

Yann OLLIVIER

Researcher in mathematics and computer science

Born May 26th, 1978

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French citizenship

Curriculum

- 2004 – present Research scientist at the CNRS, currently in the Computer Science department at Paris-Sud Orsay University, previously in the Mathematics department at the École Normale Supérieure in Lyon (2004–2010).
- 2009 “Habilitation à diriger des recherches” (accreditation to supervise research)
- 2000 – 2003 PhD in Mathematics, under the supervision of M. Gromov and P. Pansu.
- 1997 – 2001 Student at the École Normale Supérieure (ENS Ulm) in Paris.

Research topics & achievements

My research generally focuses on the introduction of probabilistic models on structured objects, and more particularly addresses the interplay between probability and differential geometry.

Probability and information theory for artificial intelligence. Ongoing project (2010) to develop probabilistic models well suited to the representation of, e.g., text in natural language or musical tunes. Possible applications include compression, machine translation, automated text correction.

Discrete curvature and its applications. I have been able to develop a notion of (Ricci) curvature that is valid on discrete spaces. The main tools come from optimal transport and Markov chains. Several results about smooth manifolds with positive curvature are extended to discrete spaces: spectral gap, concentration of measure, functional inequalities, etc. Geometric properties can thus be transferred to non-geometric settings, allowing for new results such as statistics of MCMC (Monte Carlo Markov chain) simulations. Even in the original setting of smooth manifolds, this point of view yields previously unknown results (spectral gap, ergodic-like properties).

Probabilistic general relativity. Since general relativity is non-linear, statistical fluctuations in the content of space-time do not cancel out on average. The net effect on space-time geometry is an emerging “apparent matter”. For instance, we have shown that small gravitational waves could generate large amounts of apparent matter in the Universe.

Random groups. What does a “typical” group look like? Gromov suggested ways to pick a group at random among all possible finitely presented groups; he showed that typically a random group is hyperbolic. In my PhD thesis I identified a number of properties of random groups, depending in particular on a density parameter. I have subsequently written a short book on the subject.

Selected works

Y. Ollivier, *Ricci curvature of Markov chains on metric spaces*, J. Funct. Anal. **256** (2009), no. 3, 810–864.

A. Joulin, Y. Ollivier, *Curvature, concentration, and error estimates for Markov chain Monte Carlo*, Ann. Probab. **38** (2010), no. 6, 2418–2442.

Y. Ollivier, *A January 2005 Invitation to Random Groups*, Ensaios Matemáticos **10**, Sociedade Brasileira de Matemática, Rio de Janeiro (2005).

Y. Ollivier, *Sharp phase transition theorems for hyperbolicity of random groups*, GAFA, *Geom. Funct. Anal.* **14** (2004), no. 3, 595–679.

C. Chevalier, F. Debbasch, Y. Ollivier, *Multiscale cosmological dynamics*, *Physica A* **388** (2009), 5029–5035.

Y. Ollivier, P. Senellart, *Finding related pages using Green measures: An illustration with Wikipedia*, *Proc. of the Twenty-Second Conference on Artificial Intelligence (AAAI 2007)*, 1427–1433.

Full list and files at <http://www.yann-ollivier.org/rech/>

Popular science

I have written several mathematical texts for the general public, available on my Web page. Some of them have been published, for instance in the French magazine *Quadrature*.

I used to be a member of the board of *Animath*, a French association promoting the diffusion of mathematics. I participated in coaching the French team to the International Mathematical Olympiad, delivered talks for high school students about contemporary mathematics, and was involved in the day-to-day life of the association.

Thus, I have developed communication skills with the media (TV, press), with the general public, and with students from middle school to college levels.

Scientific management & teaching

Advisor of a PhD student since September 2008.

Teaching. Lab sessions of C++ programming in Orsay (2001–2004); mandatory course on exposition technique and scientific English at the Master’s level at the ENS Lyon (2004–2008).

Project management. I was project leader for an ANR grant “Robust geometry and fluctuating space-times” from 2005 to 2008.

International conferences I organized: *Glimpses of geometry* (ENS Lyon, May 2008) and the summer school *Optimal transportation, Theory and applications* (Grenoble, June and July 2009). I also organized various working seminars.

Services to the community as usual in academia: referee reports for scientific journals and theses, participation in hiring committees, etc. In particular I was vice-chairman of the math department hiring committee at the ENS Lyon from 2005 to 2008.

Computer skills. I was Webmaster for my research group at the ENS Lyon (2004–2009). I wrote several small mathematical programs, some of which with hundreds of downloads.

Contacts in the industry. Collaboration with SYSTRAN, the leading machine translation company (development of probabilistic models).

Awards and honors

Bronze medal of the CNRS (2011).

First prize at the European Union Contest for Young Scientists (Helsinki, 1996).

Junior Fermat Prize (1995).

Second place in Mathematics at the “Concours général” (French general competition of high school students).

Second place in Physics at the “Concours général”.

International Mathematical Olympiad (Toronto, 1995).

First prize at the “Dictée de l’École normale supérieure” (1999).

Other interests

Philosophy, piano, choir singing, paleontology, economics, linguistics, etc.