CURRICULUM VITAE

Milan Sonka

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QUALIFICATIONS

- **M.S.** Electrical Engineering – Technical Cybernetics, Czech Technical University of Prague, Czechoslovakia, 1979
- **Ph.D.** Technical Cybernetics – Digital Image Analysis, Czech Technical University of Prague, Czechoslovakia, 1983, Thesis title: *Texture Recognition*

EMPLOYMENT

- College of Engineering, The University of Iowa
  2014 – now, Lowell C. Battershell Chair in Biomedical Imaging
  2014 – now, Associate Dean for Graduate Programs and Research
  2008 – 2014, Chair, Department of Electrical and Computer Engineering
  2000 – now, Professor of Electrical and Computer Engineering
  1994 – 2000, Associate Professor of Electrical and Computer Engineering
  1993 – 1994, Visiting Associate Professor
  1990 – 1993, Visiting Assistant Professor
- Iowa Institute for Biomedical Imaging
  2010 – now, Director
  2007 – 2010, Founding Co-director
- Secondary appointments at the University of Iowa
  2001 – now, Professor of Applied Mathematical and Computational Sciences
  2006 – now, Professor of Ophthalmology and Visual Sciences
  2006 – now, Professor of Radiation Oncology
- Department of Control Engineering, Czech Technical University of Prague
  1984–1990, Assistant Professor

HIGHLIGHTS

- **IEEE Fellow** – 2002; for contributions to medical image analysis and computer vision.
- **Fellow, American Institute for Medical and Biological Engineering** – 2006.
- **Fellow, Medical Image Computing and Computer-Aided Intervention Society** – 2014.
- **Iowa Board of Regents Award for Faculty Excellence** – 2011, the highest award from the State Board of Regents of Iowa for "outstanding accomplishments and contributions to the Regents institutions as well as the State of Iowa".
- **Editor-in-Chief, IEEE Transactions on Medical Imaging**, 2009 – 2014.

- **Research** efforts are directed at developing clinically applicable knowledge-based methods for semi-automated and automated analysis of medical images. Over the last several years, the following methods were developed and validated, and in some cases their main ideas adopted by other researchers in the field.
  - **Quantitative Assessment of Cardiovascular Disease** represents one of the primary research area. The coherent list of developed methods and approaches presented below, in which the newer methods build on the results of the previously developed ones, demonstrates long-term accomplishments in this important area.
    * Coronary border detection, the first method reported in literature that determines both coronary borders simultaneously. Introduction of this idea improved the segmentation success rate in clinical angiograms four-fold.
    * Robust coronary border detection in small diameter vessels, the first adaptive approach to coronary segmentation in which approximate vessel diameter was used to select an appropriate edge detector in a feedback control manner.
    * Semi-automated method for coronary border detection in intravascular ultrasound (IVUS) images and image sequences, the first reported model-based IVUS segmentation method that incorporated an edge pattern of several ultrasound echoes in the border detection function.
    * Pattern recognition method for coronary plaque type characterization (soft/hard) from IVUS pullback data sequences with 90% classification accuracy.
    * Geometrically correct representation of vessel lumen and plaque morphology via data fusion of biplane angiography and intravascular ultrasound (patent 6,148,095), with automatically generated virtual-reality visualization, the only highly automated approach to date allowing to determine location of an IVUS frame with respect to the angiographic location in the catheterization laboratory in close-to-real time.
    * Self-learning method for robust analysis of brachial ultrasound image sequences consisting of several thousands of image frames acquired in clinical setting; this method is used for an NIH-funded endothelial function epidemiologic study; brachial artery endothelial function may be an early predictor of coronary disease. This is the only existing brachial segmentation method that uses patient-specific border detection quality control to automatically identify and discard non-reliable measurements. This method has been successfully commercialized and is used in more than 250 leading cardiovascular research laboratories around the world.
    * Semi-automated analysis of 2D and 3D intracardiac ultrasound images that may be utilized for long-term monitoring of critically ill cardiac patients.
    * Methodology for separation of arteries and veins, vessel labeling, and quantitation of disease in image data sets from contrast-enhanced magnetic resonance angiography.
    * Development of a 2D+time Active Appearance Motion Model (AAMM) representing cardiac cycle dynamics in combination with the shape and specific imaging modality appearance of the heart. Cootes' 2D Active Appearance Model framework was extended to allow simultaneous and therefore temporally consistent segmentation of the entire cardiac sequence. The clinical potential of the AAMM was demonstrated in short-axis cardiac magnetic resonance (MR) imaging and four-chamber echocardiograms. The method shows high promise for successful application to clinical MR and echocardiography image sequence analysis in clinical setting.
    * Development of a 3D Active Appearance Motion and 3D Spatial Model with application to volumetric cardiac MR and transthoracic echo image data.
  - **Medical Image Segmentation** research outlined below represents novel more widely applicable approaches to image analysis and interpretation.

* Genetic image interpretation method with application to segmentation and labeling of 2D MR brain images, the first image interpretation approach in which genetic algorithm was employed to generate image interpretation hypotheses the validity of which were tested in a feedback loop.
* A new approach was reported to identify and remove shape outliers in point distribution models with a good performance in MR brain segmentation.
* Point distribution model description for the brain substructure shapes may be derived from manually-identified contour vertices, a tedious and time consuming process. Automated learning of shape from shape examples was developed that seems to be the first shape learning tool applicable to large shape data sets.
* Graph-based determination of cortical thickness in human brain MR images.
* Segmentation of airway trees from 3D CT images. Three generations of methods were developed with increasing performance. The first-generation approach used decision rules, the second was based on manually-designed fuzzy rules and fuzzy membership functions, the third generation was automatically designing the fuzzy rules and membership functions from examples.
* Segmentation and characterization of lung nodules from pulmonary CT.
* Pulmonary tissue characterization approach was developed that is the first approach for local characterization of pulmonary parenchyma (patent 6,466,687).
* Quantitative analysis of ovarian ultrasound images.
* Automated design of border detection criteria from manually traced border examples, a self-learning border property identification method that minimizes the need for manual design of border detection functions. This approach was successfully incorporated in our brachial ultrasound segmentation described above and showed the performance comparable to that achieved by tedious manual design of segmentation criteria in comparison with our previously developed single-purpose methods.
* Development of computer-assisted methods for surgical planning of liver tumor resection – automated segmentation of the lower thoracic cavity, liver, liver tumor, and identification of the vascular trees, interactive surgical planning and quantitative outcome assessment tools are being built to assist in the clinical decision making process.
* Novel 3D image analysis techniques, including parallel 3D skeletonization, 3D smoothing without shrinkage, and 3D edge detection in anisotropic image data.
* New optimal 3-D, 4-D, ..., n-D graph-search method for detection of multiple mutually interacting surfaces in n-D image data, producing results in low-polynomial time.

– **Pulmonary Image Analysis** research represents another strong direction of research.
* Developed approaches for 3D segmentation of pulmonary airway trees.
* Analysis of airway wall in complete intrathoracic trees and across bifurcations.
* Identification of pulmonary fissures, contributing to segmentation of lung lobes.
* Separation of arteries and veins in pulmonary vasculature.
* Automated labeling of airway tree segments according to the international nomenclature.

– **Ophthalmic Image Analysis** is one of the most recent areas of research interest.
* Multi-layer segmentation of 3D retinal OCT images – up to 11 layers are reliably segmented for the macular as well as peripapillary OCT scans.
* Analysis of structure–function relationship between retinal layer morphology and visual function.
* Segmentation of SEADs – symptomatic exudate-associated derangements of the retina in presence of age-related macular degeneration and diabetic macular edema.

    - Early detection of retinal changes on diabetic retinopathy.
    - Image-guided therapy development for age-related macular degeneration.
    - Image analysis of optic nerve head morphology for quantitative assessment of glaucoma.
  - **Orthopaedic Image Analysis** concentrates on bone–cartilage analysis of knee and ankle joints.
    - Application and targeted development of multi-object, multi-surface method for simultaneous segmentation and subsequent morphologic analysis of bones and cartilages for all three knee-joint bones (tibia, femur, patella).
    - Automated analysis of meniscal morphology from MR.
    - Osteophyte image analysis.

- **Book**
  - Published a textbook entitled *Image Processing, Analysis, and Machine Vision (Sonka, Hlavac, Boyle)*, 1st edition 1993, 2nd edition 1998, 3rd edition 2007, 4th edition 2014.
  - The book's first edition was very successful in Europe, for example it outsold the classical text by Gonzalez and Woods in Britain.
  - The second edition was substantially updated. It has a comprehensive coverage and can be used for at least two Image Processing and Computer Vision courses typically offered at Electrical Engineering and/or Computer Science departments.
  - Here are some comments from the 2nd-edition reviewers:
    - This is the text I chose for Computer Vision because it is the best I've seen. It approaches the subject from the point of view of a newcomer to the field and provides background chapters on the mathematics and image processing necessary to make working computer vision applications. ... It has good bibliographies and indices for use as a research reference in the future. Graduate students would frequently use it as a starting point when exploring a new topic in computer vision ... it is an excellent text for people who want to learn about computer vision from the ground up.
    - A good combination of Image Processing and Computer Vision. ... The inclusion of fuzzy logic, neural networks, hidden Markov models, genetic algorithms, and other AI type techniques is excellent (especially the HMMs, of which this is the first decent coverage I've seen). ... many of the examples are pictures that people can relate to: castles, medical images, etc. The medical images also give the student a sense of motivation for understanding the image analysis process.
    - What is remarkable in this textbook is the constant concern of motivating the interest of the reader, through introductions, examples, case studies (one chapter is devoted to that) and extensive summaries at the end of each chapter. In addition, the numerous algorithms presented help the reader to have a better understanding of how things are working on the practical side.
  - The third edition (2008) was again substantially updated to reflect the changes in the field that occurred since the 2nd edition was published.
    - Updated throughout, refreshed, new references added, old or obsolete references removed, many new figures added. Reformatted to the benefit of the reader. Two introductory chapters substantially rewritten, reorganized and enhanced to better present a comprehensive yet not overwhelming foundation, which is used throughout the book.
    - While the second edition published in 1998 provided a comprehensive treatment of 2D image processing and analysis, analysis of volumetric and thus inherently 3D image data has become a necessity. To keep up with the rapidly advancing field, a brand new chapter

covers image segmentation methods and approaches with 3D or even n-D segmentation capabilities.
    * The book now has two chapters devoted to segmentation—clearly reflecting the importance of this area.
    * Many other new topics were added throughout the book, many wholly new sections are presented. All in all, about 25% of this third edition consists of a newly written material presenting recent state-of-the-art methods and techniques that have already proven their importance in the field.
  - The fourth edition (2014) has again been updated to include latest accomplishments of the computer vision community.
    * The same Chapter structure has been retained but many sections have been rewritten or introduced as new.
    * Among the new topics are the Radon transform, a unified approach to image/template matching, efficient object skeletonization (MB and MB2 algorithms), nearest neighbor classification including BBF/FLANN, histogram-of-oriented-Gaussian (HOG) approach to object detection, random forests, Markov random fields, Bayesian belief networks, scale invariant feature transform (SIFT), recent 3D image analysis/vision development, texture description using local binary patterns, and several point tracking approaches for motion analysis.
    * Several sections have been rewritten or expanded in response to reader and reviewer comments.
    * About 15% of this edition consists of newly written material presenting state-of- the-art methods and techniques that already have proven their importance in the field.

- **Handbook of Medical Imaging**
  - Edited (with J. M. Fitzpatrick, Vanderbilt University) a volume entitled *Medical Image Processing and Analysis* of a 3-volume Handbook of Medical Imaging, published by SPIE in 2000. This Handbook has become a defining publication of the rapidly developing field. An excellent group of authors was attracted to work on this comprehensive project. Our 1250-page volume contains 14 chapters.

- **Educational activities**
  - 15 Ph.D. students and 19 M.S. students successfully graduated.
  - Hosted 6 faculty members, 6 postdoctoral associates and 10 foreign graduate students.
  - In 1996, developed a Quantitative Imaging Electronic Classroom (QIEC), a specialized facility for collaborative interactive image systems engineering instruction, funded by a series of grants by Hewlett Packard. This teaching facility became the primary place for hands-on engineering instruction, far exceeding the area of image processing.
  - To support image systems engineering instruction in QIEC, developed a new lecture strategy consisting of interactive teaching approach of theory–example–experiment. Applied this strategy to teaching three new or modified image processing courses offered in the computer classroom. To support computer classroom instruction, developed extensive web-based image processing site using the above referenced book (see www.engineering.uiowa.edu/∼dip). This (at that time – 1996) pioneering educational development was well received by students and is reported in IEEE Transactions on Education (see also www.engineering.uiowa.edu/∼dip/CVPR/title.html).

COURSES TAUGHT

- Core courses
  - 57:012, Linear System Analysis
  - 57:017, Computers in Engineering
  - 57:008, Electronic Circuits
- Advanced undergraduate and graduate courses
  - 55:042, Signals and Systems
  - 55:060, Control Systems
  - 55:148, Digital Image Processing
  - 55:247, Image Analysis and Understanding
  - 55:248, Advanced Image Processing
  - 55:295, Pattern Recognition

GRANTS

- **1996 – 1998**, principal investigator, American Heart Association – Iowa Affiliate: Automated 3D analysis of plaque morphology and composition in IVUS images, $45,000.
- **1996–1998**, principal investigator, NSF: Automated Learning in Knowledge-Based Image Analysis, $50,000.
- **1996**, principal investigator (MPI), Hewlett Packard Co., Image Systems Engineering curriculum development, $890,000.
- **1997**, principal investigator, Hewlett Packard Co., Image Systems Engineering curriculum development, $110,000.
- **1998**, principal investigator, Hewlett Packard Co., Image Systems Engineering, $462,000.
- **1997 – 1998**, principal investigator, Bowman Gray School of Medicine, Automated analysis of brachial ultrasound, $10,000.
- **1997 – 1998**, principal investigator, Boston Scientific Corporation, Geometrically Accurate 3D Reconstruction of Vessel Morphology, $44,637.
- **1998 – 1999**, co-investigator, Whitaker Foundation, A Collaborative Educational Environment for Functional Cardiovascular Image Analysis, $350,000.
- **1998 – 2000**, principal investigator, American Heart Association, Iowa Affiliate, Automated Analysis of Echo Images: Imaging of the Left Ventricle from the Right Ventricle using 2D and 3D Techniques, $55,000.
- **1998 – 1999**, principal investigator, The University of Iowa, Quantitative Medical Imaging: Collaborative Research between the University of Iowa and the Iowa State University, $20,000.
- **1998 – 1999**, principal investigator (MPI), The University of Iowa, Assessing the Malignant Potential of Cancers by Magnetic Resonance Imaging of Microcirculation, $30,000.
- **1998 – 2003**, co-investigator responsible for image analysis, NIH, Arterial Endothelial Function - An Epidemiologic Study, $3,404,221, image analysis part $58,000/year.

- **1998 – 1999**, principal investigator, EPIX Medical, Boston MA, Highly Automated Segmentation of Venous and Arterial Trees from Three-Dimensional MR Angiography, $93,600.
- **1999 – 2004**, principal investigator, NIH, 3D & 4D Coronary Hemodynamics and Local Atherosclerosis, $1,036,557.
- **1999–2002**, principal investigator of Univ. of Iowa subcontract, Astra Medical - subcontract for Harvard Medical School, Pilot Study of Candesartan to Reduce Coronary In-Stent Restenosis and Progression of Atherosclerosis $30,000, (Complete grant $96,000, P. Stone PI at Harvard).
- **1999–2001**, principal investigator, University Hospital Bern, Switzerland, 3D Assessment of Coronary Geometry using Non-Sheathed Catheters, $30,000.
- **2000–2005**, co-investigator, NIH, Image and Model-Based Analysis of Lung Diseases, $7,044,907, Hoffman PI, Sonka's image analysis part $275,000.
- **1999 – 2003**, principal investigator (MPI), NIH, Vascular Analysis Workstation, $840,000.
- **2002 – 2005**, co-investigator, NIH, Large Scale Digital Cell Analysis System, $1,583,273, Mackey PI, Sonka's image analysis part $210,000.
- **2003 – 2008**, principal investigator, NIH, Highly Automated Analysis of 4-D Cardiovascular MR Data, $1,470,000.
- **2004 – 2009**, co-investigator responsible for image analysis, NIH, Arterial Endothelial Function - An Epidemiologic Study, $3,700,000, Sonka's image analysis part $416,000.
- **2004 – 2008**, co-investigator responsible for image analysis, NIH, Regulation of Coronary Vessel Assembly and Growth, $1,000,000, Sonka's image analysis part $80,000.
- **2004 – 2009**, co-investigator responsible for image analysis, NIH, Epidemiology of Carotid Artery Atherosclerosis in Youth, $3,200,000, Sonka's image analysis part $250,000.
- **2003 – 2005**, principal investigator, Philips Medical Systems, Quantitative Analysis of Coronary CT images, $160,000.
- **2005**, principal investigator (MPI), NIH – conference organization grant, Information Processing in Medical Imaging 2005, $10,000.
- **2005**, principal investigator (MPI), Whitaker Foundation – conference organization grant, Information Processing in Medical Imaging 2005, $10,000.
- **2005 – 2009**, principal investigator (MPI), NIH, 3D Analysis of MR-imaged Articular Cartilage, $900,000.
- **2005 – 2010**, principal investigator, NIH, 3-D and 4-D Coronary Hemodynamics and Local Atherosclerosis, $1,350,000.
- **2006 – 2009**, principal investigator, NIH, Graph-Based Medical Image Segmentation in 3D and 4D, $1,070,000.
- **2006–2010**, co-investigator, NIH, Image and Model-Based Analysis of Lung Diseases, $10,000,000, Hoffman PI, Sonka's image analysis part $375,000.
- **2006 – 2007**, principal investigator, Philips Medical Systems, Quantitative Analysis of Vascular CT images, $118,000.

- **2007 – 2012**, co-investigator, NIH, University of Iowa Clinical and Translational Science Award, $33,800,000, Hunninghake PI.
- **2007 – 2008**, principal investigator (MPI), Zeiss Meditec, Quantitative Analysis of Optic Nerve Head from 3D OCT Images, $80,000.
- **2009 – 2012**, principal investigator (MPI), NIH, Focal Structure-Function Relationships in Macular Layers from 3D Spectral OCT, $1,100,000.
- **2009 – 2011**, co-investigator, NIH, Expediting Patient-Specific Assessment of Chronic Contact Stress Exposure, $210,000, Anderson PI.
- **2009 – 2014**, principal investigator, NIH, Graph-Based Medical Image Segmentation in 3D and 4D - Phase II, $1,530,000.
- **2009 – 2014**, co-investigator, Veterans Administration, VA Center of Excellence for the Prevention and Treatment of Visual Loss, $5,500,000, Kardon PI.
- **2010 – 2016**, principal investigator (MPI), NIH, Retinal Therapy Guided by 3-D OCT Image Analysis, $2,800,000
- **2010 – 2015**, principal investigator (MPI), NIH, Quantitative Imaging to Assess Response in Cancer Therapy Trials, $2,900,000.
- **2012 – 2015**, co-investigator, NIH, Expanding Objective CT-based Phenotyping to Lungs with Enhanced Radiodensities, $1,100,000. Beichel PI.
- **2012 – 2016**, principal investigator (MPI), NIH, Focal Structure-Function Relationships in Macular Layers from 3D Spectral OCT, $1,500,000.
- **2013 – 2018**, principal investigator of subcontract, Christian Doppler Society Austria. OPTIMA – Approaches for large-throughput analyses of retinal AMD-OCT, $2,500,000 – Iowa part $600,000.
- **2013 – 2018**, co-investigator of subcontract, NIH, Quantitative Image Informatics for Cancer Research (QIICR), $4,000,000 – Iowa part $350,000.
- **2014 – 2018**, principal investigator, NIH, Graph-Based Medical Image Segmentation in 3D and 4D - Phase III, $1,600,000.
- **2015 – 2020**, principal investigator (MPI), NIH, Quantitative Imaging to Assess Response in Cancer Therapy Trials - Phase II, $3,000,000.

PROFESSIONAL ACTIVITIES

- Editor in Chief, IEEE Transactions on Medical Imaging, 2009–2014.
- Associate Editor, IEEE Transactions on Medical Imaging, 1995–2008.
- Editorial Board member, The International Journal of Cardiac Imaging, 1998 - 2009.
- Associate Editor, Medical Image Analysis, 2001 - now.
- Boerhaave Visiting Professor at the Leiden University, The Netherlands (prestigious named visiting professorship, one invitation per year) May–June 1999.
- SPIE International Symposium on Medical Imaging – Image Processing, Conference Chair, 2001–2004.

- SPIE International Symposium on Medical Imaging, Symposium Chair, 2006–2008.
- Information Processing in Medical Imaging, Conference Chair, 2005.
- IEEE International Symposium on Medical Imaging (ISBI), General Chair, 2016.
- Keynote speaker
    1. International Conference Medical Imaging - Image Processing, 1998
    2. Computer Assisted Fundus Image Analysis (CAFIA) 2000
    3. International Conference Biosignal 2000
    4. Computer Assisted Radiology and Surgery – International Symposium on Cardiovascular Imaging 2001
    5. Computer Assisted Fundus Image Analysis (CAFIA) 2001
    6. 25th Anniversary Symposium LKEB – Clinical and Experimental Image Analysis 2002
    7. Southwest Symposium on Image Analysis and Interpretation 2004
    8. Computer-Based Medical Systems 2004
    9. MICCAI Intravascular Ultrasound workshop 2006
    10. IEEE International Symposium on Biomedical Imaging 2010
    11. The Dutch R&D-Landscape of Biomedical Imaging 2010
    12. MICCAI International Workshop on Machine Learning in Medical Imaging 2010
    13. Dutch NWO Governmental Workshop Investing in Technology for Sustainable Healthcare 2010
    14. SPIE Medical Imaging - Image Processing 2011
    15. IAPR Graph-based Representations in Pattern Recognition 2011
    16. IEEE-EMBS International Conference on Biomedical and Health Informatics 2012
    17. MMBIA - Mathematical Methods in Biomedical Image Analysis 2012
    18. EuRETINA - Quantitative Analysis of 3-D Retinal OCT 2013
    19. SCIA - Workshop on Farm Animal and Food Quality Imaging 2013
    20. MIUA - Medical Image Understanding & Analysis 2013
    21. ISCA - International Symposium on Computational Anatomy 2014
    22. BHI - International Conference on Biomedical and Health Informatics 2014
- Invited lectures – about 5 other invited lectures per year during the past 10 years.
- Tutorials
    1. ISBI 2008 Paris, France – Segmentation of biomedical images
    2. IEEE International Summer School Ile Berder, France – Knowledge-based Approaches in Cardiovascular Image Analysis, 2008
    3. MICCAI 2010 Beijing, China – Graph Algorithmic Techniques for Biomedical Image Segmentation (with Wu and Garvin)
    4. Biomedical Image Analysis Summer School: Modalities, Methodologies & Clinical Research, Ecole Centrale Paris. Graph Algorithmic Techniques for Ophthalmic Image Analysis, 2012

- Co-guest editor of Special Issue of Computer Vision and Image Understanding on Analysis of Volumetric Images, Dec. 1999; co-guest editor of Special Issue on Image Analysis in Drug Discovery and Clinical Trials, IEEE Transactions on Medical Imaging, October 2002; co-guest editor of Special Issue on Advances in Modality-Oriented Medical Image Processing, EURASIP Applied Signal Processing, 2002; co-guest editor of Special Issue on Pulmonary Imaging, IEEE Transactions on Medical Imaging, April 2006.

- Institute of Electrical and Electronics Engineers, member 1994, senior member 2000, Fellow 2002; IEEE Image Systems working group coordinator, 1996 – 2001; International Association for Pattern Recognition, member 1992 – now; Joint IEEE Computer Society/ACM Task Force on the Year 2001 Model Curricula for Computing (CC-2001) - focus group on Computing at the Interface, member, 1999-2001.

- Program committee member: SPIE Medical Imaging – Image Processing 1995–2004; Symposium on computer graphics, image processing, and vision SIBGRAPI'98; Iowa Cardiovascular Symposium 1998; Information Processing in Medical Imaging IPMI 1999-now; Software Seminar SOFSEM'00. Track Co-chair, Radiographic Imaging track of the 20th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 1997 - 1998. International jury member – Cardiovascular Imaging Award of the 1998 International Symposium in Cardiovascular Imaging, Leiden, The Netherlands. Technical Program Co-Chair - IEEE Southwest Symposium on Image Analysis and Interpretation, Austin TX, April 2000.

- 2005-2010, RSNA (Radiological Society of North America) Physics Program Committee.

- Reviewing conference papers: International SPIE Conference Medical Imaging, International IMEKO Biosignal conference, International Conference Database and Expert Systems Applications, Conference Computer Analysis of Images and Patterns, IEEE/ECLA/IFIP International Conference on Architecture and Design Methods for Balanced Automation Systems, SIPGRAPI, IPMI, SSIAI, CVPR, MICCAI.

- Reviewing book proposals: Chapman and Hall, IEEE Press, Prentice Hall, Springer Verlag.

- Reviewing journal papers: IEEE Transactions on Medical Imaging, IEEE Transactions on Biomedical Engineering, IEEE Transactions on Image Processing, IEE Proceedings - Vision, Image and Signal Processing, Clinical Cardiology, The American Journal of Cardiology, Annals of Biomedical Engineering, Journal of Electronic Imaging, Academic Radiology, Graphical Models and Image Processing, Machine Vision and Applications, International Journal on Cardiac Imaging, IEEE Signal Processing Letters, Computer Vision – Image Understanding, Proceedings of the IEEE.

- Reviewing grant proposals: NSF Knowledge Models and Cognitive Systems panel reviewer; NSF Neuroscience, Computer and Mathematical Sciences and Engineering; STW - Dutch Technology Foundation Applied Research; GACR - Grant Agency of the Czech Republic; NSE-RCC - Natural Sciences and Engineering, Research Council of Canada; NATO - North Atlantic Treaty Organization, Scientific and Environmental Affairs Division; GAAS - Grant Agency of the Czech Academy of Sciences; NOW - Netherlands Organization for Scientific Research; U.S. Civilian Research and Development Foundation (CRDF).

- Reviewing research conducted by the computing departments (DTU Compute) of the Technical University of Denmark - member of a 5-person international panel.

- Student paper awards (supervised or co-supervised research)

  – IEEE EMBS 1992
  – IEEE EMBS 1993

  - SPIE Medical Imaging 1995
  - SPIE Medical Imaging 1996
  - SPIE Medical Imaging 1998
  - IEEE EMBS 1997 (2 awards),
  - SPIE Medical Imaging 1999
  - Information Processing in Medical Imaging IPMI'99
  - Michael B. Merickel Award for Best Student Paper at the Medical Imaging 2002
  - Michael B. Merickel Award for Best Student Paper at the Medical Imaging 2007
- Visiting Professor at the University of Hawaii, January – February 2000.
- Visiting Professor at the Technical University of Graz, Austria, March – May 2000.
- Visiting Professor at the University of Bremen, Germany, June 2000.
- Visiting Professor at the University of Copenhagen, Denmark, October 2002.
- Visiting Professor at the University of Calgary, Canada, February 2003.
- Visiting Professor, Chinese Academy of Sciences, Beijing China, November 2010.
- Visiting Professor, Soochow University, Suzhou China, 2012.
- Visiting Professor, Soochow University, Suzhou China, 2013.
- Chinese Academy of Sciences Visiting Professorship for Senior international Scientists, 2014.
- Serving on Ph.D. committees at Chalmers University of Technology, Gothenburg, Sweden (June 1999); University of Leiden, Leiden, The Netherlands (October 1999); Technical University of Denmark, Denmark (December 2000); Technical University Graz (May 2005); ITU Copenhagen, Denmark (December 2006); University of Utrecht, the Netherlands (December 2006); Chalmers University of Technology, Gothenburg, Sweden (June 2008), ITU Copenhagen, Denmark (May 2012).
- Marquis Who's Who – Who's Who in Science and Engineering, listed, 1996-now.
- Marquis Who's Who in Medicine and Healthcare, listed, 2002-now.
- Marquis Who's Who in America, listed, 2005-now.
- International Professional of the Year 2005 - International Biographic Center, Cambridge, England.
- Outstanding Intellectuals of the 21st Century - listed, 2005-now.

PATENTS

1. US Patent 6,148,095, Apparatus and method for determining three-dimensional representations of tortuous vessels. Inventors: G P M Prause and M Sonka.
2. US Patent 6,466,687, Method and apparatus for analyzing CT images to determine the presence of pulmonary tissue pathology. Inventors: R Uppaluri, T Mitsa, E A Hoffman, G McLennan, M Sonka.
3. US Patent 7,885,438, Methods and apparatuses for analyzing images. Inventors: R Uppaluri, T Mitsa, E A Hoffman, G McLennan, M Sonka.
4. US Patent 7,995,810, System and Methods for image segmentation in N-dimensional space. Inventors: K Li, X. Wu, D Z Chen, M. Sonka.

5. US Patent 8,073,210 Methods of smoothing segmented regions and related devices. Inventors: J M Reinhardt, M Sonka, G McLennan, E A Hoffman, S Ukil.

6. US Patent 8,155,403 Methods and devices for airway tree labeling and/or matching. Inventors: J Tschirren, M Sonka, J M Reinhardt, G McLennan, E A Hoffman.

7. US Patent 8,189,885 Apparatus and method for computing regional statistical distribution over a mean anatomic space. Inventors: P K Saha, M Sonka.

8. US Patent 8,358,819 B2, System and Methods for image segmentation in N-dimensional space (CIP-1). Inventors: X. Wu, M. Garvin, M. Abramoff, M. Sonka.

9. US Patent US 8,571,278, System and methods for multi-object multi-surface segmentation (CIP-2). Inventors: M. Sonka, Y. Yin, X. Wu, X. Zhang.

10. US Patent 9,545,196 Automated assessment of glaucoma loss from optical coherence tomography Inventors: M Abramoff, M Sonka.

INDUSTRIAL EXPERIENCE

- 1998–now – Founder, Medical Imaging Applications LLC (currently close to 100% market share in software tools for ultrasound-based assessment of endothelial function in research setting and clinical/epidemiologic trials, company markets FDA-approved software environment for carotid artery IMT and brachial artery FMD analysis, also 3D analysis of articular cartilage in osteoarthritis imaged by MR).

- 2001–now – Founder, VIDA Diagnostics Inc. (pulmonary imaging and image analysis, software suite of 3D pulmonary analysis tools for assessment of intrathoracic airway trees, vascular trees, lung lobes, pulmonary parenchyma, bronchoscopic navigation, computer-guided pulmonary interventions).

- 2002-2006 – Expert Witness in 2 medical image analysis patent cases.

- 2012-2013 – Expert Witness in an International Trade Commission digital image analysis patent case.

- **Small business research grants**

  - (1999–2000) NIH R43 – SBIR Phase I – Arterial Ultrasound Analysis Software Package ($100k, Sonka Co-PI)
  - (2001–2003) NIH R44 – SBIR Phase II – Vascular Ultrasound Analysis Workstation ($740k, Sonka Co-PI)
  - (2005–2006) NIH R43 – SBIR Phase I – 3D Analysis of MR-imaged Articular Cartilage ($100k, Sonka Co-PI)
  - (2006–2008) NIH R44 – SBIR Phase II – 3D Analysis of MR-imaged Articular Cartilage ($800k, Sonka Co-PI)

1 Publications

- h-index = 67 (= 49 over past 5 years, Google Scholar, September 2017)
- total number of citations > 25, 800 (> 12, 000 in past 5 years)
- i10 index = 239 (164 over past 5 years)

1.1 Books and monographs. (Limit to textbooks, research monographs, conference/ symposium/congress proceedings, handbooks, etc., of which you are an author or an editor. Do not include articles or chapters in such media.)

1. Mařík, V., Hlaváč, V., Kalačová, M., Sonka, M.: Theory of Automatic Control, Problems – Teorie automatického řízení II, příklady. Skriptum ČVUT, Praha, 1987, 224 p. (in Czech).
2. Sonka, M., Hlaváč, V. eds.: Image Processing Methods and Devices I – Metody a prostředky zpracování vizuální informace '86. Sborník ČSVTS FEL ČVUT, Praha, 1986, 210 p. (in Czech).
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