INVITATION

ISRAEL SIGGRAPH PROFESSIONAL CHAPTER MEETING

February 12, 2010
9:00 – 13:00

Efi Arazi Building, Room C209
Interdisciplinary Center
(IDC) Herzliya

LABS hp

IDC HERZLIYA | Efi Arazi School of Computer Science

Program:

- **8:45 – 9:15**
  Gathering & Refreshments
- **9:15 – 9:45**
  Fast Image and Video Upscaling from Self-Examples
  Gilad Freedman, Hebrew University
- **9:45 – 10:15**
  Reconstruction of 3D objects from arbitrary cross-section data
  Amit Bermano, Technion
- **10:15 – 10:45**
  Reconstruction of 3D objects from 2D cross-sections with the 4-point subdivision scheme adapted to sets
  Shay Kels, Tel-Aviv University
- **10:45 – 11:15**
  Coffee Break
- **11:15 – 11:45**
  Layered Shape Synthesis: Automatic Generation of Control Maps for Non-Stationary Textures
  Amir Rosenberger, Tel-Aviv University
- **11:45 – 12:15**
  Point distance and orthogonal range problems with dependent geometric uncertainties
  Yonathan Myers, Hebrew University
- **12:15 – 12:45**
  On Edge Detection on Surfaces
  Michael Kolomenkin, Technion

Free parking available next to the campus.
Directions at: www.idc.ac.il/directions

Visit our web-site at www.cs.technion.ac.il/~israsig
Join the Israel SIGGRAPH mailing-list at: http://listserv.technion.ac.il/cgi-bin/wa?A0=ISRAEL-SIGGRAPH-L

Fast Image and Video Upscaling from Self-Examples

Gilad Freedman, Hebrew University

We propose a new high-quality and efficient single-image upscaling technique that extends the example-based super-resolution framework of Freeman et al. [2002]. Unlike Freeman et al. and others, we do not rely on an external example database or use the whole input image as a source for example patches. Instead, we extract patches form extremely localized regions in the image which allows us to considerably reduce the search time without compromising quality. Moreover, we derive a novel filter bank, made of nearly biorthogonal non-dyadic filters, based on principles that properly model the upscaling process. These non-dyadic filters allow us to increase the number and relevance of the example patches, as well as produce high-resolution images which are consistent with the input. Our method is capable of producing high-quality resolution enhancement efficiently and applies to video sequences with no modifications.

Joint work with Raanan Fattal

Reconstruction of 3D objects from arbitrary cross-section data

Amit Bermano, Technion

We describe a simple algorithm to reconstruct the surface of smooth three-dimensional multi-labeled objects from sampled planar cross-sections of arbitrary orientation. The algorithm has the unique ability to handle cross-sections in which regions are classified as being inside the object, outside the object, or unknown. This is achieved by constructing a scalar function on R^3, whose zero set is the desired surface. The function is constructed independently inside every cell of the arrangement of the cross-section planes using transfinite interpolation techniques based on barycentric coordinates that guarantee that the function is smooth, and its zero set interpolates the cross-sections.

Joint work with Amir Vaxman and Craig Gotsman

Reconstruction of 3D objects from 2D cross-sections with the 4-point subdivision scheme adapted to sets

Shay Kels, Tel-Aviv University

We introduce a new geometric weighted average of two sets, defined for positive weights (corresponding to interpolation) and also when one weight is negative (corresponding to extrapolation). This new average can be used to interpolate between cross-sections of a 3D object in a piecewise way. To obtain a smooth reconstruction of the 3D object, we adapt to sets the 4-point subdivision scheme, using the new weighted average between two sets. The reconstruction by this method approximates the original 3D object.

Joint work with Nira Dyn

Layered Shape Synthesis: Automatic Generation of Control Maps for Non-Stationary Textures

Amir Rosenberger, Tel-Aviv University

Many inhomogeneous real-world textures are non-stationary and exhibit various large scale patterns that are easily perceived by a human observer. Such textures violate the assumptions underlying most state-of-the-art example-based synthesis methods. Consequently, they cannot be properly reproduced by these methods, unless a suitable control map is provided to guide the synthesis process. Such control maps are typically either user specified or generated by a simulation. In this paper, we present an alternative: a method for automatic example-based generation of control maps, geared at synthesis of natural, highly inhomogeneous textures, such as those resulting from natural aging or weathering processes. Our method is based on the observation that an appropriate control map for many of these textures may be modeled as a superposition of several layers, where the visible parts of each layer are occupied by a more homogeneous texture. Thus, given a decomposition of a texture exemplar into a small number of such layers, we employ a novel example-based shape synthesis algorithm to automatically generate a new set of layers. Our shape synthesis algorithm is designed to preserve both local and global characteristics of the exemplar's layer map. This process results in a new control map, which then may be used to guide the subsequent texture synthesis process.

Joint work with Danny Cohen-Or

Point distance and orthogonal range problems with dependent geometric uncertainties

Yonathan Myers, Hebrew University

Classical computational geometry algorithms handle geometric constructs whose shapes and locations are exact. However, many real-world applications require modeling and computing with geometric uncertainties, which are often coupled due to inaccuracies in sensing, measurement, and manufacturing processes. We address distance problems and orthogonal range queries in the plane in the presence of geometric uncertainty. Point coordinates and range uncertainties are modeled with the Linear Parametric Geometric Uncertainty Model (LPGUM), a general and computationally efficient worst-case first-order linear approximation of geometric uncertainty that supports dependencies among uncertainties. We present efficient algorithms for closest pair, diameter, width, and bounding box problems, and for uncertain range queries: uncertain range/nominal points, nominal range/uncertain, uncertain range/uncertain points, with independent/dependent uncertainties.

Joint work with Leo Joskowicz

On Edge Detection on Surfaces

Michael Kolomenkin, Technion

Edge detection in images has been a fundamental problem in computer vision from its early days. Edge detection on surfaces, on the other hand, has received much less attention. The most common edges on surfaces are ridges and valleys, used for processing range images in computer vision, as well as for non-photorealistic rendering in computer graphics. We propose a new type of edges on surfaces, termed relief edges. Intuitively, the surface can be considered as an unknown smooth manifold, on top of which a local height image is placed. Relief edges are the edges of this local image. We show how to compute these edges from the local differential geometric surface properties, by fitting a local edge model to the surface. We also show how the underlying manifold and the local images can be roughly approximated and exploited in the edge detection process. Last but not least, we demonstrate the application of relief edges to artifact illustration in archaeology.

Joint work with Ilan Shimshoni, and Ayellet Tal