

MICHAEL UNSER

Professor of Image Processing
École polytechnique fédérale de Lausanne (EPFL), Switzerland

Laboratoire d'imagerie biomédicale
EPFL, LIB Bât. BM 4.127
Station 17
CH-1015 Lausanne, Switzerland
Tel : +41(21) 693-5175



URL:<http://bigwww.epfl.ch/>
Email : michael.unser@epfl.ch

Personal Details

Born on April 9, 1958 in Zug, Switzerland.
Married. Two children: Matthias (13/10/96) and Monica (05/01/99)

Languages: French, English, German (fluent oral), Italian (passive)

Education

1976-1981 M.S. Electrical Engineering, EPFL Lausanne, Switzerland
(summa cum laude — 1st Rank among all EPFL graduates)
1981-1984 Ph.D. Electrical Engineering, EPFL Lausanne, Switzerland
(Advisor: Prof. F. De Coulon, Signal Processing Laboratory)

Professional Experience

2000-present Full Professor, Director of the Biomedical Imaging Laboratory, Institute of Imaging and Applied Optics, École polytechnique fédérale de Lausanne, Switzerland
1997-2000 Associate Professor, Department of Micro-Engineering, EPFL, Switzerland
1996 Invited Professor, INRIA, PASTIS Project, Sophia-Antipolis, France
1990-1997 Visiting Scientist¹, Head of the Image Processing Group, Biomedical Engineering and Instrumentation Program (BEIP), National Center for Research Resources, National Institutes of Health (NIH), Bethesda MD, USA
1988-1994 Research Scientist (chargé de recherches 1ère classe), INSERM, Unité U2, Créteil, France, delegated to conduct research at the NIH from May 88 to Oct. 89. On leave since Nov. 89.
1987-1990 Visiting Associate, BEIP, NIH, Bethesda MD, USA
1985-1987 Visiting Fellow (post-doctoral fellowship), BEIP, NIH, Bethesda MD, USA

¹ : "Intent for tenure" was granted by the board of NIH directors on March 1990. The criteria are the same as for a tenured position which is granted to US citizens only.

Areas of Research/Expertise

- **Current research focus**

Development of new algorithms for the processing of images in medicine and biology. Topics of interest are image reconstruction, multimodal imaging, image analysis and visualization.

Research efforts are taking place at two complementary levels:

- Fundamental and mathematical aspects of imaging
- Application-oriented projects in collaboration with researchers in medicine and biology

Mathematical tools for advanced signal and image processing:

- Splines
- Wavelets
- Stochastic modeling

- **Broader areas of expertise/interest**

- Signal processing
- Image processing
- Pattern recognition, machine learning
- Computer vision
- Imaging: optics, microscopy (EM, fluorescence), MRI/fMRI, ultrasound, X-ray tomography
- Biomedical engineering (computational aspects)
- Applied mathematics: inverse problems, numerical analysis, functional and harmonic analysis (wavelets), approximation theory (splines), stochastic processes, fractals

Honors and Awards

- **ISI Highly Cited Researcher** in Engineering (cf. <http://isihighlycited.com/>).
- Election to Member of the **Swiss Academy of Engineering Sciences** (SATW), 2007.
- IEEE Signal Processing Society 2003 **Best Paper Award** for the paper with T. Blu, "Wavelets, Fractals, and Radial Basis Functions", *IEEE Trans. Signal Processing*, March 2002.
- IEEE Signal Processing Society 2000 **Magazine Award** for the paper: M. Unser, "Splines: A perfect fit for signal and image processing," *IEEE Signal Processing Magazine*, November 1999.
- **Fellow of the IEEE** (Jan. 1999) with the citation "for contribution to the theory and practice of splines in signal processing."
- IEEE Signal Processing Society 1995 **Best Paper Award** for the paper with A. Aldroubi and M. Eden, "B-spline signal processing: Part I—Theory," *IEEE Trans. Signal Processing*, February 1993.
- ABB Research Prize 1984: Awarded to a graduate or postgraduate student of the EPFL, who has conducted outstanding original research in the field of information technology, automation, or communications.
- Dommer Prize 1981: Awarded to a student who has obtained the **best EPFL grade point average** over the entire period of studies.

Selected Invited Talks

- Keynote speaker, *Int. Conf. on Control, Automation, Robotics and Vision* (ICARCV 2008), December 17-20, 2008, Hanoi, Vietnam.
- Keynote speaker, *Indian Conf. on Computer Vision, Graphics and Image Processing* (ICVGIP 2008), December 16-19, 2008, Bhubaneswar, India.

- Plenary speaker, *Workshop "Rapid MR-Imaging – Beyond the Nyquist Limit"*, October 12-13, 2008, Freiburg, Germany.
- Keynote speaker, *International Workshop on Local and Non-Local Approximation in Image Processing*, August 23-24, 2008, Lausanne, Switzerland.
- Keynote speaker, *Medical Image Understanding and Analysis (MIUA 2008)*, July 2-3, 2008, Dundee, UK.
- Plenary speaker, *8th European Light Microscopy Initiative meeting (ELMI'08)*, May 27 - 30, 2008, Davos, Switzerland.
- Keynote speaker, *IASTED Int. Conf. on Signal Processing, Pattern Recognition, and Applications (SPPRA 2008)*, February 13–15, 2008, Innsbruck, Austria.
- **2007/2008 Israel Pollak Distinguished Lecturer**, January 12-17, 2008, Technion, Haifa, Israel, .
- Plenary speaker, *International Symposium on Image and Signal Processing and Analysis (ISPA 2007)*, Istanbul, Turkey, September 27-29, 2007.
- **Keynote speaker, SPIE conference Wavelets XII**, August 26-30, 2007, San Diego, CA.
- Plenary speaker, *International Conference on Sampling Theory and Applications (SAMPTA'07)*, 2-7 June 2007, Thessaloniki, Greece.
- Invited tutorial speaker, *IEEE International Symposium on Biomedical Imaging*, April 12-15, 2007, Washington DC, USA.
- Invited tutorial speaker, *European Signal Processing Conference (EUSIPCO'06)*, September 4-8, 2006, Florence, Italy.
- Invited tutorial speaker, *IEEE International Symposium on Biomedical Imaging*, April 6-9, 2006, Arlington, VA, USA.
- **Keynote speaker, IEEE International Conference on Image Processing**, September 11-14, 2005, Genova, Italy.
- Plenary speaker, *20th GRETSI Symposium on Signal and Image Processing*, September 6-9, 2005, Louvain-la-Neuve, Belgium.
- Plenary speaker, *International Conference on Scale Space and PDE Methods in Computer Vision*, April 6-10, 2005, Hofgeismar, Germany.
- Plenary speaker, *International Conference on Signal Processing and Communications*, December 11-14, 2004, Indian Institute of Sciences, Bangalore, India.
- **Plenary speaker, IEEE Medical Imaging Conference (MIC'04)**, October 16-22, 2004, Rome, Italy.
- Plenary speaker, *Computer Vision Approaches to Medical Image Analysis Workshop (CVAMIA)*, Prague, May 15, 2004, Prague, Czech Republic.
- Plenary speaker, *IFAC Workshop on Fractional Differentiation and its Applications (FDA'04)*, July 19-21, 2004, Bordeaux, France.
- Plenary speaker, *5th caesarium / Advances in Molecular Biomedicine*, September 6-8, 2004, Bonn, Germany.
- Plenary speaker, *Pattern Recognition Symposium (DAG'03)*, September 10-12, 2003, Magdeburg, Germany.
- Plenary speaker, *International Conference on Wavelets and Splines*, July 3-8, 2003, Saint Petersburg, Russia.

- **Keynote speaker, SPIE Conference on *Medical Imaging***, 23-28 February, 2002, San Diego CA, USA.
- Plenary speaker, Fourth International Meeting on *Sampling Theory and Applications*, May 13-17, 2001, Orlando FL, USA.
- Plenary speaker, *European Signal Processing Conference (EUSIPCO'2000)*, September 4-8, 2000, Tampere, Finland.

PROFESSIONAL ACTIVITIES

Society Membership

- Member of the Board, Swiss Society of Biomedical Engineering (SSBE)
- Fellow Member, IEEE: Signal Processing Society (SPS) & Engineering in Medicine and Biology Society (EMBS)
- Member, European Association for Signal Processing (EURASIP)
- Member, Society for Industrial and Applied Mathematics (SIAM)
- Member, The International Society of Optical Engineering (SPIE)

Editorial Activities

- Associate Editor, *SIAM Journal of Imaging Sciences*, 2007-present
- **Associate Editor-in-Chief, *IEEE Transactions on Medical Imaging***, 2003-2005
- **Editor-in-Chief, *Wavelet Digest*** at <http://www.wavelet.org/>, 2003-present
- Associate Editor, *IEEE Transactions on Medical Imaging*, 1999-2002; 2006-2007
- Associate Editor, *IEEE Signal Processing Letters*, 1995-1998
- Associate Editor, *IEEE Transactions on Image Processing*, 1992-1995
- Member of the Editorial Board, *IEEE Signal Processing Magazine*, 2003-2006
- Member of the Editorial Board, *Journal of Mathematical Imaging and Computer Vision*, 1998-2007
- Member of the Editorial Board, *Foundations and trends in Signal Processing*, 2006-present
- Member of the Editorial Board, *Sampling Theory in Signal and Image Processing*
- Member of the Editorial Board, *Signal Processing*, 1996-2003
- Member of the Editorial Board, *Pattern Recognition*, 1996-2006
- Member of the Editorial Board, *Journal of Visual Communication and Image Representation*, 1997-2006

Selected Committee Activities

EPFL and Switzerland

- Member, EPFL Research Commission (CR), 2000-present
- Member, Research Commission of the EPFL School of Engineering (CR-STI), 2001-2007
- Member, Academic Promotion (e.g., tenure) Committee of the EPFL (CPA), 2005-present
- Chairman, Award Committee, Swiss Society for Biomedical Engineering (SSBE), 2003-2006

International

- **Chairman, Steering Committee for the IEEE International Symposium on Biomedical Imaging**; 2006-2008; IEEE-EMBS representative (2002-2005)
- **Chairman, Technical committee on Bio Imaging and Signal Processing¹** (BISP-TC), IEEE Signal Processing Society, 2004-2006; Member (2006-2007)
- Member, Technical committee on Image and Multidimensional Signal Processing (IMDSP-TC), IEEE Signal Processing Society, 1993 – 2000; 2003-present
- Member, Advisory Board, SIAM Activity Group (SIAG) on Imaging Science, 2000-present

Selected Conference Organization

Switzerland

- Co-chair, WavE 2006, Workshop on *Wavelets and Applications*, July 10-14, 2006, EPFL Lausanne, Switzerland
- Program chair, *Annual meeting of the Swiss Society of Biomedical Engineering (SSBE)*, September 1-2, 2005, EPFL Lausanne, Switzerland
- Co-chair, *Wavelet Applications Workshop*, Switzerland, September 28 - October 2, 1998, Centro Stefano Franscini, Monte Verità, Ticino, Switzerland

International

- **Chair, SPIE Conference *Wavelet X*, 3-8 August, 2003, San Diego CA, USA**
- **Chairman, First IEEE International Symposium on Biomedical Imaging, July 7-10, 2002, Washington DC, USA**
- Co-chair, SPIE Conference on *Wavelets IX*, July 29-August 3, 2001, San Diego CA, USA
- Chair, SPIE Conference on *Wavelet Applications in Signal and Image Processing VIII*, 18-23 July, 2000, San Diego CA, USA
- Chair, SPIE Conference on *Wavelet Applications in Signal and Image Processing VII*, 18-23 July, 1999, Denver CO, USA

Reviewing Activities

Journals

Signal Processing, Pattern Recognition, IEEE Trans. Image Processing, IEEE Trans. Signal Processing, IEEE Signal Processing Letters, IEEE Trans. Information theory, IEEE Trans. Circuits and Systems, IEEE Trans. Pattern Analysis and Machine Intelligence, IEEE Trans. Systems Man and Cybernetics, IEEE Trans. Medical Imaging, IEEE Trans. Biomedical Engineering, Proceedings of the IEEE, Int. J. Computer Vision, CVGIP: Graphical Models and Image Processing, CVGIP: Image Understanding, J. Microscopy, Ultramicroscopy, IEE Proceedings, Optical Engineering, J. Optical Society of America, Electronic Letters, SIAM J. Math. Analysis, J. Fourier Analysis and Applications, Applied and Computational Harmonic Analysis.

Publishers

CRC Press, Prentice Hall, Birkhauser, IEEE Press.

¹ : The BISP-TC is responsible, among other things, for the review of the larger portion of the bio related papers in the following yearly international conferences: IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), IEEE International Conference on Image Processing (ICIP), IEEE International Symposium on Biomedical Imaging (ISBI).

Agencies

Swiss National Science Foundation, American National Science Foundation, National Institutes of Health USA, various European funding agencies including Engineering and Physical Sciences Research Council (UK) etc.

ACADEMIC ACTIVITIES

Mentorship

Post-doctoral fellows (past and present)

Chulhee Lee (Full prof., Yonsei Univ. Korea), Michael Vrhel, Philippe Thévenaz (EPFL), Patrick Brigger, Gloria Menegaz (Assoc. prof., Univ of Verona), Thierry Blu (Full prof., Chinese University of Hong Kong), Daniel Sage (EPFL), Dimitri Van de Ville (EPFL/HUG), Brigitte Forster (Assist. prof. TU- Munich), Erik Meijering (Assist. prof., Univ. Rotterdam), Carlos Sanchez Sorzano, Chandra Sekhar Seelamentula (EPFL), Olivier Bernard (Ass. prof., INSA Lyon).

Former Ph.D. students

Stephan Horbelt, Jan Kybic (Senior lecturer, Tech. University, Prague), Manuela Feilner, Maria Arrate Muñoz Barrutia (Researcher, University of Navarra, Spain), Mathews Jacob (Ass. prof., Univ. Rochester), Slavica Jonic (Researcher CNRS), Michael Liebling (Ass. prof., UC Santa Barbara), Michael Sühling (Research scientist, Siemens Medical Solutions), Muthuvel Arigovindan (Post. doc, UC San Francisco)

Current Ph.D. students

François Aguet, Jean-Charles Baritoux, Aurélien Bourquard, Kunal Narayan Chaudhury, Ricard Delgado, Matthieu Guerquin-Kern, Djano Kandaswamy, Ildar Khalidov, Florian Luisier, Sathish Ramani, Pouya Dehghani Tafti, Cédric Vonesch

Teaching

- Signals and Systems I and II, EPFL Micro-Engineering section 3rd year (bachelor), Winter and Summer semesters, 6 credits, yearly since 2001.
- Signals and Systems SV I and II, EPFL Life Sciences section 3rd year (bachelor), Winter and Summer semesters, 6 credits, yearly since 2005.
- Image Processing I and II, EPFL Micro-engineering section 4th year (Master), Winter and Summer semesters, 3+3 credits, yearly since 1998.
- Image Processing I and II, EPFL Life Science section, Master, Winter and Summer semesters, 3+3 credits, yearly since 2006.
- Advanced Signal Processing: Wavelets and Subband Coding, EPFL Doctoral School in Computer, Communication and Information Sciences, Summer semester (4 credits), bi-yearly since 1998.

Funding Record

Swiss National Science Foundation

- Principal investigator for « Spline method for the continuous/discrete processing of images » (2008-2011, CHF 764'906)
- Systems X, Co-principal investigator for « Yeast Protein Network Dynamics : DynamiX » (2008-2012, CHF 194'700)
- Principal investigator for « Spline methods for the continuous / discrete processing of images »(2005-2008, CHF 564'435)
- Co-principal investigator for « Improved noninvasive diagnosis and monitoring of heart disease by quantitative echocardiography and computer vision technology » (2005–2008, CHF 296'000)
- Principal investigator for « Spline methods for the continuous / discrete processing of images »(2003-2005, CHF 358'308)
- Co-principal investigator for « Optimization methods and image registration » (2002-2004, CHF 99'190)
- Co-principal investigator for « Improved noninvasive diagnosis of ischemic heart disease by quantitative stress echocardiography and advanced digital image processing » (2000-2004, approx. CHF 140'000)
- Principal investigator for « Spline methods for the continuous / discrete processing of images » (2001-2003, CHF 364'224)

Swiss innovation promotion agency (CTI)

- Principal investigator for « Dual X-ray/fluorescence tomography : advanced reconstructions and optical measurement techniques » (2008-2010, CHF 200'000)
- CTI, Co-principal investigator for « Système de surveillance vidéo pour le contrôle de structures hydrauliques en assainissement urbain » (2007-2010, CHF 34'000)

Industry

- Essilor: « Novel acquisition/reconstruction paradigms for 2nd generation digital photography and microscopy » (2008-2010, Euros 190'300)
- Roche Diagnostics Ltd: « Research and development on algorithms » (2008, CHF 36'000)
- Scanco Medical AG : « Research on optical tomography » (2007-2009, CHF 30'000)
- Carl Zeiss : « Research on 3D deconvolution » (2006-2007, euros 30'000)
- Serono : « Research on classification of ovocytes images » (2005, CHF 26'000)

European Union

- Principal investigator for « Hassip : Harmonic Analysis and Statistics for Signal and Image Processing » (2002-2006, CHF 275'000)

Centers and foundations

- Principal investigator, NCCBI (National Competence Center in Biomedical Imaging), Improved magnetic resonance image reconstruction via wavelet regularization » (2008-2012) CHF 169'700
- Principal investigator for Indo Swiss Joint Research Programme (ISJRP) « Advanced restoration and super-resolution techniques for 3D fluorescence microscopy » (2009-2012) CHF 165'525
- Principal investigator and Director, « Signal Processing Core », Center for Imaging and Bio-Medicine, Foundations Leenards et Louis-Jeantet de Médecine, (2005-2009, CHF 2'300'000)

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- Principal investigator for Hasler Foundation : « Information Recovery from Microscopy Images » (2005-2009, CHF 308'000)
- Co-principal investigator for GRS Foundation : « Intracellular 3D nanomanipulator” (2007-2009, CHF 94'500)
- Principal investigator for AO Asif Foundation: « Fluoroscopy-Based 3D/2D Registration for Minimally-Invasive Approaches in Trauma and Spine Surgery » (2003, CHF 59'740)
- Co-principal investigator for the Swiss Foundation for Cardiology : « Computer Vision in Multidimensional Echocardiography » (2000 – 2003, approx. CHF 90'000)

References will be provided upon request.

January, 2009.