Robust Cell Segmentation: Half a Century Between Hope and Reality

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Abstract

A central problem in many areas of bioimage analysis is cell segmentation. Cellular morphology is an important phenotypic feature and is indicative of the physiological state of a cell. But also for the study of intracellular processes (single particle analysis), or of cell sociology (in embryogenesis or histopathology), segmentation of cells is often the premier step in the image processing pipeline. First examples of computerized cell analysis date back more than half a century. Since then, the field of light microscopy has undergone a series of revolutions, giving rise to a wide variety of imaging modalities, which are greatly challenging the development of generic and robust cell segmentation methods. While research in this area has intensified exponentially in the past decade, and new solutions are proposed in the literature every month, it turns out that the majority of the methods are still based on a small set of classical image segmentation approaches, whose limitations are well known. More powerful data processing concepts will need to be developed to finally bridge the gap between hope and reality. In addition, to accelerate and steer these developments, it is highly desirable to improve the possibility to easily and fairly peer-evaluate new methods and compare them to the state of the art. To this end, the availability of a single, open-source image processing software platform, supported as widely as possible by researchers in image processing as well as in biology, will be of key importance.

Biography

Erik Meijering is an Associate Professor of Bioimage Analysis at the Erasmus University Medical Center Rotterdam in the Netherlands. He received a MSc degree (cum laude) in Electrical Engineering from Delft University of Technology (1996), and a PhD degree in Medical Image Analysis from Utrecht University (2000), both in the Netherlands. During 2000-2002, he worked as a postdoctoral fellow at the Biomedical Imaging Group of the Swiss Federal Institute of Technology in Lausanne (EPFL), Switzerland. In 2002 he returned to the Netherlands to join the new Biomedical Imaging Group of the Erasmus University Medical Center Rotterdam. His research interests are in the areas of computer vision, image processing, and image analysis, with applications in cellular and molecular imaging. He published more than 60 peer-reviewed articles in this area. He is a Senior Member of the Institute of Electrical and Electronics Engineers (IEEE), its Signal Processing Society (SPS), and Engineering in Medicine and Biology Society (EMBS). He was Technical Program Chair for the IEEE International Symposium on Biomedical Imaging (ISBI) in 2006 and 2010. He was/is an Associate Editor for the IEEE Transactions on Medical Imaging (since 2004), the International Journal on Biomedical Imaging (term 2006-2009), and the IEEE Transactions on Image Processing (term 2008-2011), and was a Guest Editor for the September 2005 Special Issue of the latter journal, which focused on Molecular and Cellular Bioimaging. He also served/serves in a great variety of scientific conference, advisory, and review boards.