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Saal Auditorium Rm.202, Alon High-Tech Building 37

Seminar Series Supported by Jeffrey and Holly Ullman

3rd BGU Vision Day

26 November, 2009

09:30 Coffee & Tagging

09:50 Opening Remarks

10:00 A Universal and Exact Linear Framework for Estimation, Registration and Recognition of Deformable Objects

Joseph Francos, Ben-Gurion University

Abstract: We consider the problem of estimating the geometric deformation of an object, with respect to some reference observation on it. Existing solutions, set in the standard coordinate system imposed by the measurement system, lead to high-dimensional, non-convex optimization problems. We propose a novel framework that employs a set of non-linear functionals to replace this originally high dimensional problem by an equivalent problem that is linear in the unknown transformation parameters. The proposed solution is unique and exact and is applicable to any elastic or affine transformation regardless of its magnitude. By analyzing the stochastic properties of the proposed non-linear functionals in the presence of various error sources, optimal estimators of the deformation models are derived.

10:50 Sketch2Photo: Internet Image Montage

Ariel Shamir, Interdisciplinary Center, Herzliya

Abstract: We present a system that composes a realistic picture from a simple freehand sketch annotated with text labels. The composed picture is generated by seamlessly stitching several photographs in agreement with the sketch and text labels; these are found by searching the Internet. Although online image search generates many inappropriate results, our system is able to automatically select suitable photographs to generate a high quality composition, using a filtering scheme to exclude undesirable images. We also provide a novel image blending algorithm to allow seamless image composition. Each blending result is given a numeric score, allowing us to find an optimal combination of discovered images. Experimental results show the method is very successful; we also evaluate our system using the results from two user studies.

11:40 Mosaicing and Super Resolution of Sonar Images

Nathan Intrator, Tel-Aviv University

Abstract: Sonar systems generate noisy low resolution images. Creating a mosaic from multiple images is thus, far more difficult than in regular video cameras. In this talk I will present some aspects of the process of building super resolution and mosaiced images using computer vision and robust statistics tools.

12:30 Lunch

13:30 Asynchronous Pattern Matching

Ilan Shimshoni, Haifa University

Abstract: Archaeological artifacts are of vital importance in archaeological research. At present there is a drive to scan these artifacts and store the scanned objects on the internet making them accessible to the whole research community. We propose a new approach for automatic processing of these 3D models. Given such an artifact our first goal is to find edges termed relief edges on the surface. The 3D curves that we defined are the 3D equivalent of Canny Edges in images. These edges can be used to illustrate the object replacing the human illustrator or at least helping him produce accurate illustrations efficiently using an interactive computerized tool. Based on these curves we have defined a new direction field on surfaces (a normalized vector field), termed the \emph{prominent field}. We demonstrate the applicability of the prominent field in two applications. The first is surface enhancement if archaeological artifacts, which helps enhance eroded features and remove scanning noise. The second is artificial coloring that can replace manual artifact illustration in archaeological reports.

16:10 Encoding of Color Information: Insights from Biology

Ronen Segev, Ben-Gurion University

Abstract: As we look around in order to grasp the colors of different objects, optical signals that reach our retina are encoded by the retinal ganglion cells, the only cells to project axons from the retina to the brain, into sequences of action potentials. These pulses transmit information about the spectral properties of light arriving at the eye to the brain. Indeed, during many years of study an immense progress was achieved in the understanding of spectral information processing in the retina. The progress is both in terms of characterizing the molecular level of signal transduction from light into electrical signal and in the whole cell level where the responses of ganglion cells to different color stimuli have been worked out. Despite these great achievements two important aspects of encoding of color information by ganglion cells were neglected.
The first is the role of retinal adaptation to chromatic properties of visual signals. That is, how the retina modifies the representation of information according to spectral properties of different visual environments the animal encounters. The second important aspect is how exactly the different color channels, realized by different types of ganglion cells, are combined in order to enable an animal to distinguish between objects with different colors. I will discuss these two aspects of the neural code of the retina.

15:10 Coffee Break

15:20 Shift-Map Image Editing

Shmuel Peleg, Hebrew University

Abstract: Geometric rearrangement of images includes operations such as image retargeting, inpainting, or object rearrangement. Each such operation can be characterized by a shiftmap: the relative shift of every pixel in the output image from its source in an input image. We describe a new representation of these operations as an optimal graph labeling, where the shift-map represents the selected label for each output pixel. Two terms are used in computing the optimal shift-map: (i) A data term which indicates constraints such as the change in image size, object rearrangement, a possible saliency map, etc. (ii) A smoothness term, minimizing the new discontinuities in the output image caused by discontinuities in the shift-map. This graph labeling problem can be solved using graph cuts. Since the optimization is global and discrete, it outperforms state of the art methods in most cases. Efficient hierarchical solutions for graph-cuts are presented, and operations on 1M images can take only a few seconds.

16:10 Unsupervised estimation of segmentation quality using nonnegative matrix factorization

Michael Lindenbaum, Technion Institute

Abstract: Common segmentation evaluation methods are typically based on evaluating smoothness within segments and contrast between them, and the measure they provide is not explicitly related to segmentation errors. The proposed approach differs from these methods on several important points and has several advantages over them. First, it provides a meaningful, quantitative assessment of segmentation quality, in precision/recall terms, which were applicable so far only for supervised evaluation. Second, it builds on a new image model, which characterizes the segments as a mixture of basic feature distributions. The precision/recall estimates are then obtained by a nonnegative matrix factorization (NMF) process. A third important advantage is that the estimates, which are based on intrinsic properties of the specific image being evaluated and not on a comparison to typical images (learning), are relatively robust to context factors such as image quality or the presence of texture. Experimental results demonstrate the accuracy of the precision/recall estimates in comparison to ground truth based on human judgment. Moreover, it is shown that tuning a segmentation algorithm using the unsupervised measure improves the algorithm's quality (as measured by a supervised method).

17:00 End of Vision Day

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