Editorial, Special Issue Siemens Corporate Research

In 1977, Siemens AG established a small research facility in Cherry Hill, New Jersey, to support its US manufacturing activities. This small outpost was then known as Siemens Research and Technology Laboratories and was the first research laboratory of Siemens outside of Europe. The lab began to outgrow the Cherry Hill site and in 1982 moved to a newly built site in Princeton, NJ. In 1988 the lab changed its name to Siemens Corporate Research (SCR) as it is known today.

SCR is responsible for Siemens central research efforts in the US and has grown commensurately with Siemens presence in the US market. Today Siemens employs approximately 440,000 people worldwide, of these 70,000 are in the US. The business segments are all rooted in engineering: Medical Imaging, Power Generation, Lighting, Automation & Control, Transportation, and Communications.

SCR's research in image processing and vision began to take off in the early 1990's and are focused into two application areas, medical imaging and industrial imaging. SCR is one of the largest centers in the world for medical image processing, with approximately 100 full-time medical imaging researchers complemented with an equal number of students, postdocs and visiting researchers. The community is diverse, with over 25 nationalities represented.

The articles in this issue reflect a sample of the scope of work at SCR. Segmentation, registration, visualization, detection, tracking and augmented reality are current active areas of investigation for both basic theory and applications. The issue opens with two contrasting pieces: The graph-cut article by Boykov & Lea generalizes the image segmentation problem into a constrained graph optimization avoiding the direct incorporation of prior knowledge into the design of the system to create a tool for broad applications. The second paper from Navab & Appel on the canonical modeling and recovery of cylinders takes a very different approach, developing a robust tool that takes maximum advantage of prior knowledge to model the constraints of the solution space. This work presents a subset of many theoretical and practical results, which allowed Siemens Corporate Research to introduce various computer vision and augmented reality techniques for industrial applications.

Continuing into the third paper regarding segmentation of the left ventricle from MR & CT images from Jolly, we observe some of the specific character of clinically targeted research in medical imaging. The keys to a successful medical image-processing tool are accuracy, repeatability, robustness and validation. The challenge is often not to originate a new class of tool to solve a problem, but to understand and model the sources of information and error in the clinical application and design a combination of existing techniques (often significantly modified from their original forms), which answers accurately and fails gracefully. The final application itself is really the tip of an enormous iceberg of exhaustive validation, documented primarily in the clinical literature.

The fourth article from O'Donnell, Funka-Lea, Tek, Jolly, Rasch & Setser is in much the same vein as the third and offers a comprehensive view of applications of computer vision techniques in cardiovascular imaging. This work is interesting in that it provides an overview of some of the key problems in the field and an inventory of techniques that have successfully made the transition from research to clinical application.

The issue closes with an article by Vogt, Khamene & Sauer on the applications of augmented reality in surgery. Image guided surgery, or, more broadly, the field of image-guided intervention includes procedures like traditional open surgery, laparoscopy, biopsy (both percutaneous and endoscopic), catheter-based procedures etc. Image-guided intervention is perhaps currently the most fertile area for crossover between traditional computer vision and medical imaging. There are immediate applications for tracking, calibration, stereo, recognition and sensor integration in intervention. The interventional imaging arena is dynamic and can be considered as the "on-line" or "real-time" equivalent to "off-line" diagnostic radiology. This article provides a fitting close because it touches an area of great still-untapped potential for computer vision to improve medical practice.

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