Levent Sagun

Affiliation: EPFL **DOB:** March 28, 1987 **Contact:** leventsagun@gmail.com

Research Interests

Probability theory, statistical physics, and their applications on deep learning.
Statistical and geometric properties of loss functions in machine learning.

Education

2011 - 2017 Ph.D. in Mathematics, Courant Institute of Mathematical Sciences, New York University
Thesis title: Explorations on High Dimensional Landscapes: Spin Glasses and Deep Learning
Academic advisors: Gérard Ben Arous and Yann LeCun

2006 - 2011 B.S. in Mathematics, Boğaziçi University, Istanbul, Turkey
Double major: B.S. in Physics
Exchange program: Columbia University, New York, Fall 2009
Graduated first rank in the Faculty of Arts and Sciences, Class of 2011

2001 - 2006 High School, İstanbul Lisesi, Istanbul, Turkey

Academic Employment

2018 - 2019 Postdoctoral Fellow, École Polytechnique Fédérale de Lausanne, Switzerland
Simons Collaboration on Cracking the Glass Problem - Part II

2017 - 2018 Postdoctoral Fellow, École Normale Supérieure Paris & CEA Saclay, France
Simons Collaboration on Cracking the Glass Problem - Part I

2015 - 2016 Teaching Assistant, Center for Data Science, New York University

2011 - 2017 Research & Teaching Assistant, Department of Mathematics, Courant Institute, NYU

Industry Employment

2016 - 2017 Research Intern and Contractor, Facebook AI Research, New York
Project: Local geometry of solutions & effects of noisy algorithms in deep learning.
Manager: Léon Bottou

Papers

Stefano Spigler, Mario Geiger, Stéphane d'Ascoli, Levent Sagun, Giulio Biroli, Matthieu Wyart. A jamming transition from under- to over-parametrization affects loss landscape and generalization. Integration of Deep Learning Theories Workshop at NeurIPS, 2018.

David Lopez-Paz, Levent Sagun. Easing non-convex optimization with neural networks. Workshop Track at ICLR, 2018.

Marco Baity-Jesi, Levent Sagun, Mario Geiger, Stefano Spigler, Gérard Ben Arous, Chiara Cammarota, Yann LeCun, Matthieu Wyart, Giulio Biroli. Comparing Dynamics: Deep Neural Networks versus Glassy Systems. Conference Paper at ICML, 2018.

Levent Sagun, Utku Evci, V. Uğur Güney, Yann Dauphin, Léon Bottou. Empirical Analysis of the Hessian of Over-Parametrized Neural Networks. Workshop Track at ICLR, 2018.

Levent Sagun, Thomas Trogdon, Yann LeCun. Universal halting times in optimization and machine learning. Optimization Workshop at ICML, 2016; and *Quart. Appl. Math.*, **76**, *289-301*, 2018.

Andrew J. Ballard, Ritankar Das, Stefano Martiniani, Dhagash Mehta, Levent Sagun, Jacob D. Stevenson, David J. Wales. Perspective: Energy Landscapes for Machine Learning. *Phys. Chem. Chem. Phys.*, **19**, 12585-12603, 2017.

Matthew Dunn, Levent Sagun, Hale Şirin, Daniel Chen. Early Predictability of Asylum Court Decisions. ML and the Law, ICAIL Pages 233-236, 2017.

Pratik Chaudhari, Anna Choromanska, Stefano Soatto, Yann LeCun, Carlo Baldassi, Christian Borgs, Jennifer Chayes, Levent Sagun, Riccardo Zecchina. Entropy-SGD: Biasing Gradient Descent Into Wide Valleys. Conference Track at ICLR, 2017.

Levent Sagun, Uğur Güney, Gérard Ben Arous, Yann LeCun. Explorations on high dimensional landscapes. Workshop Track at ICLR, 2015.

Preprints

Mario Geiger, Stefano Spigler, Stéphane d'Ascoli, Levent Sagun, Marco Baity-Jesi, Giulio Biroli, Matthieu Wyart. The jamming transition as a paradigm to understand the loss landscape of deep neural networks. Preprint, available at arXiv:1809.09349, 2018.

Matthew Dunn, Levent Sagun, Mike Higgins, Uğur Güney, Volkan Cirik, Kyunghyun Cho. SearchQA: A New Q&A Dataset Augmented with Context from a Search Engine. Preprint, available at arXiv:1704.05179, 2017.

Levent Sagun, Léon Bottou, Yann LeCun. Eigenvalues of the Hessian in Deep Learning: Singularity and Beyond. Preprint, available at arXiv:1611.07476, 2017.

Reviewer duties

ICLR, JMLR, COLT, NeurIPS, TPAMI, SIAM Journal, Cambridge University Press

Talks and Presentations

A jamming transition from under- to over-parametrization affects loss landscape and generalization, NeurIPS Workshop on Integration of Deep Learning Theories, Montreal, December 2018
Over-paramertrization in NNs: observations and a definition, Google Brain, Montreal, November 2018
Over-paramertrization in NNs: observations and a definition, FAIR, Montreal, November 2018
Over-paramertrization in NNs: observations and a definition, MILA, Montreal, November 2018
An empirical look at the loss landscape: shape, dynamics, and loose ends, Statistical Physics and Machine Learning back together, Institut d'Études Scientifiques de Cargèse, Corsica, August 2018
Over-parametrization in Deep Learning, Institut für Theoretische Physik, Heidelberg, July 2018
Easing non-convex optimization with neural networks, ICLR 2018 Poster, May 2018

Empirical Analysis of the Hessian of Over-Parametrized Neural Networks, ICLR 2018 Poster, May 2018
Shape and Dynamics of the Loss Landscape, CILVR Lab Meetings, NYU, New York, April 2018
Shape and Dynamics of the Loss Landscape, High-Dimensional Dynamics Workshop, New York, April 2018
Comparing Dynamics: Deep Neural Networks versus Glassy Systems, Mathematics, Information and Computation Seminar, NYU, New York, March 2018
Over-parametrization in Deep Learning, Invited Visit at Google Brain, Zurich, January 2018
Over-parametrization in Deep Learning, Télécom ParisTech, Paris, November 2017
Over-parametrization in Deep Learning, Université Paris-Sud, Paris, November 2017
Over-parametrization in Deep Learning, Facebook AI Research, Paris, October 2017
Over-parametrization in Deep Learning, ENS, Paris, October 2017
The Role of Over-Parametrization in Optimization, Nonlinear and Stochastic Optimization at SIAM Conference on Optimization, Vancouver, May 2017
Singularity of the Hessian in deep learning, CILVR Lab Meetings, NYU, New York, November 2016
Universality in Halting Time, Spotlight talk at Optimization Workshop, ICML, New York, June 2016
Universality in Halting Time and Optimization, CILVR Lab Meetings, NYU, New York, April 2016
Explorations on High Dimensional Landscapes, Spotlight presentation, MLSS Kyoto, September 2015
Explorations on High Dimensional Landscapes, Poster presentation, DLSS, U. of Montreal, August 2015
Explorations on High Dimensional Landscapes, Poster presentation, ICLR, San Diego, May 2015
Optimization in High Dimensional Landscapes, ML Seminar, Boğaziçi University, January 2015
High Dimensional Landscapes: Spin Glasses and Deep Learning, ML Seminar, NYU, September 2014
Critical Points in High Dimensional Landscapes, NCAP Presentations by Participants, U of T, August 2014
An Introduction to Longest Increasing Subsequences, Boğaziçi University, June 2011
Insight into Theory of Large Deviations, Department of Mathematics, Boğaziçi University, May 2010
Conjugate Gradient Method, Student Seminars in Mathematics and Physics, Boğaziçi University, April 2010

Educational Experience

Statistical Physics and Machine Learning back together, Institut d'Études Scientifiques de Cargèse, Corsica, August 2018
Deep Learning and Statistical Physics, Beg Rohu Summer School, June 2018
Machine Learning Summer School, University of Kyoto, September 2015
Deep Learning Summer School, University of Montreal, August 2015
CIFAR Neural Computation & Adaptive Perception Summer School, University of Toronto, August 2014
Workshop on Stochastic Gradient Methods, IPAM, February 2014
St. Petersburg School in Probability and Statistical Physics, Chebyshev Laboratory, June 2012
Minicourse on Compressed Sensing by Emmanuel Candès, University of Cambridge, March 2011
Summer School on Complex Systems, Institute for Theoretical and Applied Physics, Summer 2010
Summer School on Computational Solution of Inverse Problems, Helsinki University, Summer 2010
Summer School on Dynamical Systems and Their Applications, Utrecht University, Summer 2009
Independent Study on Dynamical Systems, Boğaziçi University, Summer 2009

Teaching Experience

Recitation leader, Statistical and Mathematical Methods, NYU - Center for Data Science, Fall 2016
Recitation leader, Theory of Probability, Courant Institute, Fall 2016
Recitation leader, Machine Learning, NYU - Center for Data Science, Fall 2015
Recitation leader, Statistical and Mathematical Methods, NYU - Center for Data Science, Fall 2015
Recitation leader, Probability and Statistics, Courant Institute, Spring 2015
Recitation leader, Theory of Probability, Courant Institute, Fall 2014
Teaching assistant, Introduction to Mathematical Analysis II, Courant Institute, Spring 2014

Instructor for the Written Exam Workshop, Courant Institute, Fall 2013
Teaching Assistant for Statistics and Probability, Boğaziçi University, 2009-2010

Honors, Awards & Fellowships

MacCracken Fellowship, New York University, 2011-2016
Dora Aksoy Award, Department of Mathematics, Boğaziçi University, 2011
Hilmi Tolun Award, Faculty of Arts and Sciences, Boğaziçi University, 2011
Honorable Mention, 9^{th} National Mathematical Olympiads, Akdeniz University, Antalya, Turkey, 2004
Silver Medal, 5^{th} National Mathematical Olympiads for Junior High School Students, TÜBİTAK, 2001

References

Research

Gérard Ben Arous - benarous@cims.nyu.edu
Professor of Mathematics, Courant Institute of Mathematical Sciences, NYU
Associate Provost for the Quantitative Disciplines, Global Network Professor of Mathematics, NYU Shanghai
Relationship: PhD thesis advisor

Léon Bottou - leonb@fb.com
Research Lead, Facebook AI Research, New York
Visiting Research Professor, Computer Science Department, NYU
Relationship: Manager at FAIR and PhD thesis co-advisor

Giulio Biroli - giulio.biroli@ens.fr
Professor of Theoretical Physics
Laboratoire de Physique Statistique, École Normale Supérieure, PSL Research University, Paris, France
Relationship: Postdoc advisor

Teaching

Carlos Fernandez-Granda - cfgranda@cims.nyu.edu
Assistant Professor of Mathematics and Data Science
Courant Institute of Mathematical Science and Center for Data Science NYU
Relationship: I have been his teaching assistant at the Center for Data Science

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