Pierre-Antoine Thouvenin

Curriculum Vitae

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Research interests

Optimization — Non-convex optimization, stochastic optimization, online algorithms, proximal algorithms, distributed asynchronous optimization.

Bayesian inference — Statistical modeling, hierarchical Bayesian models, MCMC algorithms.

Applications — Blind source separation, hyperspectral imaging, remote sensing, radio-interferometric imaging.

Education

2014 – Sept. 2017 **PhD degree in Signal and Image Processing**, *Institut de Recherche en Informatique de Toulouse (IRIT)*, Toulouse, France.
Funding from the French Ministry of Defence (Direction Générale de l'Armement).

2011 – Sept. 2014 **Electrical engineering degree**, *École Nationale Supérieure d'Électronique, d'Électrotechnique, d'Informatique, d'Hydraulique et des Télécommunications (INP-ENSEEIHT)*, Toulouse, France.
Major in Signal and Image processing.

2009 – 2011 **Classes préparatoires scientifiques**, *Lycée Kléber*, Strasbourg, France.
Two year special undergraduate classes in Mathematics and Physics to prepare the competitive entrance examinations for admission in engineering schools.

June 2009 **Baccalauréat scientifique**, *Lycée Schwilgué*, Sélestat, France.

Distinctions

Dec. 2017 **Prix Léopold Escande**, *Institut National Polytechnique de Toulouse (INPT)*, France.
Distinction awarded to the best PhD theses defended at INPT between Nov. 2016 and Nov. 2017 (15% of the theses defended).

Oct. 2014 **Prix de l'INPT**, Toulouse, France.
Distinction awarded for outstanding academic achievement during the engineering degree.

Scientific experience

Jan. 2018 **Qualification aux fonctions de maître de conférence**, *section CNU 61 (Génie informatique, Automatique et Traitement du Signal)*.
French qualification to serve as an assistant professor in Signal Processing.

Sept. 2017 – today **Research associate at Heriot Watt University**, *Institute of Sensors, Signals and Systems (ISSS)*, Edinburgh, United-Kingdom.
Research conducted within the Biomedical and Astronomical Signal Processing (BASP) group under the supervision of Prof. Yves Wiaux.

Responsabilities
- Research in hyperspectral imaging and calibration for radio-interferometry;
- Intensive collaboration to the development of a parallel C++ library for radio-interferometric imaging, in collaboration with an HPC expert (library under developement, more details at `https://basp-group.github.io/Puri-Psi/`);
- Maintenance of the workstations and github page of the group (`https://github.com/basp-group`).

2014 - Oct. 2017 **PhD degree in Signal and Image Processing**, *IRIT*, University of Toulouse, France.

Advisors Prof. Nicolas Dobigeon and Prof. Jean-Yves Tourneret

Jury — Prof. Màrio Figueiredo, Prof. Jérôme Idier, Prof. Christian Jutten, Dr. Stéphane May, Prof. Jean-Christophe Pesquet, Mrs. Véronique Serfaty

Title — Modeling spatial and temporal variabilities in hyperspectral image unmixing

Keywords — Hyperspectral unmixing, source separation, variability, non-convex optimization, online algorithm, Bayesian inference, MCMC algorithms, distributed algorithms.

2014 (6 months) — **Research internship**, *IRIT*, University of Toulouse, France.

Advisors — Dr. Nicolas Dobigeon and Prof. Jean-Yves Tourneret

Title — Modeling spatial endmember variability in hyperspectral image unmixing

Keywords — Hyperspectral unmixing, spectral variability, Alternating Direction Method of Multipliers.

2013 (3 months) — **Electrical engineering internship**, *Itron*, 76185 Karlsruhe, Allemagne.

Advisors — Patrick Garcia and Philippe Vegnaduzzi

Title — Analysis of dysfunctions occurring on a gas-meter test bench.

Professional activities

Reviewing — IEEE Trans. Computational Imaging, IEEE Trans. Goescience and Remote Sensing.

Conference organization — International BASP Frontiers workshop 2019 (webmaster), IEEE IPAS 2018 (member of the technical program committee).

Teaching experience

2017–2019 — **Teaching assistant**, *Heriot-Watt University*, Edinburgh, United Kingdom.

Fields — Signal processing

Details — **Supervision of Matlab programming sessions and tutorials (L2 students)**, *68 h*, Introduction to signal processing, untitled "Signal & Systems", delivered to second-year electronics students. Course focused on the following concepts: continuous-time linear time-invariant system modeling, Fourier analysis, Fourier transform, Laplace transform.
Teaching supervisor: Prof. Yves Wiaux, Heriot-Watt University, Y.Wiaux@hw.ac.uk

2014–2017 — **Teaching assistant, department of Electronics and Signal Processing**, *INP-ENSEEIHT*, Toulouse, France.

Fields — Digital filtering, audio signal processing, algorithm implementation on Blackfin DSPs.

Skills — Supervision of practical sessions and projects (first and third year engineering students, equivalent to L3 and M2 level).

Details — **Supervision of practical session on digital signal processing (L3 students)**, *52.5h*, Initiation to digital signal processing given to first year engineering students in electronics, focused on digital filter synthesis (FIR and IIR filters).
Teaching supervisor: Prof. Nicolas Dobigeon, INP-ENSEEIHT, 2, rue Charles Camichel, 31071 Toulouse Cedex 7, France, Nicolas.Dobigeon@enseeiht.fr

Digital signal processing project (M2 students), *45h*, Projects devoted to the study of several topics in digital signal processing, based on research articles from the literature. Examples of proposed projects include the study of quantization effects on filter synthesis, the study of optimal filter synthesis (e.g., eigenfilter), or the implementation of interpolated FIR filters with an analysis of their computational and memory cost.
Teaching supervisor: Prof. Nicolas Dobigeon, INP-ENSEEIHT, 2, rue Charles Camichel, 31071 Toulouse Cedex 7, France, Nicolas.Dobigeon@enseeiht.fr

Programming on digital signal processors (DSP) (M2 students), *94.5h*, Practical sessions and project devoted to the implementation of audio effects (flanger, chorus, equalization, fade-in/out, filtering) on an Analog Device BlackFin (ADSP-BF533) DSP, with a fixed-point precision architecture. Algorithm development is conducted in C and assembly language.
Teaching supervisor: Dr. Adam Quotb, INP-ENSEEIHT, 2, rue Charles Camichel, 31071 Toulouse Cedex 7, France, adam.quotb@enseeiht.fr.

2014–2015 **Personal tutor**, Toulouse, France.
Self-employed personal tutor in mathematics and physics (undergraduate level).

Computing skills and languages

Computer languages	Julia, C/C++, VHDL, LaTeX	Softwares	MATLAB, ADS, OrCAD/PSpice
French	native		
English	C1 level (CEFRL level)		*fluent, Toeic 980/990 obtained in June 2013*
German	C1 level (CEFRL level)		*advanced level, Goethe-Zertifikat C1 obtained in June 2009*

References

Thesis advisor **Nicolas Dobigeon** (Professor), INP-ENSEEIHT, nicolas.dobigeon@enseeiht.fr.
Thesis co-advisor **Jean-Yves Tourneret** (Professor), INP-ENSEEIHT, jean-yves.tourneret@enseeiht.fr.

List of publications

▶ International journals

[J1] P.-A. Thouvenin, N. Dobigeon, and J.-Y. Tourneret, "A hierarchical Bayesian model accounting for endmember variability and abrupt spectral changes to unmix multitemporal hyperspectral images," *IEEE Trans. Comput. Imag.*, vol. 4, no. 1, pp. 32–45, Mar. 2018.

[J2] ——, "Partially asynchronous distributed unmixing of hyperspectral images," *IEEE Trans. Geosci. Remote Sens.*, 2018, to appear. [Online]. Available: `https://arxiv.org/abs/1710.02574`.

[J3] ——, "Hyperspectral unmixing with spectral variability using a perturbed linear mixing model," *IEEE Trans. Signal Process.*, vol. 64, no. 2, pp. 525–538, Jan. 2016.

[J4] ——, "Online unmixing of multitemporal hyperspectral images accounting for spectral variability," *IEEE Trans. Image Process.*, vol. 25, no. 9, pp. 3979–3990, Sep. 2016.

▶ International conferences

[C1] P.-A. Thouvenin, A. Repetti, A. Dabbech, and Y. Wiaux, "Time-regularized blind deconvolution approach for radio interferometry," in *Proc. IEEE Sensor Array and Multichannel Signal Process. Workshop (SAM)*, Sheffield, UK, Jul. 2018, pp. 475–479.

[C2] P.-A. Thouvenin, N. Dobigeon, and J.-Y. Tourneret, "Unmixing multitemporal hyperspectral images accounting for smooth and abrupt variations," in *Proc. European Signal Process. Conf. (EUSIPCO)*, Kos, Greece, Sep. 2017.

[C3] ——, "Unmixing multitemporal hyperspectral images with variability: An online algorithm," in *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, Shanghai, China, Mar. 2016.

[C4] ——, "A perturbed linear mixing model accounting for spectral variability," in *Proc. European Signal Process. Conf. (EUSIPCO)*, Nice, France, Sep. 2015, pp. 819–823.

▶ National conferences

[NC1] P.-A. Thouvenin, N. Dobigeon, and J.-Y. Tourneret, "Une approche distribuée asynchrone pour la factorisation en matrices non-négatives – application au démélange hyperspectral," in *Actes du XXVIième Colloque GRETSI*, in French, Juan-les-Pins, France, Sep. 2017.

[NC2] ——, "Estimation de variabilité pour le démélange non-supervisé d'images hyperspectrales," in *Actes du XXVième Colloque GRETSI*, in French, Lyon, France, Sep. 2015.