Computer Vision Research at the Technion

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The Technion–Israel Institute of Technology is a technical university located in Haifa, Israel. Founded in 1924, the Technion is the oldest university in Israel. Its early history is closely related to the revival of the Hebrew language and its acceptance as the main language of modern Israel. The Technion is one of the seven research universities that are the core of the Israeli academic system, and one of three (together with Tel Aviv University and Ben Gurion University of the Negev) that offer education in the main engineering disciplines. Additional information on the history of the Technion can be found in [1].

Vision research at the Technion was initiated by Franz Ollendorf (1900-1981), the founder of the electrical engineering department (1938), its first dean, a vice president of the IRE (1961) and a recipient of the IEEE education medal (1971). Best known for his contributions in general and relativistic electrodynamics, Ollendorf was also interested in the transmission of optic stimuli to the brain in hope of restoring sight to the blind [2]. Some of his ideas were put forward in 1947 in a lecture at the Weizmann Institute [3], see also [4, 5, 6, 7].

Nowadays, research on various aspects of image processing and analysis, computer vision and human vision takes place in many departments of the Technion, including the departments of biomedical engineering, civil engineering, computer science, electrical engineering, industrial engineering, and mechanical engineering. The Intelligent Systems Laboratory of the department of computer science and the Vision and Image Sciences Laboratory (in connection with the Ollendorff Research Center) of the department of electrical engineering provide shared resources for research in vision and related fields. Technion faculty members operate as independent researchers, working with their graduate students or in collaboration with other researchers. All five papers in this special issue are based on collaborative research, transcending departmental, institutional and international borders.

In assembling this special issue, paper selection was based on the expected interest and relevance for IJCV readers. Thus, manuscripts in adjacent and related fields, for which specialized journals exist, were not collected and only papers for which IJCV is a natural forum were considered. The papers went through two independent reviewing processes. Out of about ten initial entries, five manuscripts were selected based on an internal round of reviews at the Technion. The final papers were then forwarded to IJCV editor O. Faugeras and were subject to anonymous external refereeing according to the standard IJCV procedures. We thank Olivier Faugeras for this unique opportunity to present our research in IJCV as a team, and for coordinating the external reviews. We thank Freddy Bruckstein for his help

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in collecting the manuscripts and in overseeing the internal reviewing phase. We thank all referees for their helpful comments.

The five papers in this special issue cover a wide variety of topics in computer vision. The paper by Rivlin and Rotstein is an interdisciplinary collaboration that brings together computer vision and control theory methodologies in the study of active vision control. The need for foveal vision, the necessity of separate smooth pursuit and saccade mechanisms and the interrelationship between pursuit and saccade are analyzed based on control considerations.

A new approach for 3-D shape recovery, integrating photometric and geometric information, is presented in the paper of Shimshoni, Moses and Lindenbaum. It is shown that 3-D objects that are symmetric with respect to a plane (such as faces), illuminated by an unknown point light source and viewed from a non-frontal direction can be reconstructed from a single image. The integration of photometric and geometric information yields the unknown lighting and viewing parameters, as well as dense correspondence between pairs of symmetric points.

Kimmel, Malladi and Sochen consider a geometric framework for image enhancement that is based on ideas borrowed from high-energy physics, extend and apply it to color images, movies and volumetric medical data. They further introduce an extension of Gabor’s geometric image sharpening procedure to color images, based on inverse diffusion across multi-channel edges.

The paper by Bruckstein, Holt, Huang and Netravali deals with the 3-D self-location problem. Intriguing space fiducials, inspired by structures found in insects eyes, ancient clocks and modern art, can be positioned in the environment, providing powerful cues for pose estimation with an artistic touch.

Finally, Schechner and Kiryati present a theoretical unification of the Depth from Focus (DFF) and Depth from Defocus (DFD) methods with the geometric triangulation principle. This sets a foundation for fair performance comparison between DFF/DFD and shape from stereo (or motion) algorithms. The analysis leads to surprising conclusions regarding the merits and drawbacks of DFF and DFD in comparison to stereo.

We hope you’ll find these papers interesting.

References


