint work with Anath Fischer.

6

11:40 – 12:05

Detecting Coplanar Sets of Points in Space

Michel Bercovier
School of Computer Science,
The Hebrew University, Jerusalem

Given n points in 3D, sampled from k original planes (with sampling errors), a new probabilistic method for detecting coplanar subsets of points in $O(k^6)$ steps is introduced. The subsets are detected with small probability of error. The algorithm reduces the problem of detection to the problem of clustering in R^3 and thereby produces effective results. The algorithm is significantly faster than other known algorithms in most cases.

Joint work with Moshe Luzon and Elan Pavlov.

7

12:05 – 12:30

Estimating The Principle Curvatures and The Darboux Frame from Real 3D Range Data and its Application to Primitive Recovery

Eyal Hameiri
Computer Science Department, Technion

Local differential properties of surfaces such as principle curvatures and the local Darboux frame are natural tools for object recognition. As second-order derivative computations are involved in principle curvatures and principle directions computations, their estimations are highly sensitive to noise and therefore, until recent years, it was almost impractical to extract reliable results out of real 3D data. Since more accurate 3D range imaging equipment has become more available, evaluation of existing algorithms for curvature estimation is now relevant. The work presented here, makes some subtle but very important modifications to algorithms originally suggested by Taubin, and Chen and Schmidt yielding more accurate estimations for those properties. The algorithms have been adjusted to deal with real discrete noisy range data given as a cloud of sampled points lying on the surface of a freeform object. The results of this linear time (and space) complexity implementation are then used to recover primitives from range data which might include several partially occluded primitives.

Joint work with Ilan Shimshoni.

INVITATION

ISRAEL SIGGRAPH PROFESSIONAL CHAPTER MEETING

Sponsored by
Silicon Graphics (Israel) Ltd.

8:30 – 12:30
June 1, 2001
Melamed Hall (No. 06)
Exact Sciences Bldg.
Tel Aviv University

Chair: Anath Fischer
Technion – Israel Institute of Technology

This invitation is an entry permit for your car at Gate 4 of the Tel Aviv University campus.