INVITATION

ISRAEL SIGGRAPH PROFESSIONAL CHAPTER MEETING

June 21, 2013
9:00 – 13:00

Efi Arazi Building, Room CL03
Interdisciplinary Center
(IDC) Herzliya

IDC HERZLIYA | Efi Arazi School of Computer Science

Program:

- **8:45 – 9:15**
  Gathering & Refreshments
- **9:15 – 9:45**
  Planar Shape Interpolation with Bounded Distortion
  Renjie Chen, Technion
- **9:45 – 10:15**
  Injective and Bounded Distortion Mappings in 3D
  Noam Aigerman, Weizmann Institute
- **10:15 – 10:45**
  An Operator Approach to Tangent Vector Field Processing
  Omri Azencot, Technion
- **10:45 – 11:15**
  Coffee Break
- **11:15 – 11:45**
  Optimizing Color Consistency in Photo Collections
  Yoav HaCohen, Hebrew University
- **11:45 – 12:15**
  Style and Abstraction in Portrait Sketching
  Itamar Berger, Interdisciplinary Center Herzliya
- **12:15 – 12:45**
  Dynamic Maps for Exploring and Browsing Shapes
  Yanir Kleiman, Tel-Aviv University
- **12:45 – 13:15**
  Weak Convex Decomposition by Lines-of-sight
  Oliver van Kaick, Tel-Aviv University

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Planar Shape Interpolation with Bounded Distortion

Renjie Chen, Technion

Planar shape interpolation is widely used in computer graphics applications. Despite a wealth of interpolation methods, there is currently no approach that produces shapes with a bounded amount of distortion with respect to the input. As a result, existing interpolation methods may produce shapes that are significantly different than the input and can suffer from fold-overs and other visual artifacts, making them less useful in many practical scenarios. We introduce a novel shape interpolation scheme designed specifically to produce results with a bounded amount of conformal (angular) distortion. Our method is based on an elegant continuous mathematical formulation and provides several appealing properties such as existence and uniqueness of the solution as well as smoothness in space and time domains. We further present a discretization and an efficient practical algorithm to compute the interpolant and demonstrate its usability and good convergence behavior on a wide variety of input shapes. The method is simple to implement and understand. We compare our method to state-of-the-art interpolation methods and demonstrate its superiority in various cases.

Joint work with Ofir Weber, Daniel Keren and Mirela Ben-Chen

Injective and Bounded Distortion Mappings in 3D

Noam Aigerman, Weizmann Institute

We introduce an efficient algorithm for producing provably injective mappings of tetrahedral meshes with strict bounds on their tetrahedra aspect-ratio distortion. The algorithm takes as input a simplicial map (e.g., produced by some common deformation or volumetric-parameterization technique) and projects it on the space of injective and bounded-distortion simplicial maps. Namely, finds a similar map that is both bijective and bounded-distortion. The construction of the algorithm was made possible due to a novel closed-form solution to the problem of finding the closest orientation-preserving bounded-distortion matrix to an arbitrary matrix in three (and higher) dimensions. We demonstrate applications of our algorithm for producing bijective and bounded-distortion volume parameterizations and deformations of tetrahedral meshes, and improving tetrahedral meshes, increasing the tetrahedra quality produced by state-of-the-art techniques.

Joint work with Yaron Lipman

An Operator Approach to Tangent Vector Field Processing

Omri Azencot, Technion

In this paper, we introduce a novel coordinate-free method for manipulating and analyzing vector fields on discrete surfaces. Unlike the commonly used representations of a vector field as an assignment of vectors to the faces of the mesh, or as real values on edges, we argue that vector fields can also be naturally viewed as operators whose domain and range are functions defined on the mesh. Although this point of view is common in differential geometry it has so far not been adopted in geometry processing applications. We recall the theoretical properties of vector fields represented as operators, and show that composition of vector fields with other functional operators is natural in this setup. This leads to the characterization of vector field properties through commutativity with other operators such as the Laplace-Beltrami and symmetry operators, as well as to a straight-forward definition of differential properties such as the Lie derivative. Finally, we demonstrate a range of applications, such as Killing vector field design, symmetric vector field estimation and joint design on multiple surfaces.

Joint work with Mirela Ben-Chen, Fred Chazal and Maks Ovsjanikov

Optimizing Color Consistency in Photo Collections

Yoav HaCohen, Hebrew University

With dozens or even hundreds of photos in today's digital photo albums, editing an entire album can be a daunting task. Existing automatic tools operate on individual photos without ensuring consistency of appearance between photographs that share content. In this paper, we present a new method for consistent editing of photo collections. Our method automatically enforces consistent appearance of images that share content without any user input. When the user does make changes to selected images, these changes automatically propagate to other images in the collection, while still maintaining as much consistency as possible. This makes it possible to interactively adjust an entire photo album in a consistent manner by manipulating only a few images. Our method operates by efficiently constructing a graph with edges linking photo pairs that share content. Consistent appearance of connected photos is achieved by globally optimizing a quadratic cost function over the entire graph, treating user-specified edits as constraints in the optimization. The optimization is fast enough to provide interactive visual feedback to the user. We demonstrate the usefulness of our approach using a number of personal and professional photo collections, as well as internet collections.

Joint work with Eli Shechtman, Dan B Goldman, Dani Lischinski

Style and Abstraction in Portrait Sketching

Itamar Berger, Interdisciplinary Center Herzliya

We use a data-driven approach to study both style and abstraction in sketching of a human face. We gather and analyze data from a number of artists as they sketch a human face from a reference photograph. To achieve different levels of abstraction in the sketches, decreasing time limits were imposed – from four and a half minutes to fifteen seconds. We analyzed the data at two levels: strokes and geometric shape. In each, we create a model that captures both the style of the different artists and the process of abstraction. These models are then used for a portrait sketch synthesis application. Starting from a novel face photograph, we can synthesize a sketch in the various artistic styles and in different levels of abstraction.

Joint work with Ariel Shamir Moshe Mahler Elizabeth Carter Jessica Hodgins

Dynamic Maps for Exploring and Browsing Shapes

Yanir Kleiman, Tel-Aviv University

Large datasets of 3D objects require an intuitive way to browse and quickly explore shapes from the collection. We present a dynamic map of shapes where similar shapes are placed next to each other. Similarity between 3D models exists in a high dimensional space which cannot be accurately expressed in a two dimensional map. We solve this discrepancy by providing a local map with pan capabilities and a user interface that resembles an online experience of navigating through geographical maps. As the user navigates through the map, new shapes appear which correspond to the specific navigation tendencies and interests of the user, while maintaining a continuous browsing experience. In contrast with state of the art methods which typically reduce the search space by selecting constraints or employing relevance feedback, our method enables exploration of large sets without constraining the search space, allowing the user greater creativity and serendipity. A user study evaluation showed a strong preference of users for our method over a standard relevance feedback method.

Joint work with Noa Fish, Joel Lanir, Daniel Cohen-Or

Weak Convex Decomposition by Lines-of-sight

Oliver van Kaick, Tel-Aviv University

We define the convexity rank of a set of points to be the portion of mutually visible pairs of points out of the total number of pairs. Based on this definition of weak convexity, we introduce a spectral method that decomposes a given shape into weakly convex regions. The decomposition is applied without explicitly measuring the convexity rank. The method merely amounts to a spectral clustering of a matrix representing the all-pairs line of sight. Our method can be directly applied on an oriented point cloud and does not require any topological information, nor explicit concavity or convexity measures. We demonstrate the efficiency of our algorithm on a large number of examples and compare them qualitatively with competitive approaches.

Joint work with Shmuel Asafi, Avi Goren, Daniel Cohen-Or