

Caroline CHAUX

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42 y.o., French national.



Education

- From Aug. 2022 CNRS **Full-time Senior researcher** (section 7) at IPAL IRL CNRS 2955 and CNRS@CREATE, Singapore.
- 2019 **Habilitation à diriger des recherches** of Aix-Marseille université.
Title: “From the modelization of direct problems in image processing to the resolution of inverse problems”.
Defense date: 9 january 2019.
Committee: J.-F. Aujol, J. Delon, R. Gribonval, N. Kingsbury, G. Steidl, B. Torrèsani.
- From Sept. 2012 to Jul. 2022 CNRS **Full-time Junior researcher** (CR1) (section 07) at Aix-Marseille Université, Institut de Mathématiques de Marseille (UMR CNRS 7373).
- Nov. 2014 to Oct. 2015 **Member of the CNU** (“Conseil National des Universités”) (section 61).
- Feb. 2012 to Aug. 2012 CNRS **Full-time Junior researcher** (CR1) (section 07) at Université Paris-Est, Paris, Laboratoire d’Informatique Gaspard Monge (CNRS-UMR 8049).
- 2011 **Prime d’Excellence Scientifique** (PES).
- 2007 to 2011 CNRS **Full-time Junior researcher** (CR2) (section 07) at Université Paris-Est, Paris, Laboratoire d’Informatique Gaspard Monge (CNRS-UMR 8049).
- 2006 to 2007 **Post-Doc in image processing** at INRIA Sophia-Antipolis, in ARIANA project, goal: 3D confocal microscopy image restoration.
- 2003 to 2006 **Ph.D in Image Processing** at Université de Marne-la-Vallée, Paris, Laboratoire d’Informatique de l’Institut Gaspard Monge (CNRS-UMR 8049). Thesis supervisor: Prof. Jean-Christophe Pesquet.
Summary: Signal analysis using M -band filter banks; applications to seismic data. Different topics have been studied throughout this thesis: image analysis using directional wavelets, seismic image denoising, satellite image restoration (multispectral aspects were taken into account for these images, convex optimization methods applied to deconvolution).
Defense date: 13 December 2006.
- 2000 to 2003 **DEA** (equivalent to Master degree in France) **Signal and communications** (2003) at Université de Nice Sophia-Antipolis (with honors).
Engineer in telecommunications (2003), I.S.I.T.V. (Institut des Sciences de l’Ingénieur de Toulon and du Var).
- 1998 to 2000 **Junior college** studies in Maths and Physics in Lycée Lalande, Bourg en Bresse.

Teaching and supervision

Teaching activities:

- ◆ Teaching in CNAM, Univ. Toulon, computer science engineer in “Sciences et Technologies des Médias Numériques”: lecture in signal processing (Engineer 1st year). (14h in total)

- ◆ **Teaching in Institut des Sciences de l'Ingénieur de Toulon et du Var (ISITV):** lectures in “Image, wavelet and compression” (Engineer ISITV, 3rd year). (*approximately 30h in total*)
- ◆ **Teaching in Aix-Marseille Université:**
 - lectures in “Inverse problem” (Master, 2nd year). (*approximately 15h in total*)
 - lectures in “Signal processing” (Master 1st year). (*approximately 25h in total*)
 - C language, project of algorithmic (BSc, 2nd year). (*approximately 30h in total*)
- ◆ **Continuing education :** EUROSAAE “New signal processing methods”.

Teaching (2007-2012) :

- ◆ **Teaching in Université Paris-Est Marne-la-Vallée:** lectures in computer science: C++ (Engineers IMAC, 2nd year), lectures in representations and filtering in 1D/2D (Master research, 2nd year) and lectures in random and statistical signal processing (Master in Electronics and Telecommunications, 1st year). (*approximately 90h ETD in total*)
- ◆ **Teaching at Université Paris-Est Créteil:** lectures in image processing for medical imaging (Master research, 2nd year). (*around 6h ETD in total*)
- ◆ **In Telecom SudParis:** lectures on multiresolution representations (Engineer Telecom SudParis, 3rd year) (*approximately 18h in total*)
- ◆ **Continuing education:** in ENSTA (École Nationale Supérieure de Techniques Avancées) for “Wavelets and applications” training (SAE formation).

Project supervision activities:

- ◆ **Supervision** (with S. Anthoine) of **two interns** (Master in Math/Computer Science) (2016-2017). Removing Camera Shake via Weighted Fourier Burst Accumulation.
- ◆ **Supervision** (with S. Anthoine) of **one intern** (Master in Math/Computer Science) (2013). Biphotonic image deconvolution.
- ◆ **Supervision** (with S. Anthoine, B. Torrèsani) of **three interns** (Master in Math/Computer Science) (2020). Blind source separation in 3D NMR spectroscopy.
- ◆ **Supervision** (with P. Escande) of **three interns** (Master in Math/Computer Science) (2021). Photoacoustic tomography image reconstruction.
- ◆ **Co-Supervision** (with V. Tan) of **one intern** (Undergraduate/NUS Math dept.) (2022-2023). Deep Unrolling for Robust Principal Component Analysis.
- ◆ **Co-Supervision** (with V. Tan) of **one intern** (Undergraduate/NUS DSA dept.) (2023-2024). Deep Unrolling for Matrix Completion.

Master student supervision activities:

- ◆ **Supervision** of **two interns** (Master in Electronics and Telecommunications). During this internship, the students have implemented Java applets illustrating random signal processing notions.
- ◆ **Supervision** of **two interns** (Master in Electronics and Telecommunications). During this internship, the students have implemented a C/C++ toolbox for image restoration.
- ◆ **Supervision** of **one intern** (Master SUP'COM Tunis). During this internship, the student have developped adapted methods for the restoration of images with spatially-varying blur (collaboration with Thalès Alenia Space Cannes).
- ◆ **Co-Supervision** of **one intern** (Université Polytechnique de Bucarest) (2009). Image Reconstruction in Parallel MRI by using Wavelet-Based Statistical Estimators.

- ◆ **Co-Supervision of one intern** (3rd year in Université de Naples) (2011). Multiple removal in seismic data.
- ◆ **Co-Supervision of one intern** (Master 2nd year in Aix-Marseille Université) (2015). Covariance Estimation By Penalty Criterion.
- ◆ **Co-Supervision of one intern** (Master 2nd year in Aix-Marseille Université) (2017). Phase reconstruction for audio inpainting.
- ◆ **Co-Supervision of one intern** (Master 2nd year in Univ. Bordeaux) (2018). Blind source separation in NMR spectroscopy.
- ◆ **Co-Supervision of one intern** (Master 1st year in Aix-Marseille Université) (2020). Dimension reduction for blind source separation in 2D NMR spectroscopy.
- ◆ **Co-Supervision of one intern** (Master 2nd year in Aix-Marseille Université) (2020). Matrix decomposition in sparse matrix product.
- ◆ **Co-Supervision of one intern** (Master 2nd year in Aix-Marseille Université) (2021). New models for fast transform learning.
- ◆ **Co-Supervision** (with E. Soubies, V. Tan) of **one intern** (Master, NUS, Math dept.) (2022). Forward-Backward Splitting unrolling strategies for inverse problems resolution.

PhD student supervision activities:

- ◆ **Co-Supervision** of a PhD of ARIANA project working on blind confocal microscopy image deconvolution (2006-2007).
- ◆ **Co-Supervision** of a PhD (N. Pustelnik) of LIGM working on PET image reconstruction (2007-2010).
- ◆ **Co-Supervision** of a PhD (A. Jezierska) of LIGM (ANR DIAMOND) working on confocal macroscopy image restoration (2009-2012).
- ◆ **Co-Supervision** of a PhD (M. El Gheche) of LIGM working on parallel optimization methods for the analysis and compression of multiview flows (2010-2013).
- ◆ **Co-Supervision** of a PhD (M. Quyen Pham) of LIGM working on optimization methods for multiple removal in seismic data (2011-2014).
- ◆ **Co-Supervision** of a PhD (T. Thanh Xuan Vu) of LSIS (LabEx Archimède fellowship) working on deterministic and stochastic optimization for solving large size inverse problems in image processing. (2013-2017).
- ◆ **Co-Supervision** of a PhD (K. Le) of I2M (doctoral school fellowship) working on statistics and optimization for covariance estimation and application to medical imaging. (2015-2020).
- ◆ **Co-Supervision** of a PhD (A. M. Kreme) of I2M/LIS (PACA region fellowship) working on audio data inpainting in the time frequency plane. (2017-2021).
- ◆ **Co-Supervision** of a PhD (M. Mohamed) of LIS/I2M (PACA region fellowship) working on frugal machine learning: new models and algorithms. (2021-2024).

Post-doctoral supervision activities:

- ◆ **Co-Supervision** of a post-doctoral researcher (A. Cherni) in I2M (Amidex Bifrost fellowship) (2018-2020). Blind source separation in 2D NMR spectroscopy (HSQC).

Publications

Accepted or published journal papers:

- ◆ Laurent Duval, Caroline Chau, *Lapped transforms and hidden Markov models for seismic data filtering*, *International Journal of Wavelets, Multiresolution and Information Processing (IJWMIP)*, Vol. 2, No. 4, déc. 2004, p. 455-476.
- ◆ Caroline Chau, Laurent Duval and Jean-Christophe Pesquet, *Image Analysis Using a Dual-Tree M-Band Wavelet Transform*, *IEEE Transactions on Image Processing*, Vol. 15, No. 8, août 2006, p. 2397-2412.
- ◆ Caroline Chau, Patrick L. Combettes, Jean-Christophe Pesquet, and Valérie R. Wajs, *A variational formulation for frame based inverse problems*, *Inverse problems*, Vol. 23, juin 2007, pp. 1495-1518.
- ◆ Caroline Chau, Jean-Christophe Pesquet and Laurent Duval, *Noise covariance properties in dual-tree wavelet decompositions*, publié dans *IEEE Transactions on Information Theory*, Vol. 53, No. 12, déc. 2007, pp. 4680-4700.
- ◆ Caroline Chau, Laurent Duval, Amel Benazza-Benyahia and Jean-Christophe Pesquet, *A Nonlinear Stein Based Estimator for Multichannel Image Denoising*, *IEEE Transactions on Signal Processing*, Vol. 56, No. 8, Aug. 2008, pp. 3855-3870.
- ◆ Caroline Chau, Jean-Christophe Pesquet, Nelly Pustelnik, *Nested iterative algorithms for convex constrained image recovery problems*, *SIAM Journal on Imaging Sciences*, Vol. 2, No.2, juin 2009, pp. 730-762.
- ◆ Jean-Christophe Pesquet, Amel Benazza-Benyahia, Caroline Chau, *A SURE Approach for Digital Signal/Image Deconvolution Problems*, *IEEE Transactions on Signal Processing*, Vol. 57, No. 12, Dec. 2009, pp. 4616-4632.
- ◆ Nasreddine Hajlaoui, Caroline Chau, Guillaume Perrin, Frédéric Falzon, Amel Benazza-Benyahia, *Satellite image restoration in the context of a spatially varying point spread function*, *J. Opt. Soc. Am. A*, Vol. 27, No. 6, 2010, pp. 1473-1481.
- ◆ Caroline Chau, Anna Jezierska, Jean-Christophe Pesquet, Hugues Talbot, *A spatial regularization approach for vector quantization*, *Journal of Mathematical Imaging and Vision*, Springer Netherlands, Vol. 41, 2011, pp. 23-38.
- ◆ Nelly Pustelnik, Caroline Chau, Jean-Christophe Pesquet, *Parallel ProXimal Algorithm for image restoration using hybrid regularization*, *IEEE Trans. on Image Proc.*, Vol. 20, No. 9, Sep. 2011, pp. 2450 - 2462.
- ◆ Laurent Jacques, Laurent Duval, Caroline Chau, Gabriel Peyré, *A Panorama on Multiscale Geometric Representations, Intertwining Spatial, Directional and Frequency Selectivity*, *Elsevier Signal Processing - Special issue on Advances in Multirate Filter Bank Structures and Multiscale Representations*, Vol. 91, No. 12, 2011.
- ◆ Lotfi Chaari, Emilie Chouzenoux, Nelly Pustelnik, Caroline Chau et Said Moussaoui, *OPTIMED : Optimisation itérative pour la résolution de problèmes inverses de grande taille*, *Traitement du signal*, Vol. 28, No. 3-4, pp. 329-374, 2011.
- ◆ Nelly Pustelnik, Jean-Christophe Pesquet, Caroline Chau, *Relaxing Tight Frame Condition in Parallel Proximal Methods for Signal Restoration*, (correspondence) *IEEE Trans. on Signal Proc.*, Vol. 60, No. 2, Feb. 2012, pp. 968 - 973 .
- ◆ Caroline Chau, Mireille El Gheche, Joumana Farah, Jean-Christophe Pesquet, Béatrice Pesquet-Popescu, *A parallel proximal splitting method for disparity estimation from multicomponent images under illumination variation*, *Journal of Mathematical Imaging and Vision*, Vol. 47, No. 3, Nov. 2013, pp. 167-178.
- ◆ Anna Jezierska, Caroline Chau, Jean-Christophe Pesquet, Hugues Talbot, Gilbert Engler, *An EM Approach for Time-Variant Poisson-Gaussian Model Parameter Estimation*, *IEEE Trans. on Signal Proc.*, vol. 62, No. 1, Jan. 2014, pp. 17-30.

- ◆ Mai Quyen Pham, Laurent Duval, Caroline ChauX, Jean-Christophe Pesquet, *A Primal-Dual Proximal Algorithm for Sparse Template-Based Adaptive Filtering: Application to Seismic Multiple Removal*, *IEEE Trans. on Signal Proc.*, vol. 62, No. 16, Aug. 2014, pp. 4256-4269.
- ◆ Xuan Thanh Vu, Sylvain Maire, Caroline ChauX, Nadège Dorothée Thirion-Moreau, *A new stochastic optimization algorithm to decompose large nonnegative tensors*, *IEEE Signal Process. Lett.*, Vol. 22, No. 10, Oct. 2015, pp.1713-1717.
- ◆ Lotfi Chaari, Jean-Yves Tourneret, Caroline ChauX, Hadj Batatia, *A Hamiltonian Monte Carlo Method for Non-Smooth Energy Sampling*, *IEEE Trans. on Signal Proc.*, vol. 64, No. 21, Nov. 2016, pp. 5585 - 5594.
- ◆ Xuan Thanh Vu, Caroline ChauX, Nadège Dorothée Thirion-Moreau, Sylvain Maire, Elfrida M. Carstea, *A new penalized nonnegative third order tensor decomposition using a block coordinate proximal gradient approach: application to 3D fluorescence spectroscopy*, in *Journal of Chemometrics*, special issue on penalty methods, Vol. 3, CEM 31.1 March 2017, doi:10.1002/cem.2859.
- ◆ Afef Cherni, Elena Piersanti, Sandrine Anthoine, Caroline ChauX, Laetitia Shintu, Mehdi Yemloul, Bruno Torrèsani, *Challenges in the decomposition of 2D NMR spectra of mixtures of small molecules*, *Faraday Discussions*, 2019, Vol. 218, pp. 459 - 480.
- ◆ Khuyen Le, Caroline ChauX, Frédéric Richard, Eric Guedj, *An adapted linear discriminant analysis with variable selection for the classification in high-dimension, and an application to medical data*, *Computational Statistics and Data Analysis*, Vol. 152, Dec. 2020.
- ◆ Ama Marina Krémé, Valentin Emiya, Caroline ChauX, Bruno Torrèsani, *Time-frequency fading algorithms based on Gabor multipliers*, *IEEE Journal on Selected Topics in Signal Processing*, Vol. 15, No. 1, Jan. 2021.

Invited conference papers with proceedings:

- ◆ Caroline ChauX, Amel Benazza-Benyahia and Jean-Christophe Pesquet, *A block-thresholding method for multispectral image denoising*, *SPIE (Society of Photo-Optical Instrumentation Engineers) Conference*, San Diego, CA, USA, août 2005, vol 5914, pages 1H-1-1H-13.
- ◆ Caroline ChauX, Amel Benazza-Benyahia and Jean-Christophe Pesquet, *Use of Stein's principle for multichannel image denoising*. *IEEE-EURASIP International Symposium on Control, Communications, and Signal Processing (ISCCSP 2006)*, Marrakech, 13-15 march 2006, 6 pages.
- ◆ Laurent Duval, Caroline ChauX and Jean-Christophe Pesquet, *M-band filter banks and dual-tree wavelets for engine combustion and geophysical image analysis*, "Wavelet Applications in Industrial Processing IV", on *SPIE Symposium Optics East*, Boston, MA, USA, oct. 2006 (Optics East), 12 pages.
- ◆ Caroline ChauX, Laure Blanc-Féraud, Josiane Zerubia, *Wavelet-based restoration methods: application to 3D confocal microscopy images*, *SPIE 2007 Wavelets XII*, San Diego, 26-29 aug. 2007, 11 pages.
- ◆ Amel Benazza-Benyahia, Jean-Christophe Pesquet, Caroline ChauX, *Image Denoising in the Wavelet Transform Domain Based on Stein's Principle* (Tutorial), 1st *IEEE international Workshops on Image Processing Theory, Tools and Applications (IPTA'08)*, Sousse, Tunisia, Nov. 23-26, 2008, 9 pages.
- ◆ Lotfi Chaari, Nelly Pustelnik, Caroline ChauX, Jean-Christophe Pesquet, *Solving inverse problems with over-complete transforms and convex optimization techniques*, *SPIE 2009 Wavelets XIII*, San Diego, 2-4 aug. 2009.
- ◆ Nelly Pustelnik, Caroline ChauX, Jean-Christophe Pesquet, *Hybrid regularization for data restoration in the presence of Poisson noise*, *EUSIPCO 2009*, Glasgow, 24-28 Aug. 2009, 5 pages.
- ◆ Alexandru Marin, Caroline ChauX, Jean-Christophe Pesquet and Philippe Ciuciu, *Image reconstruction from multiple sensors using Stein's principle. Application to parallel MRI.*, *ISBI 2011*, Chicago, 30 Mar-2 Apr. 2011, 4 pages.
- ◆ Raffaele Gaetano, Béatrice Pesquet-Popescu, Caroline ChauX, *A Convex Optimization Approach for Image Resolution Enhancement from Compressed Representations*, *DSP 2013*, 1-3 Jul. 2013, Santorini, Greece, 8 pages.

- ◆ Mai Quyen Pham, Caroline Chaux, Laurent Duval, and Jean-Christophe Pesquet, *A constrained-based optimization approach for seismic data recovery problems*, ICASSP 2014, 4-9 May 2014, Firenze, Italy, pp. 2377 - 2381.
- ◆ Anna Jezierska, Jean-Christophe Pesquet, Hugues Talbot, Caroline Chaux, *Iterative Poisson-Gaussian Noise Parametric Estimation for Blind Image Denoising*, ICIP 2014, Oct. 2014, Paris, France.
- ◆ Ama Marina Krémé, Valentin Emiya, Caroline Chaux, *Phase reconstruction for time-frequency inpainting*, LVA-ICA, Guildford, UK, Jul. 2-6 2018.

Regular conference papers with proceedings:

- ◆ Caroline Chaux, Laurent Duval and Jean-Christophe Pesquet, *Hilbert Pairs of M-band Orthonormal Wavelet Bases*, European Signal Processing Conference (EUSIPCO 2004), Vienne, Autriche, sept. 2004, p. 1187-1190.
- ◆ Caroline Chaux, Laurent Duval and Jean-Christophe Pesquet, *2D dual-tree M-band wavelet decomposition*, IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2005), Philadelphia, PA, USA, mars 2005, p. 537-540.
- ◆ Caroline Chaux, Laurent Duval and Jean-Christophe Pesquet, *Seismic data analysis with a dual-tree M-band wavelet transform*, 67th European Assoc. of Geophysicists and Engineers (EAGE) Conference, Madrid, juin 2005, 4 pages.
- ◆ Caroline Chaux, Laurent Duval, Jean-Christophe Pesquet, *Étude du bruit dans une analyse M-bandes en arbre dual*, GRETSI 2005, Louvain, Belgique, sept. 2005, p. 229-232.
- ◆ Caroline Chaux, Patrick L. Combettes, Jean-Christophe Pesquet, Valérie R. Wajs, *A forward-backward algorithm for deconvolution with sparse representations*, Signal Processing with Adaptive Sparse Structured Representations workshop (SPARS'05), Rennes, nov. 2005, p. 49-52.
- ◆ Caroline Chaux, Laurent Duval, Amel Benazza-Benyahia and Jean-Christophe Pesquet, *A new estimator for image denoising using a 2D Dual-Tree M-band Wavelet Decomposition*, IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP 2006), Toulouse, vol. 3, 14-19 mai 2006, p. 249-252.
- ◆ Caroline Chaux, Patrick L. Combettes, Jean-Christophe Pesquet, Valérie R. Wajs, *Iterative Image Deconvolution Using Overcomplete Representations*, European Signal Processing Conference (EUSIPCO 06), Florence, 4-8 sept. 2006, 5 pages.
- ◆ Caroline Chaux, Jean-Christophe Pesquet and Laurent Duval, *2D Dual-Tree Complex Biorthogonal M-band Wavelet Transform*, ICASSP 2007, Honolulu, Hawaii, USA, 15-20 avril 2007, vol. 3, p. 845-848.
- ◆ Laurent Duval, Caroline Chaux, Stéphane Ker, *Coherent noise removal in seismic data with dual-tree M-band wavelets*, SPIE 2007 Wavelets XII, San Diego, 26-29 août 2007, 11 pages.
- ◆ Caroline Chaux, Patrick L. Combettes, Jean-Christophe Pesquet, Valérie R. Wajs, *Opérateurs proximaux pour la restauration bayésienne de signaux*, GRETSI 2007, Troyes, 11-14 sept. 2007, p. 1277-1280.
- ◆ Nelly Pustelnik, Caroline Chaux, Jean-Christophe Pesquet, *A Constrained Forward-Backward Algorithm for Image Recovery Problems*, European Signal Processing Conference (EUSIPCO 08), Lausanne, 25-29 Aug. 2008, 5 pages.
- ◆ Nelly Pustelnik, Caroline Chaux, Jean-Christophe Pesquet *A wavelet-based quadratic extension method for image deconvolution in the presence of Poisson noise*, ICASSP 2009, Taipei, 19-24 Apr. 2009, 4 pages.
- ◆ Nelly Pustelnik, Caroline Chaux, Jean-Christophe Pesquet, Florent C. Sureau, Elodie Dusch, Claude Comtat, *Adapted Convex Optimization Algorithm for Wavelet-Based Dynamic PET Reconstruction*, Fully3D, Beijing, China, 5-10 Sep. 2009.
- ◆ Nelly Pustelnik, Caroline Chaux, Jean-Christophe Pesquet, *Extension des algorithmes imbriqués pour la résolution de problèmes d'optimisation convexe en imagerie*, GRETSI 2009, Dijon, 8-11 Sep. 2009

- ◆ Caroline Chaux, Laure Blanc-Féraud, *Estimation d'hyperparamètres pour la résolution de problèmes inverses à l'aide d'ondelettes*, GRETSI 2009, Dijon, 8-11 Sep. 2009
- ◆ Nelly Pustelnik, Jean-Christophe Pesquet, Caroline Chaux, *Proximal methods for image restoration using a class of non-tight frame representations*, EUSIPCO 2010, Aalborg, Danemark, 23-27 Août 2010, pages 611-615.
- ◆ Anna Jezierska, Caroline Chaux, Hugues Talbot, Jean-Christophe Pesquet, *Image quantization under spatial smoothness constraints*, ICIP 2010, Honk Kong, 26-29 Sep. 2010.
- ◆ Nelly Pustelnik, Caroline Chaux, Jean-Christophe Pesquet, Claude Comtat, *Parallel Algorithm and Hybrid Regularization for Dynamic PET Reconstruction*, IEEE Medical Imaging Conference, Knoxville, Tennessee, Oct. 30 - Nov. 6 2010.
- ◆ Anna Jezierska, Caroline Chaux, Jean-Christophe Pesquet, Hugues Talbot, *An EM approach for Poisson-Gaussian noise modeling*, European Signal Processing Conference (EUSIPCO), Barcelona, 29 Aug. - 2 Sep. 2011.
- ◆ Nelly Pustelnik, Jean-Christophe Pesquet, Caroline Chaux, *Bancs de filtres et méthodes proximales pour la restauration d'images*, GRETSI, Bordeaux, France, 5-8 Sep. 2011.
- ◆ Mireille El Gheche, Caroline Chaux, Jean-Christophe Pesquet, Béatrice Pesquet-Popescu, Joumana Farah, *Méthodes proximales pour l'estimation du champ de disparité à partir d'une paire d'images stéréoscopiques en présence de variations d'illumination*, GRETSI, Bordeaux, France, 5-8 Sep. 2011.
- ◆ Mireille El Gheche, Jean-Christophe Pesquet, Joumana Farah, Caroline Chaux, Béatrice Pesquet-Popescu, *Disparity map estimation under convex constraints using proximal algorithms*, IEEE Workshop on Signal Processing Systems (SiPS), Beirut, Lebanon, Oct. 4-7 2011.
- ◆ Anna Jezierska, Hugues Talbot, Caroline Chaux, Jean-Christophe Pesquet, Gilbert Engler, *Poisson-Gaussian noise parameter estimation in fluorescence microscopy imaging*, International Symposium on Biomedical Imaging (ISBI), Barcelona, May 2-5, 2012.
- ◆ Diego Gagnaniello, Caroline Chaux, Jean-Christophe Pesquet, *A Convex Variational Approach for Multiple Removal in Seismic Data*, European Signal Processing Conference (EUSIPCO), Bucharest, Romania, 27 Aug. - 31 Aug. 2012.
- ◆ Roberto Cavicchioli, Caroline Chaux, Laure Blanc-Féraud, Luca Zanni, *ML estimation of wavelet regularization hyperparameters in inverse problems*, ICASSP, Vancouver, Canada, 26-31 May 2013.
- ◆ Mai Quyen Pham, Caroline Chaux, Laurent Duval, Jean-Christophe Pesquet, *Seismic multiple removal with a Primal-Dual proximal algorithm*, ICASSP, Vancouver, Canada, 26-31 May 2013.
- ◆ Mai Quyen Pham, Caroline Chaux, Laurent Duval, Jean-Christophe Pesquet, *Filtrage de multiples sismiques par ondelettes et optimisation convexe*, GRETSI, Brest, France, 3-6 Sep. 2013.
- ◆ Xuan Thanh Vu, Caroline Chaux, Sylvain Maire, Nadège Dorothée Thirion-Moreau, *Study Of Different Strategies For The Canonical Polyadic Decomposition Of Nonnegative Third Order Tensors With Application To The Separation Of Spectra In 3D Fluorescence Spectroscopy*, MLSP, Reims, France, 21-24 Sep. 2014.
- ◆ Lotfi Chaari, Jean-Yves Tourneret and Caroline Chaux, *Sparse Signal Recovery Using A Bernoulli Generalized Gaussian Prior*, EUSIPCO, Nice, France, 31 Aug. - 4 Sep. 2015.
- ◆ Emilie Chouzenoux, Lisa Lamassé, Sandrine Anthoine, Caroline Chaux, Alexandre Jaouen, Ivo Vanzetta, Franck Debarbieux, *Approche variationnelle pour la déconvolution rapide de données 3D en microscopie biphotonique*, GRETSI, Lyon, France, 8-11 Sep. 2015.
- ◆ Mai Quyen Pham, Caroline Chaux, Laurent Duval, Jean-Christophe Pesquet, *Sparse adaptive template matching and filtering for 2D seismic images with dual-tree wavelets and proximal methods*, ICIP, Québec city, Canada, 27-30 Sep. 2015.
- ◆ Sara Cadoni, Emilie Chouzenoux, Jean-Christophe Pesquet, Caroline Chaux, *A block parallel Majorize-Minimize memory gradient algorithm*, ICIP, Phoenix, USA, 25-28 Sep. 2016.

- ◆ Xuan Thanh Vu, Caroline Chaux, Nadège Dorothée Thirion-Moreau, Sylvain Maire, *A proximal approach for nonnegative tensor decomposition*, LVA-ICA, Grenoble, France, 21-23 Feb. 2017.
- ◆ Ronan Hamon, Caroline Chaux, Valentin Emiya, De la faiblesse de rang en temps-fréquence, GRETSI, Juan-les-Pins, France, 5-8 Sep. 2017.
- ◆ Valentin Emiya, Ronan Hamon, and Caroline Chaux, *Being low-rank in the time-frequency plane*, ICASSP, Calgary, Canada, Apr. 15-20 2018.
- ◆ Konstantin Usevich, Valentin Emiya, David Brie, Caroline Chaux, *Characterization of finite signals with low-rank STFT*, SSP, Freiburg, Germany, Jun. 2018.
- ◆ Afef Cherni, Elena Piersanti, Caroline Chaux, *NMF-based sparse unmixing of complex mixtures*, SPARS, Toulouse, France, 1-4 Jul. 2019.
- ◆ Afef Cherni, Caroline Chaux, *Régularisation mixte et parcimonie pour la séparation aveugle de source en spectroscopie RMN 2D*, GRETSI, Lille, France, 26-29 Aug. 2019.
- ◆ Afef Cherni, Sandrine Anthoine, Caroline Chaux, *β -NMF and sparsity promoting regularizations for complex mixture unmixing. Application to 2D HSQC NMR*. ICASSP, Barcelone, Spain, 4-8 May 2020.
- ◆ Ama Marina Kremer, Valentin Emiya, Caroline Chaux, Bruno Torrèsani, *Filtering out time-frequency areas using Gabor Multipliers*. ICASSP, Barcelone, Spain, 4-8 May 2020.
- ◆ Nelly Pustelnik, Caroline Chaux, *Evolution de la résolution de problèmes inverses en imagerie*, GRETSI, Grenoble, France, Aug. 28 - Sep. 1, 2023.
- ◆ Elizabeth Z. C. Tan, Caroline Chaux, Emmanuel Soubies, and Vincent Y. F. Tan, *Deep Unrolling for Nonconvex Robust Principal Component Analysis*, MLSP, Rome, Italy, Sep. 17-20, 2023.
- ◆ Pascal Nguyen, Emmanuel Soubies, Caroline Chaux, *MAP-informed Unrolled Algorithms for Hyper-parameter Estimation*, ICIP, Kuala Lumpur, Malaysia, 8-11 Oct. 2023.
- ◆ Marida Di Crosta, Boris Huljak, Caroline Chaux, *The city and its replica - From linear perspective to Digital Twins, the challenge of connecting urban space and its representations.*, 9ème édition du colloque HyperUrbain, Agadir, Morocco, 23-25 Nov. 2023.

Book chapter:

- ◆ Caroline Chaux, Amel Benazza-Benyahia, Jean-Christophe Pesquet, Laurent Duval, *Wavelet transform for the denoising of multivariate images*, in *Multivariate Image Processing*, C. Collet, J. Chanussot, K. Chehdi Eds., Nov. 2009.

Patent:

- ◆ Caroline Chaux, Laurent Duval, Jean-Christophe Pesquet, Mai Quyen Pham, *Procédé de traitement de réflexions multiples*, no. 12/02.299 (France), 24/08/2012.

Other presentations:

- ◆ Oral presentation in Workshop “Contenu Informatif des Images Numériques” in ENS de Cachan, Paris, nov. 2004.
- ◆ Laurent Duval, Caroline Chaux, Jean-Christophe Pesquet and Karine Broto, *Seismic data analysis and filtering with dual-tree M-band wavelets*, SIAM Conference on Mathematical and Computational Issues in the Geosciences, Avignon, juin 2005.
- ◆ Oral presentation in Workshop “Geometrical Transforms for Image Processing - Application to Satellite Image Restoration and Compression” in CNES, Toulouse, nov. 2005.
- ◆ Seminar at INRIA Sophia-Antipolis Méditerranée, *Analyse en ondelettes M-bandes en arbre dual; application au débruitage d’images*, dec. 2006.

- ◆ ADSTIC Seminar, *Dual-tree M-band wavelet transform*, Sophia-Antipolis, mars 2007.
- ◆ Seminar in CEA Saclay, *Transformée en ondelettes directionnelle pour la restauration d'images*, sept. 2007.
- ◆ Oral presentation in GdR ISIS - Analyse d'Images Multivariées, *Un nouvel estimateur basé sur le principe de Stein pour le débruitage d'images multicanaux*, Paris, nov. 2007.
- ◆ Oral presentation in GDR ISIS - Avancées méthodologiques en inversion, *Algorithmes itératifs pour la résolution de problèmes inverses*, Paris, march 2008.
- ◆ Oral presentation in GDR ISIS - Journées représentations parcimonieuses, *Représentations parcimonieuses et algorithmes itératifs pour la restauration d'images*, Paris, avr. 2008.
- ◆ Seminar in Paris 6 "Méthodes Mathématiques du Traitement d'Images", *Algorithmes itératifs décomposés pour la résolution de problèmes inverses sous contrainte à l'aide d'ondelettes*, jan. 2009.
- ◆ Oral presentation in GDR ISIS - Problèmes inverses - Estimation des hyperparamètres, *Estimation des paramètres de régularisation sur des coefficients d'ondelettes par maximum de vraisemblance en données incomplètes*, march 2009.
- ◆ Oral presentation in Porquerolles 2009 workshop "Approximation and optimization in image restoration and reconstruction", *Hybrid regularization for data restoration*, june 2009.
- ◆ Oral presentation in the statistics seminar of IRMAR 2009 *Ondelettes et estimateurs statistiques. Application à la restauration d'images*, Nov. 2009.
- ◆ Oral presentation in "Mathematics and Image Analysis 2009" workshop (MIA 2009), *Wavelet-Based Statistical Estimators. Application to image restoration*, Dec. 2009.
- ◆ Oral presentation in JSTAR 2010, *Large size image reconstruction by using wavelet-based statistical estimators*, Oct. 2010.
- ◆ Oral presentation in GDR ISIS - Inversion et Assimilation d'Images (invited presentation), *Ondelettes et optimisation convexe pour la résolution de problèmes inverses*, Jun. 2011.
- ◆ Oral presentation in the symposium on "Variational Image Analysis" (VIA'11), *Proximal Methods for Disparity Map Estimation*, Jul. 2011.
- ◆ Seminar in Aix-Marseille Université - LATP "Signal processing - machine learning seminars ", *Méthodes proximales et ondelettes pour la résolution de problèmes inverses*, Oct. 2011.
- ◆ Oral presentation in the workshop "International Traveling Workshop for Interacting Sparse Model and Technology" (iTWIST), *A hybrid optimization approach for vector quantization*, May 2012.
- ◆ Oral presentation to the conference "Méthodes mathématiques pour l'image", *Un algorithme de type EM pour l'estimation des paramètres d'un bruit Poisson+Gaussien en imagerie*, Jun. 2012.
- ◆ Oral presentation to "Hyperparameter tuning" in FRUMAM (Marseille), *ML estimation of hyperparameters in inverse problems with wavelet regularization*, Oct. 2012.
- ◆ Oral presentation in the workshop "Optimization and Statistical Learning" (OSL), *Some applications of proximal methods*, Jan. 2013.
- ◆ Poster presentation in "The Meetings of Digital Technologies" (french ANR) , *ANR Défis DIAMOND*, Apr. 2013.
- ◆ Seminar in Institut de Mathématiques de Toulouse, *Proximal methods for multiple removal in seismic data*, Jun. 2013.
- ◆ Seminar in INRIA Sophia-Antipolis Méditerranée, AYIN, *Mixed discrete/continuous optimization approaches for Poisson-Gaussian noise parameter estimation*, Sep. 2013.

- ◆ Oral presentation at I2M in the working group “Math-Cancer”, *Problèmes inverses en imagerie biologique*, Nov. 2014.
- ◆ Oral presentation in GDR ISIS - (invited presentation), *Approche Hamiltonienne et méthode de Monte Carlo pour l'échantillonnage d'une loi non différentiable*, Nov. 2015.
- ◆ Oral presentation at I2M, group ALEA day - *Seismic Multiple Removal using sparse representations and proximal methods*, Oct. 2016.
- ◆ Oral presentation at SIGMA'2016 workshop (CIRM) - *A proximal algorithm for third order tensor decomposition and application to fluorescence spectroscopy*, 30 Oct. - 4 Nov. 2016.
- ◆ Oral presentation at CIRM for “Tribute to Claude Shannon” - *L'échantillonnage*, 4 Nov. 2016.
- ◆ Oral presentation at Imaging in Paris seminar (IHP Paris) - *Nonnegative Tensor Factorization using a proximal algorithm, application to 3D fluorescence spectroscopy*, 2 Feb. 2017.
- ◆ Oral presentation at Sigma team Lille seminar - *Proximal approaches and there applications to seismic multiple removal and tensor factorization*, 18 Dec. 2017.
- ◆ Oral presentation at SIAM Imaging Science, Bologna, Italy - *A block coordinate proximal algorithm for N-th order tensor decomposition*, 5-8 Jun. 2018.
- ◆ Oral presentation at IHP for thematic trimester “The mathematics of imaging” - *From the modeling of direct problems in image processing to the resolution of inverse problems*, 4-8 Feb. 2019.
- ◆ Oral presentation at Faraday Discussions meeting, Edimbourg, UK - *Challenges in the decomposition of 2D NMR spectra of mixtures of small molecules*, 13-15 May 2019.
- ◆ Oral presentation at SPARS workshop, Toulouse - *NMF-based sparse unmixing of complex mixtures*, 1-4 Jul. 2019.
- ◆ Oral presentation at iTWIST workshop (international Traveling Workshop on Interactions between low-complexity data models and Sensing Techniques), Nantes - *Unmixing 2D HSQC NMR mixtures with β -NMF and sparsity*, 2-4 Dec. 2020.
- ◆ Oral presentation at Centuri seminar (Turing Centre for Living Systems), Marseille - *Formulation and resolution of inverse problems in signal and image processing*, 19 Apr. 2021.
- ◆ Oral presentation at summer school “AI for Medical Image Applications” (Marseille Imaging Institut), Marseille - *Solving inverse problems in signal and image processing*, 17 Sep. 2021.
- ◆ Oral presentation at the Descartes Week, Singapore - *Formulation and resolution of inverse problems in signal and image processing - From classical methods to hybrid AI*, Oct. 2-6, 2023.

Award

- ◆ **Best Student Paper Award** at IEEE ICASSP 2005 conference.
- ◆ **Best PhD thesis award** from club EEA 2008.

Industrial valorisation and softwares

- ◆ **2 Contracts with the Institut Français du Pétrole** (2005 and 2007) for the design of a Matlab Toolbox on seismic image denoising using directional filter banks and a second one for multivariate image denoising.

- ◆ Design of a **Matlab Toolbox free to download** on my web page allowing to proceed the 1D M -band dual-tree tree wavelet transform.
- ◆ **1 Contract with the Institut Français du Pétrole** (Jan.-Sep. 2011) in order to propose a new method based on wavelets and convex analysis allowing to remove the multiples in seismic data. This project allows the deposit of one patent in Aug. 2012.
- ◆ **1 Contract with Thalès Alenia Space** (Sep. 2011 - Jun. 2012) in order to propose a new method to remove motion blur in high resolution observation images.
- ◆ Design of a **Matlab Toolbox free to download** on my web page allowing to restore images using Stein principle (SURE) and more precisely, SURE-LET (Linear Expansion of Threshold).
- ◆ Participation to **public projects**:
 - Participation to the French National Research Project *New mathematical methods for restoring multichannel images* (MULTIM).
Collaboration with Laboratoire Jacques-Louis Lions of Jussieu (P. L. Combettes et V. R. Wajs) in the context of this ACI.
 - Participation to **ANR OPTIMED** *Algorithmes d'optimisation décomposés pour les problèmes d'imagerie médicale de grande taille* (2006-2009).
 - Participation to **ANR DIAMOND** *Deconvolution of Augmented Images in Multi-Dimensional Optical Microscopy* (2009-2012).
 - Subcontracting with **Institut Telecom (Paris)** (Nov. 2010-Oct. 2012) for the european project ACDC <http://acdc-itea.org/>.
 - Participation to the french research project **SUPER BQR RICO 3D** *Reconstruction and Illumination using Continuous Optimization in 3D* (2011-2013).
 - Participation to the french project **Young researcher GdR ISIS - GRETSI** (head: E. Chouzenoux) *Optimization approaches for Two-Photon microscopy imaging*. (2013-2015).
 - Participation to **ANR MAD** *Missing Audio Data Inpainting* (2014-2017).
 - Participation to the french research project **Projet Défi Imag'in OPTIMISME** (head: J.-C. Pesquet) *Stochastic optimization for multispectral Imaging* (2015-2016).
 - Participation to the french research project **Amidex Interdisciplinarité BIFROST** (head: C. Chaux) *Blind Identification, Filtering & Restoration On Spectral Techniques* (2018-2021).
 - Participation to the french research project **PEPS I3A** (head : K. Usevich) *Simplify neural networks: a tensor-based approach* (2018).
 - Participation to the France Life Imaging research project **FLI COCON** (co-head: C. Chaux) *Co-conception of fast tomographic approaches for high quality 3D photoacoustic imaging* (2021-2023).
 - Participation to the French-Singaporean **Descartes** project (A CREATE Program on Intelligent Modelling for Decision-making in Critical Urban Systems) (C. Chaux Lead PI WP3) *Optimization driven hybrid AI*. (2021-2026).
 - Participation to the french project **Young researcher GdR ISIS - GRETSI** (Head: L. Calatroni) *SPLIN - SParse & non-convex optimisation for Learning of INverse image microscopy problems* (2021-2023).
 - Participation to the CNRS project (IPAL/I2M) **OLEAVE** (Head: C. Chaux) *Optimization and LEARNING based strategies for the resolution of inVERSE problems* (2023).

Scientific responsibilities

- ◆ **Webmaster** of the ACI MULTIM website, <http://www-syscom.univ-mlv.fr/ACI>.
- ◆ Participation to **Ecole Analyse Multirésolution du club EEA** (summer school) in Le Creusot, Mar. 2009.

- ◆ Co-organisation of the Porquerolles workshop “Approximation and optimization in image restoration and reconstruction” <http://www-syscom.univ-mlv.fr/porquerolles2009/>, 8-12 Jun. 2009.
- ◆ Co-organisation with J. Idier of a special session in EUSIPCO 2009 on “Optimisation and inverse problems”.
- ◆ **Webmaster** of the ANR DIAMOND website, <http://www-syscom.univ-mlv.fr/ANRDIAMOND>.
- ◆ Co-organisation of a GdR meeting involving GDR ISIS and GDR MSPC on *Optimisation de critères convexes non différentiables pour la résolution de problèmes inverses* in Paris, 7 Dec. 2010, <http://www.ceremade.dauphine.fr/peyre/mspc/mspc-isis-10/>.
- ◆ Co-organisation with R. Gribonval of a GdR ISIS meeting on *Geometrical multiresolution transforms* in Paris, 1 Apr. 2011.
- ◆ Session chair at GRETSI 2011
- ◆ Participation to **Ecole Analyse Multirésolution du club EEA** (summer school) in Auxerre, Jun. 2012.
- ◆ Co-organisation with N. Bertaux, J. Fadili and J. Idier of a GdR ISIS meeting on *Inverse problems: optimization and parallelization* in Paris, 29 Jun. 2012.
- ◆ Elevation to the IEEE *Senior Member* grade, Apr. 2013.
- ◆ Co-organisation with S. Anthoine, V. Emiya, C. Mélot and F. Richard of a GdR ISIS meeting on *Complex valued signal processing* in Marseille, 12 Jun. 2013.
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 3 Dec. 2013 in Alcazar (Marseille). <http://treize.lif.univ-mrs.fr/>
- ◆ Co-organisation and participation to the doctoral school “Computational Harmonic Analysis - with Applications to Signal and Image Processing”, 20-24 Oct. 2014 et CIRM (Marseille) <http://feichtingertorresani.weebly.com/information1.html>
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 4 Dec. 2014 in Alcazar (Marseille). <http://treize.lif.univ-mrs.fr/>
- ◆ Co-organisation with V. Emiya and C. Févotte of a GdR ISIS meeting on *Missing data estimation* in Marseille, 8 Oct. 2015.
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 1 Dec. 2015 in Alcazar (Marseille). <http://treize.lif.univ-mrs.fr/>
- ◆ Organisation of the “Graphs and neurosciences” workshop, FRUMAM, Marseille, 18 Nov. 2016.
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 1 Dec. 2016 in Alcazar (Marseille). <http://treize.lif.univ-mrs.fr/>
- ◆ Organisation of a training course on “Graph signal processing; application to neurosciences”, FRUMAM, Marseille, 6-7 Feb. 2017 and 3-4 Apr. 2017. http://www.i2m.univ-amu.fr/seminaires_signal_apprentissage/Conf/Feb2017/
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 30 Nov. 2017 in Alcazar (Marseille). <http://treize.lif.univ-mrs.fr/>
- ◆ Participation to **école thématique GEOMDATA** (summer school) in Fréjus, 10-14 Sep. 2018. <https://geomdata.sciencesconf.org/>
- ◆ Co-organisation of a GdR meeting involving GDR ISIS and GDR OG in Paris, 8 Oct. 2018.
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 4 Dec. 2018 in La Joliette Minoterie (Marseille). <http://treize.lif.univ-mrs.fr/>

- ◆ Co-organisation of a GdR ISIS meeting “Théorie du deep learning”, 17 Oct. 2019, Paris.
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 5 Dec. 2019 in Espace Julien.
<https://treize.lis-lab.fr/>
- ◆ Co-organisation of the research school “Mathematics, Signal Processing and Learning”, 25 - 29 Jan. 2021, CIRM, Marseille.
<https://conferences.cirm-math.fr/2472.html>
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 15 Jun. 2021 in Espace Julien.
<https://treize.lis-lab.fr/>
- ◆ Co-organisation of a GdR meeting “Théorie du deep learning”, 28 Jun 2021, Online.
- ◆ Co-organisation of ILCB (Institute of Language Communication and the Brain) summer school at CIRM, Marseille, 30 Aug. -03 Sep. 2021
- ◆ Co-organisation of the workshop “High-Dimensional Data Analysis”, FRUMAM, Marseille, 21-22 Oct. 2021.
- ◆ Co-organisation of “Treize Minutes” Marseille, scientific vulgarization, 4 Apr. 2023 in Espace Julien.
<https://treize.lis-lab.fr/>
- ◆ Co-organisation of the French/Singaporean SinFra workshop, Toulouse, France, 29-30 June 2023.

- ◆ Reviewer for IEEE Trans. on Image Proc., IEEE Trans. on Signal Proc., IEEE Signal Proc. Letters, IEEE Trans. on Circuits and Systems and Signal Processing journal and for ICIP, ICASSP, SSP, ISBI, EUSIPCO and GRETSI conferences. Technical program committee member for RFIA 2012 and EUSIPCO 2012. Associate editor for ISBI.
- ◆ **Reviewer** for the french research agency (ANR) (project proposal evaluation 2013 and pre-project evaluation 2016) and **Reviewer** - Call “Credits and Projects” (2013 and 2014) of the Fund for Scientific Research - FNRS”.
- ◆ Author of PLUME index cards (Promoting Economical Useful and Maintained software For Higher Education And THE Research community), <http://www.projet-plume.org>.
- ◆ GRETSI association member (2012 - 2023) and responsible for the research part (2016 - 2023).
- ◆ SPTM TC member (2015-2020).
- ◆ ANR CES 40 member (2016-2019).
- ◆ Associate editor for IEEE Trans. on Signal Processing. (2018 - 2022)
- ◆ Head of the I2M signal and image (SI) team. (2020 - 2022)
- ◆ Member of the Senior Editorial Board for IEEE Signal Processing Magazine (2022-)
- ◆ **Interim director** of IPAL International Research Lab, Singapore (IRL CNRS 2955) (Dec. 2022 - Aug. 2023).

Internships

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| April 2005 | Invited for a week in North Carolina State University , Raleigh, USA, by professors H. Krim and D. Labate. The aim was to think of different approaches to generate two dimensional directional wavelets. |
| March to August 2003 | Institut Français du Pétrole : Seismic image analysis and denoising. |
| June to August 2002 | Laboratoire de traitement du signal of ETSI Industriales y Telecomunicación, Universidad de Cantabria, Santander (Spain) : numerical analysis of polysomnographic recordings. |
| January to February 2001 | GIAT Industries : telephone and computer networks maintenance. |

Languages

French native speaker.
English fluent.
Spanish fluent.

Operating systems Linux, Unix, Windows.

Softwares Matlab, Maple, Visual Basic C++ and J++, Borland C++, Word, Excel, Powerpoint, Access.

Programming languages C/C++, Java, Javascript, \LaTeX , HTML, SQL, ASP, XML, VRML.

Other interests

Music Piano and flute.

Sports Athletism (3^{rd} in National Universitary Championship 2003 of Cross Country), basket-ball.