

Associate Professor in Computer Science at University of Toulouse
Research activities in IRIT UMR CNRS 5505 Laboratory, Toulouse, France

Adrian BASARAB

Date of birth: October 6th 1981
Nationality: French

Université Paul Sabatier Toulouse 3, IRIT UMR 5505
118 Route de Narbonne
31062 Toulouse cedex 9 France
Tel +33 5 61 55 68 82
E-mail: basarab@irit.fr
<http://www.irit.fr/~Adrian.Basarab/index.html>

Research Topics: Signal and Image Processing for biomedical imaging

- Inverse problems
- Multidimensional signal processing
- Motion estimation and image registration
- Ultrasound imaging

Short Bio

Adrian Basarab received the M.S. and PhD degrees in signal and image processing from the National Institute for Applied Sciences of Lyon, France, in 2005 and 2008. Since 2009 (respectively 2016) he is assistant (respectively associate) professor at the University Paul Sabatier Toulouse 3 and a member of IRIT laboratory (UMR CNRS 5505). His research interests include medical imaging, and more particularly inverse problems (deconvolution, super-resolution, compressive sampling, beamforming), motion estimation and ultrasound image formation. Adrian Basarab is currently associate editor for Digital Signal Processing (Elsevier) and was a member of the French National Council of Universities Section 61 - Computer sciences, Automatic Control and Signal Processing from 2010 to 2015.

Positions

2016 *Associate professor*, University of Toulouse
2009 *Assistant Professor*, University of Toulouse
2008 *Postdoctoral position*, Catholic University of Leuven, Belgium
2008 *Assistant Professor*, University of Lyon, France

Qualifications

2016 *Habilitation to conduct researches*, A few inverse problems in ultrasound imaging, University of Toulouse
2008 *PhD Thesis*, Motion estimation in ultrasound imaging, INSA-Lyon
2005 *Post-graduate degree* in computer science and signal and image processing, INSA-Lyon

Publications

28 journal publications with peer review
4 book chapters
More than 70 communications at international conferences (including 9 invited talks)
1 French patent

Editorial experience and organized events

Associate Editor of Digital Signal Processing (Elsevier)
Guest editor (with Y. Eldar - Technion and H. Liebgott - University of Lyon) for IEEE TUFFC special issue on "Sparsity driven methods in medical ultrasound", 2017
Co-organizer of IEEE ICASSP 2017 special session on "Inverse Problems in Ultrasound Imaging: Recent Advances and Opportunities"
Area chair for EUSIPCO 2015, 2016 and ISBI 2013
Co-organizer of EUSIPCO 2016 special session on "Recent advances in medical image restoration"
Co-organizer of EUSIPCO 2015 special session on "Recent advances in biomedical signal and image processing"
Co-organizer and chair of CFA 2014 special session on "Compressed acquisition in acoustics"
Co-organizer and chair of IEEE ISBI 2013 special session on "Sparse Representations and Compressed Sensing in Medical Ultrasound Imaging"

Member of the local committee of CIMI workshop "Optimization and Statistics in Image Processing", 24 - 28 June 2013, Toulouse.

Honors

Winner of "Plane wave imaging challenge in ultrasound imaging", IEEE Ultrasonics Symposium, Tours, 2016
Paul Calas award, French Society of Endodontics, 2016
Best student paper finalist, IEEE Ultrasonics Symposium, Taiwan, 2015

Referee

Referee for IEEE Trans. on Image Processing, IEEE Journal of Selected Topics in Signal Processing, IEEE Trans. on Ultrasonics, Ferroelectrics and Frequency Control, IEEE Trans. on Biomedical Imaging, IEEE Trans. on Medical Imaging, Ultrasound in Medicine and Biology, Ultrasonics.

Supervisor of junior researchers

3 PhD thesis started in 2017
3 PhD thesis defended in 2016
1 PhD thesis started in 2016
2 PhD thesis started in 2015
1 PhD thesis started in 2013
2 PhD thesis defended in 2014
14 Post-graduate students (Image and signal processing)

Funding

2016-2017 1 national grant (30k€)
2011-2018 6 local grants (70k€), founded by the University of Toulouse
2011-2014 1 national grant (205k€) in collaboration with 4 researchers from the University of Lyon
2011-2014 1 regional grant (110k€) in collaboration with 3 researchers from the University of Toulouse

International Collaborations

Research collaborations with University of Bristol (UK), Riverside Research Institute (USA), Vanderbilt University (USA), Catholic University of Leuven (Belgium), Polytechnic University of Bucarest (Romania).

Scientific and administrative responsibility

Since 2016 Co-direction of the Computer Science in Health Activities team of IRIT laboratory
Since 2015 Associate Editor for Digital Signal Processing journal
2012-2015 Member of the French National Council of Universities (signal and image processing division) of the French Minister of Higher Education and Research

Teaching activities

In charge (with David Vanderhaeghe) of MSc Image & Multimedia, University Paul Sabatier, Toulouse.

Image Processing (Graduate): image segmentation, image restoration.
Signal Processing (Graduate): sampling, digital filtering, stochastic signal processing, beamforming.
Medical Imaging (Graduate): ultrasound, MRI, tomographic reconstruction.

Contribution to Science

1. The limited bandwidth of ultrasound transducers and the physical phenomena related to ultrasound wave propagation through human tissues affect the quality of ultrasound images in terms of spatial resolution and contrast. Under the first order Born approximation and the assumption of weak scattering classically assumed for soft tissues, these degradations can be expressed a linear image formation model relating the tissue reflectivity function to the RF acquired data. Recently, our group proposed several methods to invert this model and to successfully recover high quality images better reflecting the tissues than native ultrasound images.
 - a. N. Zhao, **A. Basarab**, D. Kouamé, J.-Y. Tourneret, "Joint Segmentation and Deconvolution of Ultrasound Images Using a Hierarchical Bayesian Model based on Generalized Gaussian Priors", IEEE Transactions on Image Processing, Vol. 25, no. 8, p. 3736-3750, 2016.

- b. N. Zhao, Q. Wei, **A. Basarab**, N. Dobigeon, D. Kouamé, J.-Y. Tournet, "Fast Single Image Super-resolution using a New Analytical Solution for 12-12Problems", IEEE Transactions on Image Processing, Vol. 25 N. 8, p. 3683-3697, 2016.
2. Recent developments in ultrasound technologies have led to novel acquisition modes such as ultrafast or 3D imaging. While the first, based on plane wave emissions, suffers from lower image quality than standard imaging using focused beams, the second leads to huge amounts of data to be collected and processed. In 2010, our group was among the first to use compressed sensing as an alternative to existing technologies to decrease the data volume in ultrasound imaging. These pioneer studies have been pursued by several research groups, imposing the concept of sparsity in ultrasound imaging as an important alternative to the well established Gaussian signal processing.
 - a. J. Kim, J. Mamou, P. Hill, N. Canagarajah, D. Kouamé, **A. Basarab**, A. Achim, "Approximate Message Passing Reconstruction of Quantitative Acoustic Microscopy Images", IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, 2017, in press.
 - b. Z. Chen, **A. Basarab**, D. Kouamé, "Reconstruction of Enhanced Ultrasound Images From Compressed Measurements Using Simultaneous Direction Method of Multipliers", IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, Vol. 63 N. 10, p. 1525-1534, 2016.
 - c. Z. Chen, **A. Basarab**, D. Kouamé, "Compressive deconvolution in medical ultrasound imaging", IEEE Transactions on Medical Imaging, Vol. 35, no. 3, p. 728-737, 2016.
 - d. A. Achim, **A. Basarab**, G. Tzagkarakis, P. Tsakalides and D. Kouamé, "Reconstruction of ultrasound RF echoes modelled as stable random variables", IEEE Transactions on Computational Imaging, Vol. 1, no. 2, p. 86-95, June 2015.
 - e. C. Quinsac, **A. Basarab**, D. Kouamé, "Frequency domain compressive sampling for ultrasound imaging", Advances in Acoustics and Vibration, Special issue on Advances in Acoustic Sensing, Imaging, and Signal Processing, Vol. 12, p. 1-16, 2012.
3. Ultrasound beamforming is the art of combining the RF raw signals acquired by multi-element transducers. While delay-and-sum still remains the most used method due to its real-time capabilities, techniques aiming at improving the quality of beamformed images have received a considerable attention in the literature. During the last three years, I have contributed significantly to this field by introducing a novel beamforming framework in ultrasound imaging, based on solving regularized inverse problems.
 - a. T. Szasz, **A. Basarab**, D. Kouamé, "Beamforming through regularized inverse problems in ultrasound medical imaging", IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control, Vol. 63 N. 12, p. 2031-2044, 2016.
 - b. T. Szasz, **A. Basarab**, D. Kouamé, "Strong reflector-based beamforming in ultrasound medical imaging", Ultrasonics, Vol. 66, p. 111-124, 2016.
4. Tissue motion estimation has several medical imaging applications, such as cardiac function assessment or elastography. Since my PhD thesis, I have developed several motion estimation methods. For many years, the main originality of the methods proposed by our group was the use of spatial phase images instead of native ultrasound images. More recently, I have contributed in showing the interest of dictionary learning methods in cardiac motion estimation.
 - a. N. Ouzir, **A. Basarab**, H. Liebgott, B. Harbaoui, J.-Y. Tournet, "Motion Estimation in Echocardiography Using Sparse Representation and Dictionary Learning", IEEE Transactions on Image Processing, 2017, in press.
 - b. L. Wang, **A. Basarab**, P. Girard, P. Croisille, P. Clarysse, P. Delachartre, "Analytic signal phase-based myocardial motion estimation in tagged MRI sequences by a bilinear model and motion compensation", Medical Image Analysis, Vol. 24 N. 1, p. 149-162, 2015.
 - c. M. Alessandrini, **A. Basarab**, L. Boussel, X. Guo, A. Serusclat, D. Friboulet, D. Kouamé, O. Bernard, H. Liebgott, "A New Technique for the Estimation of Cardiac Motion in Echocardiography Based on Transverse Oscillations: a preliminary evaluation in silico and a feasibility demonstration in vivo", IEEE Transactions on Medical Imaging, Vol. 33 N. 5, p. 1148-1162, 2014.

- d. M. Alessandrini, **A. Basarab**, H. Liebgott, O. Bernard, "Myocardial Motion Estimation from Medical Images Using the Monogenic Signal", IEEE Transactions on Image Processing, Vol. 22 N. 3, p. 1084-1095, 2013.

Complete List of Published Work:

<https://www.irit.fr/-Publications-?code=6347&nom=Basarab%20Adrian>

Google scholar profile:

<https://scholar.google.fr/citations?hl=fr&user=I2CCHb0AAAAJ>