

# 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.

### 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-ENSEEIH)*, Toulouse, France.  
Specialization 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 in hyperspectral imaging and calibration for radio-interferometry, conducted within the Biomedical and Astronomical Signal Processing (BASP) group under the supervision of Prof. Yves Wiaux.
- 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) **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.

## Teaching experience

- 2017–Mar. 2018 **Teaching assistant**, *Heriot-Watt University*, Edinburgh, United Kingdom.  
 Fields Signal processing  
 Details **Supervision of Matlab programming sessions and tutorials (L2 students)**, 34 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-ENSEEIH**T, Toulouse, France.  
 Fields Digital filtering, audio signal processing, algorithm implementation on Blackfin DSPs.  
 Skills Supervision of practical sessions and projects (first and last 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 a comparative analysis of its 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, L <sup>A</sup> T <sub>E</sub> X	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

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## 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.

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## List of publications

### ► Submitted papers

- [S1] P.-A. Thouvenin, N. Dobigeon, and J.-Y. Tournet, “Partially asynchronous distributed unmixing of hyperspectral images,” 2017. [Online]. Available: <https://arxiv.org/abs/1710.02574>.

### ► International journals

- [J1] P.-A. Thouvenin, N. Dobigeon, and J.-Y. Tournet, “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] —, “Hyperspectral unmixing with spectral variability using a perturbed linear mixing model,” *IEEE Trans. Signal Process.*, vol. 64, no. 2, pp. 525–538, Jan. 2016.
- [J3] —, “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. Tournet, “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. Tournet, “Une approche distribuée asynchrone pour la factorisation en matrices non-négatives – application au démixage hyperspectral,” in *Actes du XXVIème Colloque GRETSI*, in French, Juan-les-Pins, France, Sep. 2017.
- [NC2] —, “Estimation de variabilité pour le démixage non-supervisé d’images hyperspectrales,” in *Actes du XXVIème Colloque GRETSI*, in French, Lyon, France, Sep. 2015.