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## Seminar Series Supported by Jeffrey and Holly Ullman

# Graphics Day

## 6 July, 2010

### 11:00 Coffee & Tagging

### 11:15 Sorting in Space

**Hanan Samet, ACM Distinguished Speaker, Department of Computer Science, University of Maryland, USA**

*Abstract: The representation of spatial data is an important issue in computer graphic , computer vision, geographic information systems, and robotics A wide number of representations is currently in use. Recently, there has been much interest in hierarchical data structures such as quadtrees, octrees, R-trees. Ect. The key advantage of these representations is that they provide a way to index into space. In fact, they are little more than multidimensional sorts. They are compact and depending on the nature of the spatial data they save space as well as time and also facilitate operations such as search. In this talk we give a brief overview of hierarchical spatial data structures and related research results.*

### 12:00 Self-similarities in Urban Data Reconstruction

**Andrei Sharf, Computer Science, Ben-Gurion University**

*Abstract: Today's scanning technologies, allow fast scanning of urban scenes. Such rapid acquisition incurs imperfections: large regions remain missing, significant variation in sampling density is common, and the data is often corrupted with noise and outliers. Buildings often exhibit large scale repetitions and self- similarities. To consolidate the imperfect data, our key observation is that the same geometry, when scanned multiple times over reoccurrences of instances, allow application of a simple and effective non-local filter. The multiplicity of the geometry is fused together and projected into a base-geometry that is denoised to consolidate reoccurrences. Next, we introduce an interactive tool which enables a user to quickly assemble an architectural model. The user loosely defines and manipulates simple building blocks, which we call SmartBoxes that snap to their proper locations. The building blocks are smart in the sense that their locations and sizes are automatically adjusted on-the-fly to fit to the point data, while respecting contextual relations with nearby similar blocks.*

### 12:45 Lunch

### 13:30 Content-Aware Image Resizing by Qudratic Programming

**Zachi Karni, HP Labs Israel**

*Abstract: We present a new method for content-aware image resizing based on a framework of global optimization. We show that the basic resizing problem can be formulated as a convex quadratic program. Furthermore, we demonstrate how the basic framework may be extended to prevent foldovers of the underlying mesh; encourage the magnification of salient regions; and preserve straight line structures. We show results demonstrating the effectiveness of the proposed method by comparing with four leading competitor methods. Joint work with Renjie Chen Daniel Freedman, Craig Gotsman and Ligang Liu*

### 14:15 Patient-specific digital modeling and simulatiuon of endovascular anatomy

**Leo Joskowicz, Computer-Assisted Surgery and Medical Image Processing Laboratory School of Engineering and Computer Science, The Hebrew University of Jerusalem**

*Abstract: Segmentation and modeling of the blood vessels in the neck area from patient Computed Tomography Angiogram (CTA) images is of increasing clinical importance. The models are used for the diagnosis of stenosis, aneurisms, and for planning catheter endovascular surgeries. We have developed a nearly automatic method for patient-specific modeling of the aorta and the carotid, vertebral, and sub-clavian arteries for patient-specific simulations before the surgery. We use the graph cut method to automatically generate a vessels segmentation which is then refined with an smart interactive editing tool to produce a geometric mesh. Our results on 71 clinical CTA datasets show that our method is accurate, robust, and easy to use. The method has been used to produce four patient-specific models for the ANGIO Mentor, a training simulator for endovascular procedures developed by Simbionix Ltd, Israel. The simulations ran flawlessly for over an hour, with users reporting great realism and an improved experience. The entire segmentation and simulation model generation takes less than 10mins of computation time on a standard PC and only 1-2mins of end-user interaction. This constitutes a proof-of-concept of practical patient-specific carotid interventional radiology simulations from CTA scans.*

*Joint work with: 1. Jacob Sosna MD, Phillip Berman, Dept of Radiology, Hadassah University Hospital 2. Ofek Shilon and Einav Nammer, Simbionix Ltd, Lod. 3. Moti Freiman, Noah Broide, Miriam Natanzon, Judith Frank, Lior Weizman School of Engineering and Computer Science, The Hebrew University of Jerusalem This project is funded by a MAGNETON grant from the Ministry of Trade and Industry, Israel.*

### 15:00 Feature-Based Controllers for Physically-Simulated Characters

**Aaron Hertzmann, University of Toronto**

*Abstract: Creating controllers for physically-simulated characters is a long-standing open problem in animation and robotics. Such controllers would have numerous applications, such as in games and robotics, while also yielding insight into human motion. However, creating controllers remains very difficult: previous locomotion controllers are either limited to tracking motion capture data, or are very limited in style and robustness (e.g., producing very stiff and unnatural gaits), without providing stylistic control to an animator. I will first give some background in the area of human motion modeling, including some of my past work on characters in graphics and vision. I will then present a new approach to control of physics-based characters based on high-level features of human movement, such as center-of-mass, angular momentum, and end-effector motion. These controllers provide numerous benefits that our unique to our approach: human-like qualities such as arm-swing, heel-off, and hip-shoulder counter-rotation emerge automatically during walking; controllers are robust to changes in body parameters during movement; control parameters and goals may be modified during run-time, during control; control parameters apply to intuitive properties such as center-of-mass height; and controller may be mapped onto entirely new bipeds with different topology and mass distribution, without modifications to the controller itself. Transitions between multiple types of gaits, including walking, jumping, and jogging, emerge automatically. Our controllers can traverse challenging terrain while following high-level user commands at interactive rates. To our knowledge, none of these properties have been demonstrated in previous systems, and yet no motion capture or off-line optimization process is used. Joint work with Martin de Lasa and Igor Mordatch..*

### 15:50 End of Graphics Day