Nicolas Chopin

Professor of data sciences

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Education

2010 **Habilitation à Diriger des recherches**, *Université Paris Dauphine*.
(French habilitation to supervise Ph.D. students, Viva 1st Dec. 2010)

1999–2003 **Ph.D. thesis in Statistics**, *Université Paris VI*, supervisor: Pr C.P. Robert.
Sequential Monte Carlo methods and their applications to Bayesian inference.

1997–1999 **Msc. in Economics and Statistics**, *ENSAE*.

1994–1997 **Msc. in Engineering**, *Ecole Polytechnique*.

Experience

Sept. 2006– to date **Professor of data sciences**, *ENSAE*, Malakoff, FRANCE.

2003–2006 **Lecturer in Statistics**, *Bristol University*, UK.

2002–2003 **Statistical methodologist**, *UMS-INSEE*, Paris, FRANCE.

1999–2002 **Junior Lecturer in Statistics**, *ENSAE*, Malakoff, France.

Research Interests

I am interested in Bayesian computation in a general sense, that is, the development of numerical methods to perform Bayesian learning and inference. I am particularly interested in:

- Monte Carlo methods, especially Sequential Monte Carlo (particle filtering): theory (convergence properties, etc), methodology, and applications; Importance sampling, Markov chain Monte Carlo (MCMC), and recently quasi-Monte Carlo.
- Deterministic approximations: Laplace, Variational Bayes and Expectation Propagation.

I am also interested in Bayesian modelling and practical applications: I am collaborating or have collaborated with scientists from different areas of Science, such as cosmology, neuro-sciences, and (very recently) public health.

Awards, distinctions and grants

- 2002 Leonard J. Savage Award for an outstanding doctoral dissertation in Bayesian econometrics and statistics ('Theory and Methods' section), International Society for Bayesian Analysis.
- EPSRC first grant EP/C015886/1, Oct 2005 - Oct 2008, £74.000 ; 'Novel Applications of Sequential Monte Carlo'. (Grant awarded on a competitive basis.)
- CREST coordinator of 'SP Bayes' (Statistique Bayésienne semi-paramétrique) ANR Project led by J. Rousseau (2008-10)
- ANR grant B3DCMB, 2017-2021, 145 KE; (Big Bang à partir de Big Data (du fond diffus cosmologique)

Teaching

- **ENSAE**: “Statistique 1” (2nd year, 20 hrs), “Monte Carlo and simulation” (2nd year, 16 hrs), “State-space models and sequential Monte Carlo (3rd year, 18 hrs)
- **Master M2 MVA**: “Graphical models” (M2, half of the 24h course)
- **Université Paris Dauphine**: “Hidden-Markov models and Particle methods” (M2, 18 hours, 2007 to 2015); “Time Series” (M1, 20 hours, 2008-09)
- **HEC Paris**: "Statistique" (L3, 50 hrs, 2011-2017)
- **HEC Lausanne**: “Introduction to Time series” (Msc, 28 hours, 2009-2014)
- **Bristol University**: Bayesian Analysis (18 hours, lvl 3, 2003-06), Introduction to Statistics (18 hours, lvl 2, 2003-06)
- **Ecole Polytechnique**: “chargé de cours incomplet” (60 hours, 2007-08)
- **Universita dell’Insubria**: Bayesian Analysis (18 hours, 2005)

Academic Responsibilities

- **Associate Editor:** Annals of Statistics (2019 to date); Biometrika (2018 to date); J. Roy. Stat. Soc. B (2012 to date); Stats & Comp. (2013-2017); Stat. Methods and Appl. (2012-2015); member (2013-14) and secretary (2015-16) of the research section of the RSS.
- **Membership:** American Statistical Association (ASA), Inst. of Mathematical Statistics (IMS), Royal Statistical Society (RSS), International Society for Bayesian Analysis (ISBA).
- **Ph.D. supervision:** Gabriel Ducrocq (CREST, 2019-22), Lionel Riou-Durand (CREST, 2016-19), Alexander Buchholz (CREST, 2015-18), Charles Findling (ENS, 2015-18, co-supervision), Vincent Cottet (CREST, 2014-17, position in French administration), Mathieu Gerber (Lausanne, 2012-15, lecturer at Bristol University), James Ridgway (CREST, 2012-15, Capital Fund Management), Pierre Jacob (CREST, 2009-12, co-supervision, assistant prof at Havard University), Christian Schäfer (CREST, 2009-2012), Giusi Moffa (Bristol, 2005-06), Elisa Varini (Bristol, 2004-05, co-supervision, junior researcher at CNR)
- **Ph.D. examiner:** Tobias Schwedes (Imperial, 2019), Jordan Franks (Jyväskylä, 2019), Daniel W. Kennedy (QUT, 2019), Changye Wu (Dauphine, 2018), Jeremy Heng (Oxford, 2016), Van Bien Bui (Nice, 2016), Yohan Petetin (Télécom Sud-Paris, 2014), Paul Bui Quang (Rennes, 2013), Sinan Yildirim (Cambridge, 2012), Salima El Kolei (Nice, 2012), Mohamed Sedki (Montpellier, 2012), Anthony Lee (Oxford, 2011), Meïli Baragatti (Marseille, 2011), Nicole White (QUT, 2011), Hugo Hammer (Trondheim, 2008), Zhen Liu (Lancaster, 2008), Adam Johansen (Cambridge, 2006), David Hastie (Bristol, 2004).
- **Conference organisation:** Master class in Bayesian Statistics (CIRM, Oct 2018), SMC 2015 (Paris, 26-28 Aug), NeuroStats 2014 (Warwick, 3-5 Sept)
- **Visits:** Yale (Feb 2019), Oxford (Apr 2017), Pompeu Fabra, Barcelone (May 2013), INRIA Bordeaux (Jul 2011), Cambridge (Oct 2010, Jan 2008, Apr 2007), Lisboa (Nov 2010), Insubria (Nov 2005), Trondheim (March 2013, Sept 2005), Bank of Canada (Sept 2004).
- **Admin:** Organiser of the Statistics seminar at Bristol University (2003-06), of the BiP reading group (ENSAE, 2008 to date), co-organiser of the Paris seminar on Monte Carlo methods (BigMC, 2008-2014).

Book

- Chopin, N. and Papaspiliopoulos, O. (2019). An introduction to Sequential Monte Carlo (forthcoming).

Publications

[1] M. Gerber, N. Chopin, and N. Whiteley. Negative association, ordering and convergence of resampling methods. **Ann. Statist.** 47.4 (2019), 2236–2260.

[2] A. Buchholz and N. Chopin. Improving Approximate Bayesian Computation via Quasi-Monte Carlo. **J. Comput. Graph. Statist.** 28.1 (2019), 205–219.

[3] A. Buchholz, N. Chopin, and P. E. Jacob. Adaptive Tuning Of Hamiltonian Monte Carlo Within Sequential Monte Carlo. **ArXiv preprint 1808.07730** (Aug. 2018).

[4] C. Andrieu, A. Doucet, S. Yildirim, and N. Chopin. On the utility of Metropolis-Hastings with asymmetric acceptance ratio. **arXiv e-prints**, arXiv:1803.09527 (Mar. 2018), arXiv:1803.09527.

[5] L. Riou-Durand and N. Chopin. Noise contrastive estimation: asymptotic properties, formal comparison with MC-MLE. **Electron. J. Stat.** 12.2 (2018), 3473–3518.

[6] N. Chopin and M. Gerber. Sequential quasi–Monte Carlo: introduction for non-experts, dimension reduction, application to partly observed diffusion processes. **Monte Carlo and quasi–Monte Carlo methods**. Vol. 241. Springer Proc. Math. Stat. Springer, Cham, 2018, 99–121.

[7] D. Alvares, C. Armero, A. Forte, and N. Chopin. Sequential Monte Carlo Methods in Random Intercept Models for Longitudinal Data. **Bayesian Statistics in Action: BAYSM 2016, Florence, Italy, June 19-21**. Ed. by R. Argiento, E. Lanzarone, I. Antoniano Villalobos, and A. Mattei. Cham: Springer International Publishing, 2017, 3–9.

[8] S. Vasishth, N. Chopin, R. Ryder, and B. Nicenboim. Modelling dependency completion in sentence comprehension as a Bayesian hierarchical mixture process: A case study involving Chinese relative clauses. **ArXiv preprint 1702.00564** (May 2017).

[9] S. Vasishth, B. Nicenboim, N. Chopin, and R. Ryder. Bayesian Hierarchical Finite Mixture Models of Reading Times: A Case Study. **PsyArXiv** (July 2017).

[10] C. J. Oates, M. Girolami, and N. Chopin. Control functionals for Monte Carlo integration. **J. R. Stat. Soc. Ser. B. Stat. Methodol.** 79.3 (2017), 695–718.

[11] M. Gerber and N. Chopin. Convergence of sequential quasi-Monte Carlo smoothing algorithms. **Bernoulli** 23.4B (2017), 2951–2987.

[12] N. Chopin and J. Ridgway. Leave Pima Indians alone: binary regression as a benchmark for Bayesian computation. **Statist. Sci.** 32.1 (2017), 64–87.

[13] C. Schretter, Z. He, M. Gerber, N. Chopin, and H. Niederreiter. Van der Corput and golden ratio sequences along the Hilbert space-filling curve. **Monte Carlo and quasi-Monte Carlo methods**. Vol. 163. Springer Proc. Math. Stat. Springer, [Cham], 2016, 531–544.

[14] P. Alquier, J. Ridgway, and N. Chopin. On the properties of variational approximations of Gibbs posteriors. **J. Mach. Learn. Res.** 17.239 (2016), Paper No. 239, 41.

[15] S. Barthelmé, N. Chopin, and V. Cottet. Divide and conquer in ABC: Expectation-Progagation algorithms for likelihood-free inference. **Handbook of Approximate Bayesian Computation**. Ed. by S. Sisson, Y. Fan, and M. Beaumont. Chapman and Hall / CRC, 2018.

[16] N. Chopin and M. Gerber. Application of sequential Quasi-Monte Carlo to autonomous positioning. **Signal Processing Conference (EUSIPCO), 2015 23rd European**. Aug. 2015, 489–493.

[17] N. Chopin, J. Ridgway, M. Gerber, and O. Papaspiliopoulos. Towards automatic calibration of the number of state particles within the SMC^2 algorithm. **ArXiv preprint 1506.00570** (June 2015).

[18] M. Gerber and N. Chopin. Sequential quasi Monte Carlo. **J. R. Stat. Soc. Ser. B. Stat. Methodol.** 77.3 (2015), 509–579.

[19] S. Barthelmé and N. Chopin. The Poisson transform for unnormalised statistical models. **Stat. Comput.** 25.4 (2015), 767–780.

[20] N. Chopin and S. S. Singh. On particle Gibbs sampling. **Bernoulli** 21.3 (2015), 1855–1883.

[21] N. Kantas, A. Doucet, S. S. Singh, J. Maciejowski, and N. Chopin. On particle methods for parameter estimation in state-space models. **Statist. Sci.** 30.3 (2015), 328–351.

[22] A. Gelman et al. Expectation propagation as a way of life. **ArXiv e-prints** (Dec. 2014).

[23] J. Ridgway, P. Alquier, N. Chopin, and F. Liang. PAC-Bayesian AUC classification and scoring. **Advances in Neural Information Processing Systems 27**. Ed. by Z. Ghahramani, M. Welling, C. Cortes, N. Lawrence, and K. Weinberger. Curran Associates, Inc., 2014, 658–666.

[24] P. Alquier, V. Cottet, N. Chopin, and J. Rousseau. Bayesian matrix completion: prior specification and consistency. **ArXiv preprint** 1406.1440 (2014).

[25] S. Barthelmé and N. Chopin. Expectation propagation for likelihood-free inference. **J. Amer. Statist. Assoc.** 109.505 (2014), 315–333.

[26] C. Andrieu, N. Chopin, A. Doucet, and S. Rubenthaler. Perfect simulation for the Feynman-Kac law on the path space. **ArXiv preprint 1210.0376** (Mar. 2013).

[27] N. Chopin, P. E. Jacob, and O. Papaspiliopoulos. SMC^2: an efficient algorithm for sequential analysis of state space models. **J. R. Stat. Soc. Ser. B. Stat. Methodol.** 75.3 (2013), 397–426.

[28] N. Chopin, J. Rousseau, and B. Liseo. Computational aspects of Bayesian spectral density estimation. **J. Comput. Graph. Statist.** 22.3 (2013), 533–557.

[29] S. S. Singh, N. Chopin, and N. Whiteley. Bayesian learning of noisy Markov decision processes. **ACM Trans. Model. Comput. Simul.** 23.1 (2013), Art. 4, 25.

[30] C. Schäfer and N. Chopin. Sequential Monte Carlo on large binary sampling spaces. **Stat. Comput.** 23.2 (2013), 163–184.

[31] N. Chopin, A. Gelman, K. L. Mengersen, and C. P. Robert. In praise of the referee. **ArXiv preprint 1205.4304** (May 2012).

[32] C. Andrieu et al. Some discussions of D. Fearnhead and D. Prangle's Read Paper "Constructing summary statistics for approximate Bayesian computation: semi-automatic approximate Bayesian computation". **ArXiv preprint 1201.1314** (Jan. 2012).

[33] N. Chopin and C. Robert. Discussion of "Catching up faster by switching sooner: a predictive approach to adaptive estimation with an application to the AIC–BIC dilemma" by Erven, Tim van and Grünwald, Peter and de Rooij, Steven. **Journal of the Royal Statistical Society (series B)** 74.3 (2012), 361–417.

[34] J. Rousseau, N. Chopin, and B. Liseo. Bayesian nonparametric estimation of the spectral density of a long or intermediate memory Gaussian process. **Ann. Statist.** 40.2 (2012), 964–995.

[35] N. Chopin, T. Lelièvre, and G. Stoltz. Free energy methods for Bayesian inference: efficient exploration of univariate Gaussian mixture posteriors. **Stat. Comput.** 22.4 (22 2012), 897–916.

[36] S. Barthelmé et al. Discussions on "Riemann manifold Langevin and Hamiltonian Monte Carlo methods" by M. Girolami and B. Caldherhead. **Journal of the Royal Statistical Society (series B)** 73.2 (2011), 123–214.

[37] N. Chopin and C. Robert. Comments on "Using TPA for Bayesian inference" by Huber, M. and Schott, S. **Bayesian Statistics 9**. Ed. by J. M. Bernardo et al. Oxford University Press, 2011, 257–282.

[38] N. Chopin and O. Papaspiliopoulos. Comments on "Bayesian variable selection for random intercept modeling of Gaussian and non-Gaussian Data" by Frühwirth-Schnatter, S. and Wagner, H. **Bayesian Statistics 9**. Ed. by J. M. Bernardo et al. Oxford University Press, 2011, 165–200.

[39] N. Chopin. Fast simulation of truncated Gaussian distributions. **Stat. Comput.** 21.2 (2011), 275–288.

[40] N. Chopin, P. Del Moral, and S. Rubenthaler. Stability of Feynman-Kac formulae with path-dependent potentials. **Stochastic Process. Appl.** 121.1 (2011), 38–60.

[41] N. Chopin et al. On Particle Learning; comments on "Particle learning for sequential Bayesian computation" by Lopes, Carvalho, Johannes, and Polson. **Bayesian Statistics 9**. Ed. by J. M. Bernardo et al. Oxford University Press, 2011, 317–360.

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[44] C. P. Robert, N. Chopin, and J. Rousseau. Rejoinder: Harold Jeffreys's Theory of Probability Revisited. **ArXiv preprint 0909.1008** (Jan. 2010).

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[48] C. P. Robert, N. Chopin, and J. Rousseau. Harold Jeffreys's theory of probability revisited. **Statist. Sci.** 24.2 (2009), 141–172.

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[52] N. Chopin and C. Robert. Comment on 'Estimating the integrated likelihood via posterior simulation using the harmonic mean equality', by Raftery et al. **Bayesian Statistics 8**. Ed. by J. M. e. a. (Bernardo. Oxford University Press, 2007, 371–416.

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[54] N. Chopin. Comment on 'Sequential Monte Carlo for Bayesian computation' by Del Moral et al. **Bayesian Statistics 8**. Ed. by O. U. P. Bernardo J. M. et al. (eds). 2007, 115–148.

[55] H. Rue, S. Martino, and N. Chopin. Discussion on 'Modern Statistics for Spatial Point Processes' by Mller and Waagepetersen. **Scandinavian Journal of Statistics** 34.4 (2007), 685–711.

[56] N. Chopin. Dynamic detection of change points in long time series. **Ann. Inst. Statist. Math.** 59.2 (2007), 349–366.

[57] N. Chopin. Inference and model choice for sequentially ordered hidden Markov models. **J. R. Stat. Soc. Ser. B Stat. Methodol.** 69.2 (2007), 269–284.

[58] N. Chopin and E. Varini. Particle filtering for continuous-time hidden Markov models. **Conference Oxford sur les méthodes de Monte Carlo séquentielles**. Vol. 19. ESAIM Proc. EDP Sci., Les Ulis, 2007, 12–17.

[59] N. Chopin. Discussion of 'Exact and efficient likelihood-based estimation for discretely observed diffusion processes' by Beskos et al. **Journal of the Royal Statistical Society (series B)** 68 (2006). Ed. by O. U. P. Bernardo J. M. et al. (eds), 333–382.

[60] N. Chopin. Central limit theorem for sequential Monte Carlo methods and its application to Bayesian inference. **Ann. Statist.** 32.6 (2004), 2385–2411.

[61] N. Chopin and F. Pelgrin. Bayesian inference and state number determination for hidden Markov models: an application to the information content of the yield curve about inflation. **J. Econometrics** 123.2 (2004), 327–344.

[62] N. Chopin. Comment on ‘Iid sampling with self-avoiding particle filters: the pinball sampler by Mengersen and Robert. **Bayesian Statistics 7**. Ed. by O. U. P. Bernardo J. M. et al. (eds). 2003, 277–292.

[63] N. Chopin. A sequential particle filter method for static models. **Biometrika** 89.3 (2002), 539–551.