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Editorial

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Modern medical imaging is perhaps the most progressive and also the most appreciated diagnostic tool in health care. Images provided by different imaging modalities correspond well to the background anatomical knowledge and are therefore well accepted and understood by the medical staff. The contribution of modern imaging to the progress of medicine and level of health care is thus widely recognised. While there is admirable progress in designing new or innovated imaging modalities often based on new physical principles, the overall success is equally due to the computational part of the imaging. All modern medical imaging modalities use image data in the digital form. Image reconstruction from incomprehensible projection data, their processing, noise and distortion removal, or various display methods matched to particular needs of diagnostics, all depend heavily on the computational aspects of medical imaging. The progress in medical imaging is thus in a great part a success of information processing, both on the side of algorithm design and implementation, as well as utilising large-scale-integration-based hardware. Without being too visible, computers are a substantial part of any modern imaging system and the specialised software forms a great deal of the system value, the corresponding algorithms being often the well guarded "family silver" of the imaging systems producing firms.

During the last two decades, the development in medical imaging was crucially conditioned by inclusion of complex digital processing of the measured raw image data. This has formed a great number of scientifically interesting problems and has lead to solutions reflecting the properties of image data provided by different medical imaging modalities. It has been recognised that utilising the knowledge of physical mechanisms behind each modality, or identifying modality-specific data properties, can significantly contribute to the efficiency of designed processing methods. The image analysis methods needed, for example, in tissue characterisation, are typically modality-dependent; at least in parameter selection but often requiring new specific approaches. On the other hand, the medical knowledge of anatomic structures can be used with an advantage during the analytic phase of processing, namely to improve the segmentation reliability and quality of visualisation. Another area typical for medical image processing concerns merging of multimodal data into consistent three-dimensional or (including time-dimension) four-dimensional data blocks enabling better diagnosis based on combining different-modality information. All in all, the list of contributions and application areas is virtually endless.

New methods or modifications of modality-oriented medical image processing are continuously designed and developed but the research reports are often rather scattered in the literature. This was the philosophy behind the decision to prepare a special issue of the EURASIP Journal on Applied Signal Processing devoted to this area. The invitation to submit papers describing advances in acquisition, restoration, reconstruction, segmentation, and visualisation of medical image data was thus formulated. Contributions were also considered dealing with the impact of the new data-processing methods to imaging process itself, and to the possibilities of clinical applications. Naturally, only a limited contribution in this direction can be expected from a single issue. Nevertheless, the contributors' response shows that the concept found its audience.

Out of twenty submitted papers, nine have been finally selected by the Guest Editors, taking into account the evaluations via standard international peer-review process. The selected papers cover a wide range of imaging modalities: primarily the magnetic resonance imaging (papers by Lethmate et al. and Positano et al.), X-ray CT (Púčik et al.), X-ray projection (Öktem et al. and Liang et al.), γ-ray SPECT imaging (Lundqvist et al.), and ultrasonic imaging (Argenti et al. and Mischi et al.); each dealing with a particular problem in data processing or interpreting. The paper by Yang et al. represents a method applied to different modality images. The classification of papers could be based on other viewpoints as well (e.g., mathematical background, medical application area, etc.) but the selected one is the most natural with respect to the special issue characterisation.

The Editors were primarily seeking high-quality research papers presenting methods evaluated against state-of-the-art solutions. Whether the goal was reached is for the reader to assess. If the conclusion is positive, the objective followed by the Guest Editors is fulfilled.

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Jiri Jan graduated in electrical engineering (1963), received his Ph.D. degree in 1969, the prime scientific grade from the Czech Academy of Sciences (Prague 1986), and became Full Professor of electronics (Brno UT) in 1991. After publishing in the areas of numerical antenna—and later also circuit—analysis, he has been specialised in digital signal and image processing since the seventies, including applications in biomedical engineering. In the last ten years, he steered several international and national grant projects sponsored by European Commission (TEMPUS, COPERNICUS) and by the Grant Agency of Czech Republic. He has published over 200 papers mostly in international journals and conferences and the book *Digital Signal Filtering, Analysis, and Restoration* (IEE Publishing, London, UK, 2000) that appeared partly modified also in Czech (1997, 2002). Recent international activities: Associate Editor of IEEE Trans. on Biomedical Engineering (1996–2001); EURASIP Central European Liaison since 1994; National Board member of the Czech Society for Biomedical Engineering since 1990; member of the editorial board of EURASIP Journal on Applied Signal Processing since 2000; founding member of Engineering Academy of the Czech Republic (since 1994); Chair of International Program Committee of Biennial EURASIP Conference BIOSIGNAL 'xx (supported also by IEEE-EMBS), etc. Jiri Jan is presently the Head of the Department of Biomedical Engineering, and the Coordinator of the Institute for Signal and Image Processing (ISIP), Faculty of Electrical Engineering and Communication, Brno University of Technology, Czech Republic.

Milan Sonka received his Ph.D. degree in 1983. He is Professor of electrical and computer engineering at the University of Iowa, and a Fellow of IEEE. Sonka's research interests include knowledge-based medical image analysis. He is the first author of the book *Image Processing, Analysis, and Machine Vision* which was published in 1993 by Chapman and Hall in London, 2nd edition 1998 by PWS, Pacific Grove, Calif. He has coedited *Handbook of Medical Imaging*, Volume II—Medical Image Processing and Analysis published in 2000 and coauthored several other books and numerous journal and conference papers. He currently chairs the SPIE International Symposium Medical Imaging—Image Processing. He is an Associate Editor of the IEEE Transactions on Medical Imaging and a member of the editorial board of the International Journal of Cardiovascular Imaging.

Ivo Provaznik was born in 1968. He received the M.S., Ph.D., and Doc. degrees in 1991, 1996, and 2002, respectively, all in electrical engineering from Brno University of Technology, Faculty of Electrical Engineering and Communication, Brno, Czech Republic. In 1997–1998, he was a visiting Scientist at the Johns Hopkins University in Baltimore, Md, USA. In 2002, he became Associate Professor in the Department of Biomedical Engineering of Brno University of Technology. His current research interests are in the areas of biological signal processing, time-frequency analysis of trends in biological signals, medical image visualisation, and medical image analysis. He has published over 50 journal papers and conference abstracts. Dr. Provaznik is a member of the editorial board of Czech Scientific Journal Physician and Technology. He has been a Chairman of the Organizing Committee and a member of Program Committee of International Conferences BIOSIGNAL. Dr. Provaznik was awarded the Prize of the Minister of Education of the Czech Republic TALENT '94 for contribution to science and research (1995) and First Prize in Young Scientists Competition at International Symposium IMEKO TK-13 (1995). His area of expertise includes signal processing and analysis, image processing and analysis, time-frequency analysis, wavelet transform, and adaptive systems.