

# Pierre-Antoine THOUVENIN

## Curriculum Vitae

✉ pierreantoine.thouvenin@gmail.com

📁 pthouvenin.github.io/

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### Research interests

- Optimization Non-convex optimization, stochastic optimization, online algorithms, proximal algorithms, distributed asynchronous algorithms.
- Bayesian inference Statistical modeling, hierarchical Bayesian models, MCMC algorithms.
- Applications Blind source separation, hyperspectral imaging, remote sensing, radio-interferometric imaging.

### Education

- 2014 – Sep. 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 – Sep. 2014 **Electrical engineering degree**, *École Nationale Supérieure d'Électronique, d'Électrotechnique, d'Informatique, d'Hydraulique et des Télécommunications (INP-ENSEEIH)*, 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.
- Jun. 2009 **Baccalauréat scientifique**, *Lycée Schwilgué*, Sélestat, France.

### Distinctions

- Dec. 2017 **Léopold Escande Award**, *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 **Award from the Institut National Polytechnique de Toulouse (INPT)**, 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.
- Sep. 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.
- Responsibilities
  - 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 development, 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>).
- Keywords Primal-dual algorithm, variable metric block-coordinate forward-backward algorithm, joint calibration and imaging, radio- interferometry, HPC C++ library
- 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. Mário 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)	<b>Research internship</b> , <i>IRIT</i> , 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)	<b>Electrical engineering internship</b> , <i>Itron</i> , 76185 Karlsruhe, Allemagne.
Advisors	Patrick GARCIA and Philippe VEGNADUZZI
Title	Analysis of dysfunctions occurring on a gas-meter test bench.

## Scientific outputs

Publications	In preparation	2
	International journals	4
	International conferences	5
	National conferences	2
Softwares	Puri-Psi: a parallel C++ library for radio-interferometric imaging (in development) Codes will be made available at: <a href="https://basp-group.github.io/Puri-Psi/">https://basp-group.github.io/Puri-Psi/</a>	

## Professional activities

Refereeing	IEEE Trans. Comput. Imag., IEEE Trans. Goesci. and Remote Sens., IEEE Trans. Signal Process.
Conference organization	International BASP Frontiers workshop 2019 (webmaster), IEEE IPAS 2018 (member of the technical program committee).

## Teaching experience

2017–2019	<b>Teaching assistant</b> , <i>Heriot-Watt University</i> , Edinburgh, United Kingdom.
Fields	Signal processing
Details	<b>Supervision of Matlab programming sessions and tutorials (L2 students)</b> , 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	<b>Teaching assistant, department of Electronics and Signal Processing</b> , <i>INP-ENSEEIH</i> T, Toulouse, France.
Fields	Digital filtering, audio signal processing, algorithm implementation on Blackfin DSPs (C/assembly language).
Skills	Supervision of practical sessions and projects (first and third year engineering students, equivalent to L3 and M2 level).
Details	<b>Supervision of practical session on digital signal processing (L3 students)</b> , 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-ENSEEIH

T, 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-ENSEEIH, 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-ENSEEIH, 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++, Python (migrating from MATLAB), VHDL, L <sup>A</sup> T <sub>E</sub> X	Softwares	MATLAB, ADS, OrCAD/PSpice
French	native		
English	C1 level (CEFRL level)		<i>fluent, Toeic 980/990 obtained in June 2013</i>
German	C1 level (CEFRL level)		<i>advanced level, Goethe-Zertifikat C1 obtained in June 2009</i>

## References

Thesis advisor **Nicolas Dobigeon** (Professor), INP-ENSEEIH, nicolas.dobigeon@enseeiht.fr.  
 Thesis co-advisor **Jean-Yves Tournet** (Professor), INP-ENSEEIH, jean-yves.tournet@enseeiht.fr.

## List of publications

### ► International journals

- [J1] P.-A. Thouvenin, N. Dobigeon, and J.-Y. Tournet, “Partially asynchronous distributed unmixing of hyperspectral images,” *IEEE Trans. Geosci. Remote Sens.*, vol. 57, no. 4, pp. 2009–2021, Apr. 2019.
- [J2] —, “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.
- [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. Abdulaziz, M. Jiang, A. Repetti, and Y. Wiaux, “A faceted prior for scalable wideband computational imaging,” in *Signal Process. with Adaptive Sparse Structured Representations (SPARS) Workshop*, Toulouse, France, Jul. 2019, pp. 1–5.
- [C2] 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, U.-K., Jul. 2018, pp. 475–479.
- [C3] P.-A. Thouvenin, N. Dobigeon, and J.-Y. Tournet, “Unmixing multitemporal hyperspectral images accounting for smooth and abrupt variations,” in *Proc. European Signal Process. Conf. (EUSIPCO)*, Kos, Greece, Sep. 2017.
- [C4] —, “Unmixing multitemporal hyperspectral images with variability: An online algorithm,” in *Proc. IEEE Int. Conf. Acoust., Speech, and Signal Processing (ICASSP)*, Shanghai, China, Mar. 2016.

- [C5] —, “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. Tournet, “Une approche distribuée asynchrone pour la factorisation en matrices non-négatives – application au démelange hyperspectral,” in *Actes du XXVIème Colloque GRETSI*, in French, Juan-les-Pins, France, Sep. 2017.
- [NC2] —, “Estimation de variabilité pour le démelange non-supervisé d’images hyperspectrales,” in *Actes du XXVIème Colloque GRETSI*, in French, Lyon, France, Sep. 2015.