

Raphaël Berthier

PhD student at Inria Paris
under the supervision of
Francis Bach and Pierre Gaillard

PhD topics ...

- stochastic optimization
- gossip algorithms (averaging algorithms in networks)

See my talk on Friday 7, 5:30pm

- Berthier, Bach, Gaillard - *Tight Nonparametric Convergence Rates for Stochastic Gradient Descent under the Noiseless Linear Model*, 2020
- Berthier, Bach, Gaillard - *Accelerated Gossip in Networks of Given Dimension using Jacobi Polynomial Iterations*, 2019

... and interests related to statistical physics of machine learning

- Approximate Message Passing algorithms and proof of the state evolution equation
- multi-layer AMP
- Kac-Rice formalism
- Berthier, Montanari, Nguyen - *State Evolution for Approximate Message Passing with Non-Separable Functions*, 2017

Hugo Cui

2016-2020 : Ecole Normale Supérieure, theoretical physics
2020- PhD with Lenka Zdeborová

Research topics

Hitherto on active learning problems (HC, L. Saglietti & L. Zdeborová, MSML '20)

Eager to gain IT & algorithmic insight into the role of architecture/ data structure for learning, using the stat phys toolbox.

Stéphane d'Ascoli

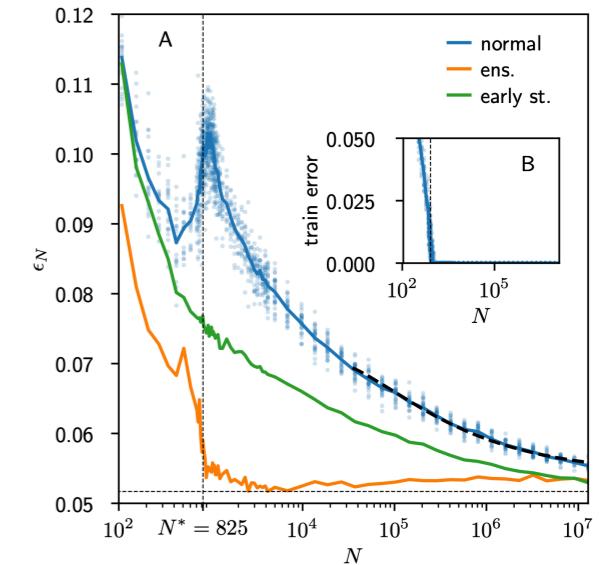
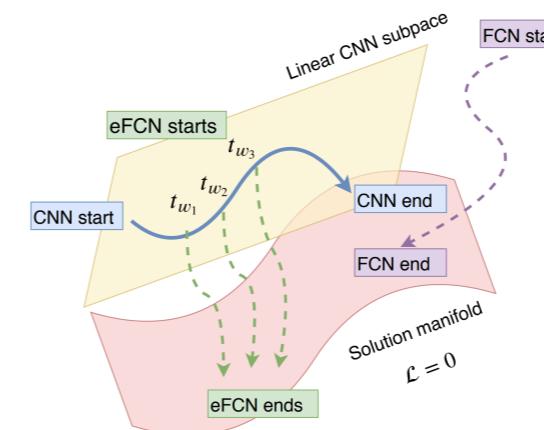
Currently : Ph.D. student, ENS Paris & FAIR Paris

Supervised by : Giulio Biroli, Lévent Sagun

Previously : Masters Degree in Theoretical Physics, ENS Paris

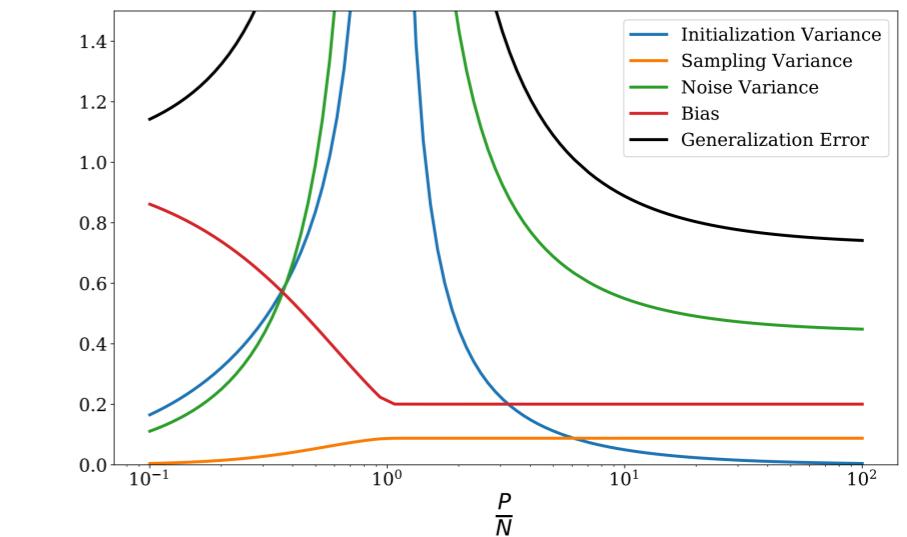
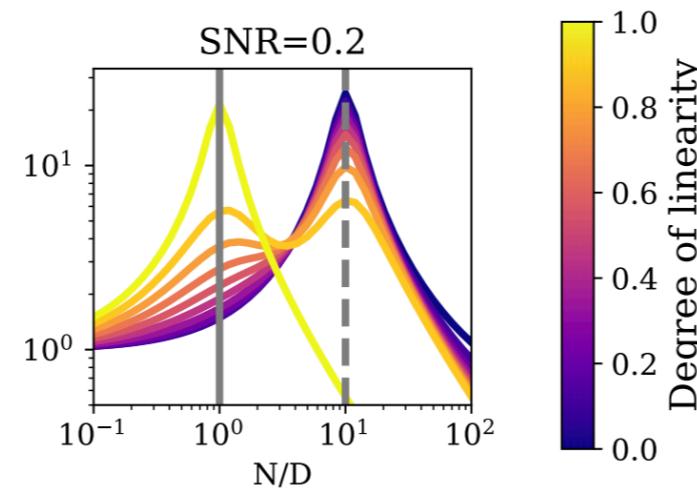
Subjects of interest :

- Dynamics and generalisation in deep learning
- Analytically tractable models of double descent
- Lazy and rich learning regimes



More recently :

- Role of data structure
- Graph neural networks



Outside work :

- Sports (cycling, hiking, tennis, hit me up if you're interested !)
- Music (come and see my orchestre play near here in two weeks !)

Lorenzo Dall'Amico

Who...

- M.Sc in Physics of complex systems
- Ph.D at GIPSA lab with Romain Couillet and Nicolas Tremblay

So far...

- Unified framework for spectral community detection in sparse graphs
- New spectral algorithm for dynamic community detection

Now heading towards...

- A competing algorithm for SSL in the dense and sparse regime
- Do common algorithms (*e.g* label propagation) have a simple, physics-inspired interpretation?

Jonathan Dong

- 3rd-year PhD student with:
 - Florent Krzakala (LPENS, Paris)
 - Sylvain Gigan (LKB, Paris)
- Next year: Postdoc with Michael Unser (EPFL, Lausanne)
- Research interests:
 - Computational imaging (phase retrieval, inverse problems)
 - Optical computing (random matrices, Random Features, Reservoir Computing)



Jorge Fernández de Cossío Díaz

- Post-doc at ENS, with Remi Monasson & Simona Cocco.
- I am working on:
 - statistical mechanics of deep Boltzmann machines;
 - interpretable representations in restricted Boltzmann machines
 - adversarial training of restricted Boltzmann machines;
 - applications to protein sequence data
- PhD in University of Havana, Cuba, on modelling of metabolic networks in cell cultures.
- In the future, I hope to continue working on statistical physics applications in machine learning and biology.
- Looking forward to exciting discussions during this school!

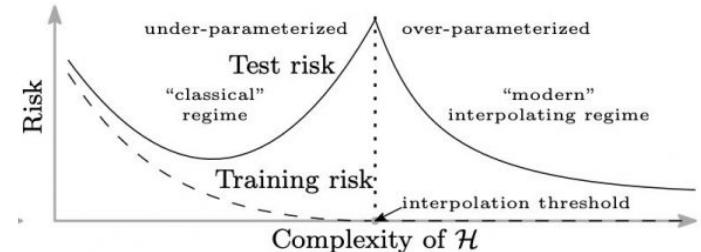
Where I come from:

- ▷ PhD completed in 2019 – École Normale Supérieure Paris
Advisors: Florent Krzakala & Lenka Zdeborová
- ▷ Postdoc since January 2020 - NYU / Flatiron Institute



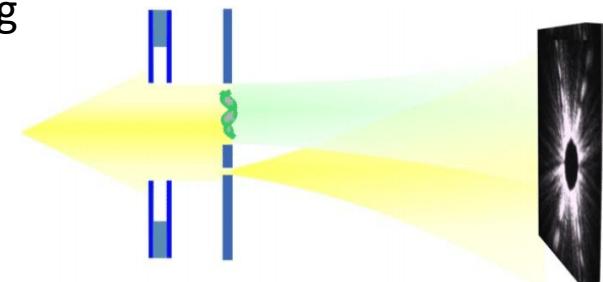
What I am interested in:

- ▷ Theory of machine learning, statistical inference
generalization / overparametrization,
role of structure in signal
- ▷ Machine learning applications in science
 - ▷ Neural networks for efficient sampling of Boltzmann distributions
 - ▷ Neural network priors for diffraction imaging



Besides Science:

- ▷ Hiking, maybe running and playing ware-wolf



Mario Geiger

Experimental physics on neural networks



Advisors

F. Krzakala (Physics, ENS) and M. Lelarge (Computer Science, ENS)

Interests

Graphical models, optimization, probability, statistical physics

Current projects

Exact asymptotics on simple machine learning models (GLM)

Get close to realistic cases - more on that later

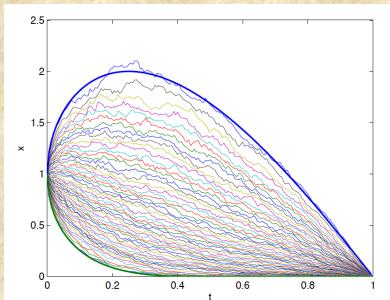
Theory : state evolution, replicas, convergence/convex analysis

Algorithms : message-passing, expectation propagation, proximal descent (ADMM)

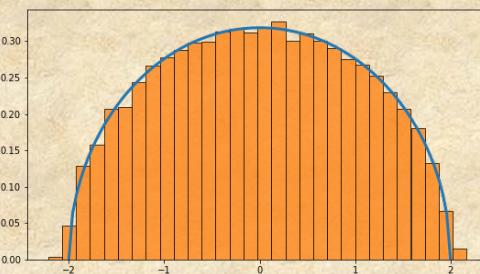
Would like to learn more about

Neural networks, learning dynamics, approximation theory

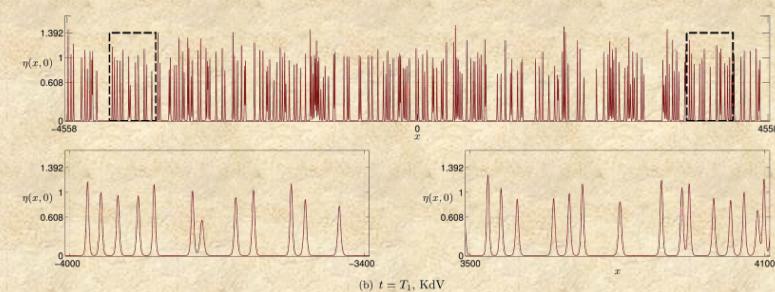
My background (Math):



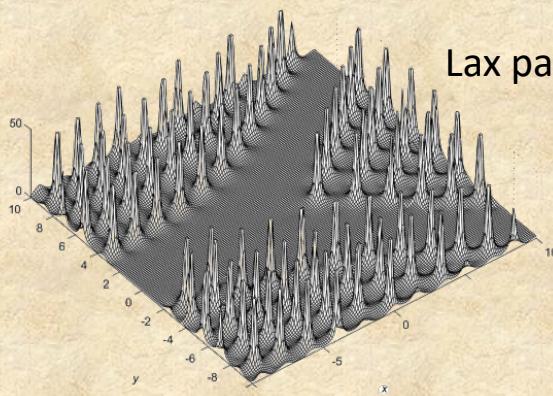
Determinantal Point
Processes



Random Matrices



Soliton gas (integrable
turbulence)



Integrable Systems:
Lax pair, Hamiltonian, τ -function,...
(e.g. KdV, Painlevé)

- **Asymptotics:** critical regimes, long-time, large/small gaps, ...
- **Universality**

More recently (ML): generalization in overparametrized models (+ optimization)

Grzegorz Głuch



From Poland

PhD candidate at EPFL

Advised by M. Kapralov & R. Urbanke

Interests

- Theoretical ML: Adversarial Robustness
- Sublinear Algorithms: Clustering via spectral methods

After hours

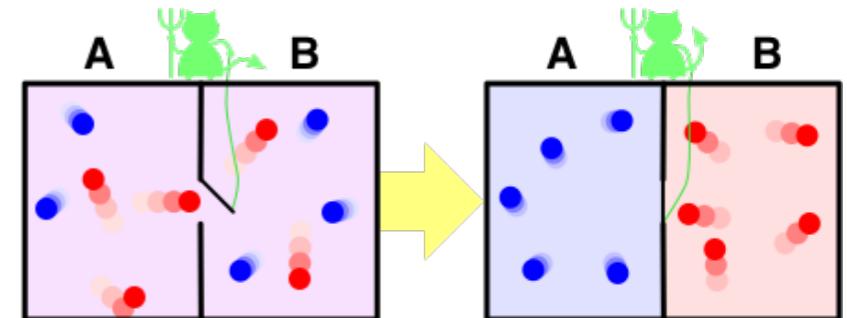
Biking MTB/downhill, crossfit, in general: sports

Sebastian Goldt

Previously

Undergraduate in physics

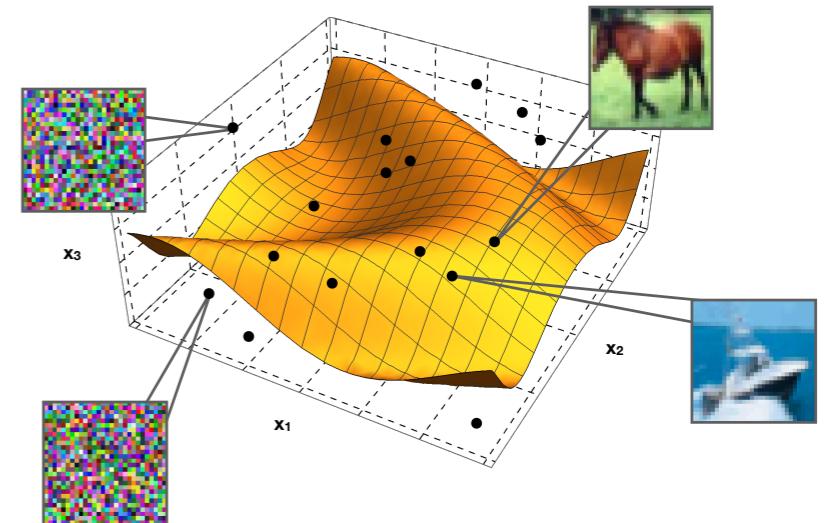
PhD in non-equilibrium statistical physics



Now

Post-doc with Lenka & Florent @ ENS (Paris)

- Dynamics of neural networks
- Impact of data structure on learning



Soon

Starting a new group at SISSA (Trieste):

“Theory of neural networks”

We're hiring - feel free to inquire :)



MOSHIR HARSH

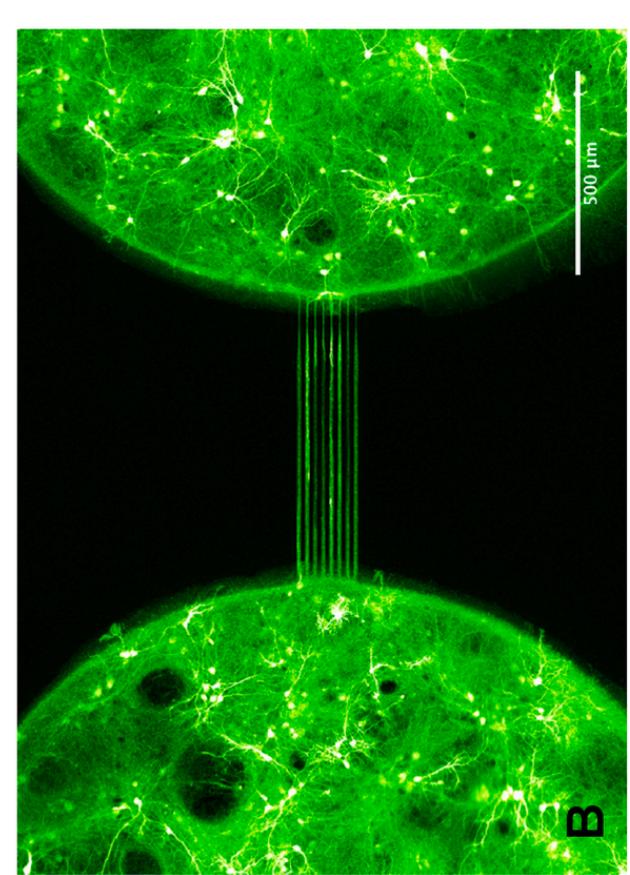
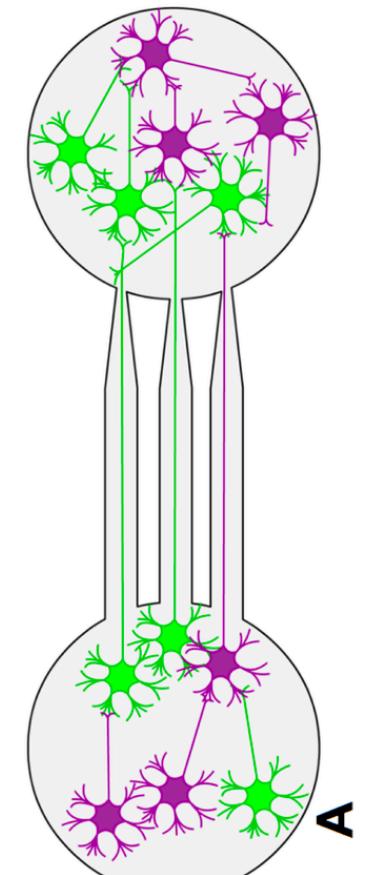
PhD student at the Institut für Theoretische Physik, Universität Göttingen

Supervisor: Prof. Peter Sollich

Past: Masters from ENS, Paris; Physics Major & Biology minor from **Indian Institute of Science**, Bangalore

PAST PROJECTS:

- Protein complex assembly by super-resolution microscopy and stochastic modelling.
- Mechanism of bacterial ‘persistence’ by single particle fluorescence imaging.
- In-vivo “Neural Networks” and neuro-degradation simulations.

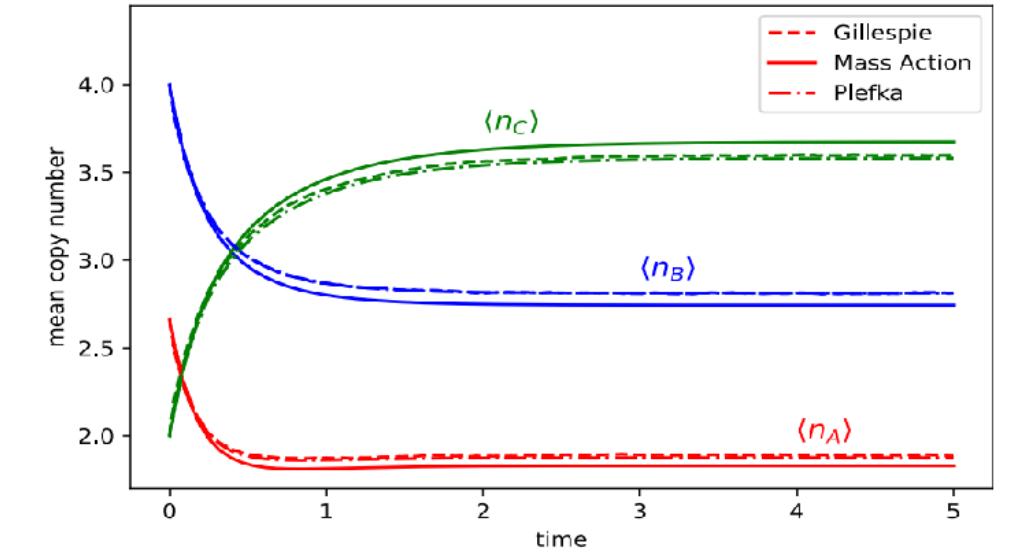


From Samuel Bottani

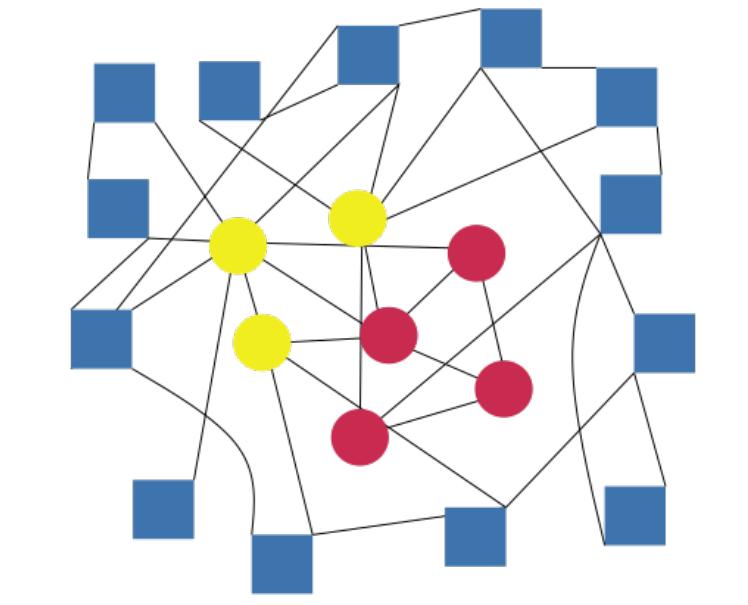


RESEARCH INTERESTS:

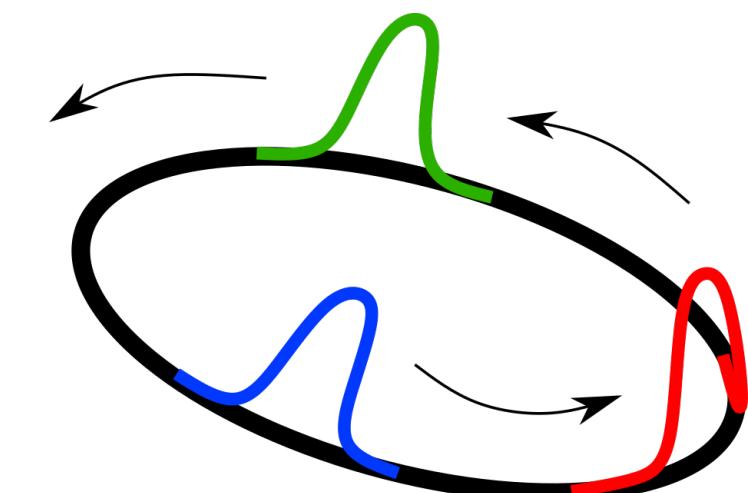
- Approximation methods for dynamics on networks with large fluctuations.
- Inference and ML methods for dynamics in biochemical networks.
- Using stat. physics to understand ML & phase transitions in learning.
- The role of symmetries in learning.
- Neural encoding in sensory space - place fields and CA!
- Glasses and dynamics on complex landscapes.
- AI for healthcare improvement and automation.



Identify the boundary layer from subnetwork dynamics



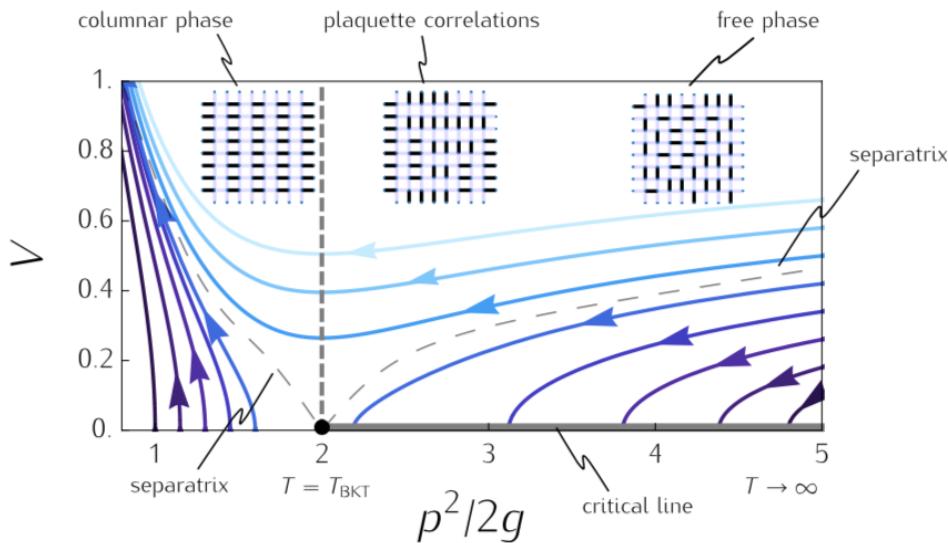
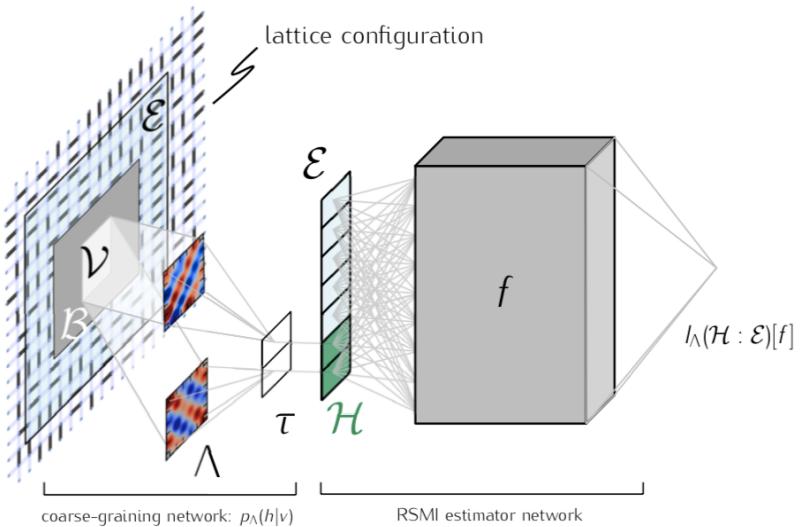
● boundary layer ● subnetwork ● bulk



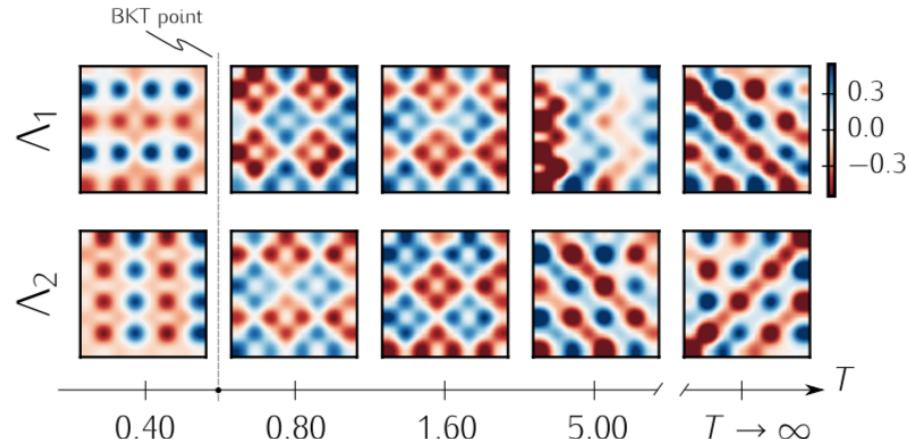
Vojtech Havlicek

- ▶ My PhD was in quantum computation.
- ▶ My academic journey so far: Imperial (Theoretical Physics) → ITP ETH for 1 year → Oxford (Computer Science) → Bristol (Math) → IBM Research? (waiting for a visa decision)
- ▶ Also interested in non-quantum things. Currently working on approximation algorithms with IBM.
- ▶ Free time: boardsports, hiking, rowing, violin, programming.

Information theoretic RG: algorithms and theory



- RG construction via efficient mutual information maximization with MINE



- Information theoretic (IB) vs. RG relevancy, symmetries in IB and RG
- Physics-inspired ML, e.g. in hyperparameter optimization

Anastasia Koloskova

PhD student at EPFL, under supervision of Martin Jaggi

Bachelor's degree from Moscow Institute of Physics and Technology

Research interests:

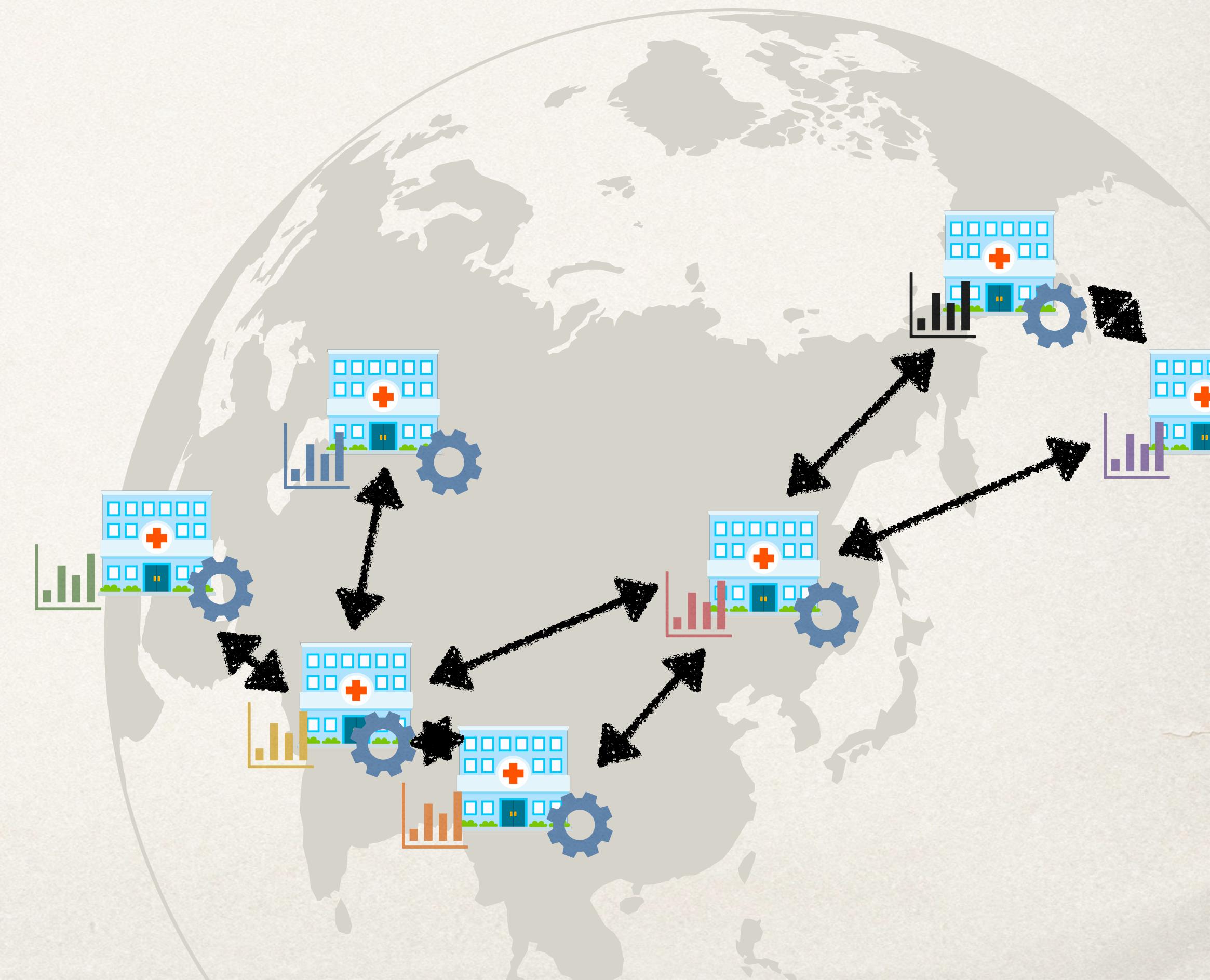
Optimization for machine learning

Distributed and decentralized optimization

Federated learning

Other interests:

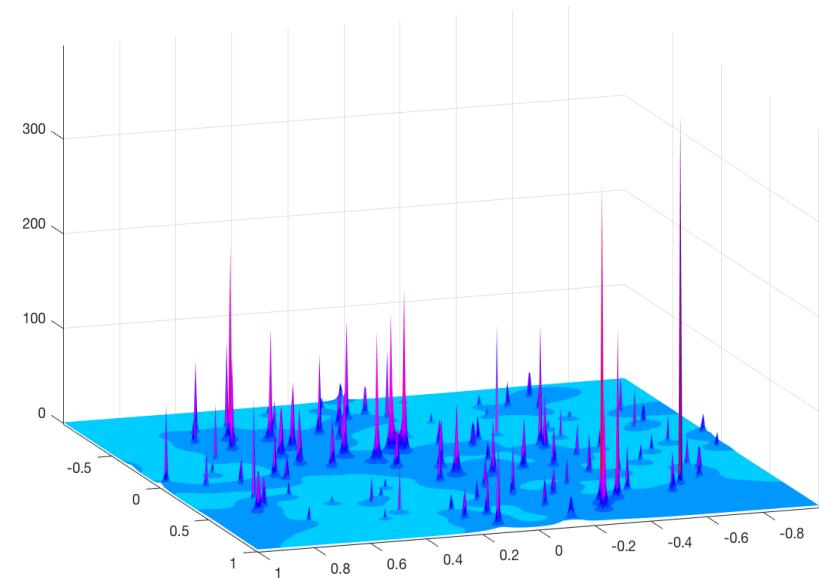
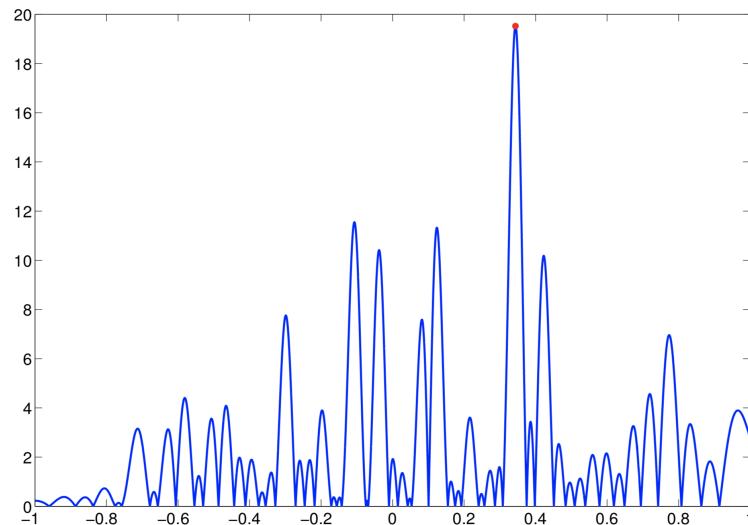
hiking, biking, bouldering, ping-pong, music, etc.



Gaultier Lambert, University of Zürich

I study eigenvalues of random matrices and other related objects.

- Central limit theorems for linear statistics of eigenvalues (combinatorics & Stein's method)
- Characteristic polynomials of random matrices (behavior of the maximum & extreme values)



- Gaussian Multiplicative Chaos
- Free fermions & determinantal point processes

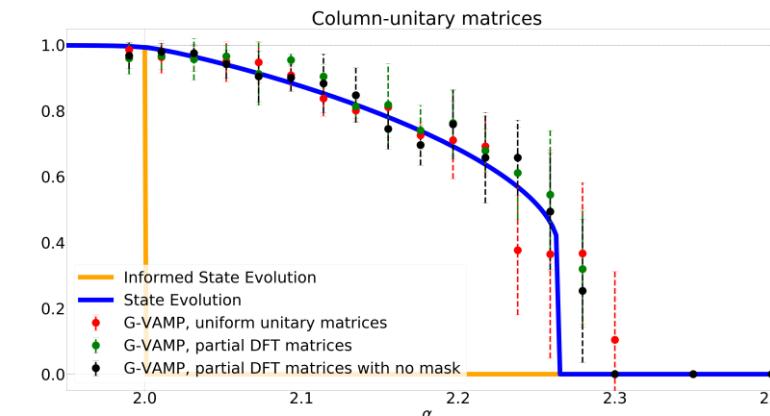
ANTOINE MAILLARD

PHD STUDENT, ENS PARIS

w. FLORENT KRZAKALA

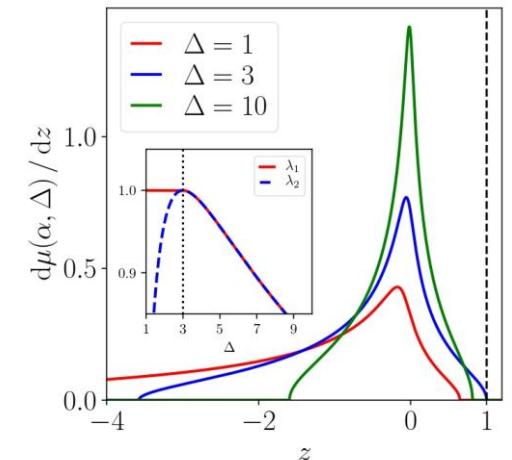
Some of my work interests :

- Statistical physics / inference problems (computational gaps, message-passing...) ↑
TAP equations of inference models, matrix factorization, committee machine, spectral methods, phase retrieval...
- Rigorous proofs of conjectures from the stat. physics literature.
Committee machine, linear regression with correlated matrix, phase retrieval w. correlated patterns....
- Random matrix theory (large deviations, Kac-Rice formula, ...)



Complexity of empirical risk of GLM: $\lim_{n \rightarrow \infty} \frac{1}{n} \ln \mathbb{E} \text{Crit}_{n,L_1} = \frac{1 + \ln \alpha}{2} + \sup_{\nu \in \mathcal{M}_1^+(\mathbb{R})} \left[-\frac{1}{2} \mathcal{E}_\phi(\nu) + \kappa_{\alpha,\phi}(\nu, t_\phi(\nu)) - \alpha H(\nu | \mu_G) \right].$

Spiked matrix model with generative prior





Chiara Marullo

Department of Mathematics "G. Castelnuovo"
Sapienza Università di Roma



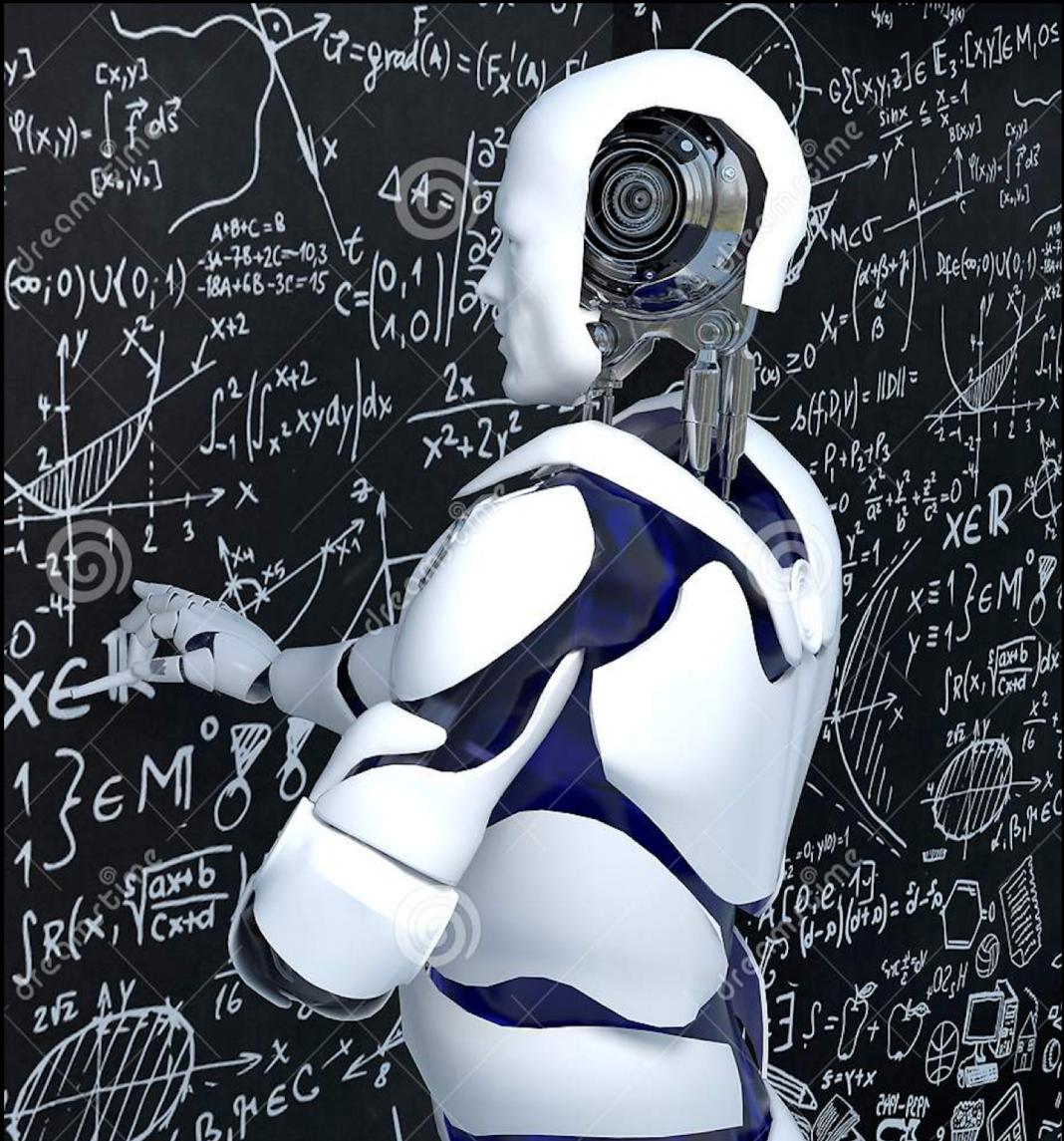
Master degree in Applied Mathematics, July 2019
current position: PhD student in mathematics

My main field of research is Statistical Mechanics
In particular, I am interested in Neural networks and Machine Learning

This year submitted papers:

"The relativistic Hopfield model with correlated patterns" E. Agliari, A. Fachechi, C. Marullo
Submitted to Journal of Mathematical Physics (2020)

"Retrieval capabilities of neural networks with biased patterns" E. Agliari, A. Fachechi, C. Marullo
In preparation



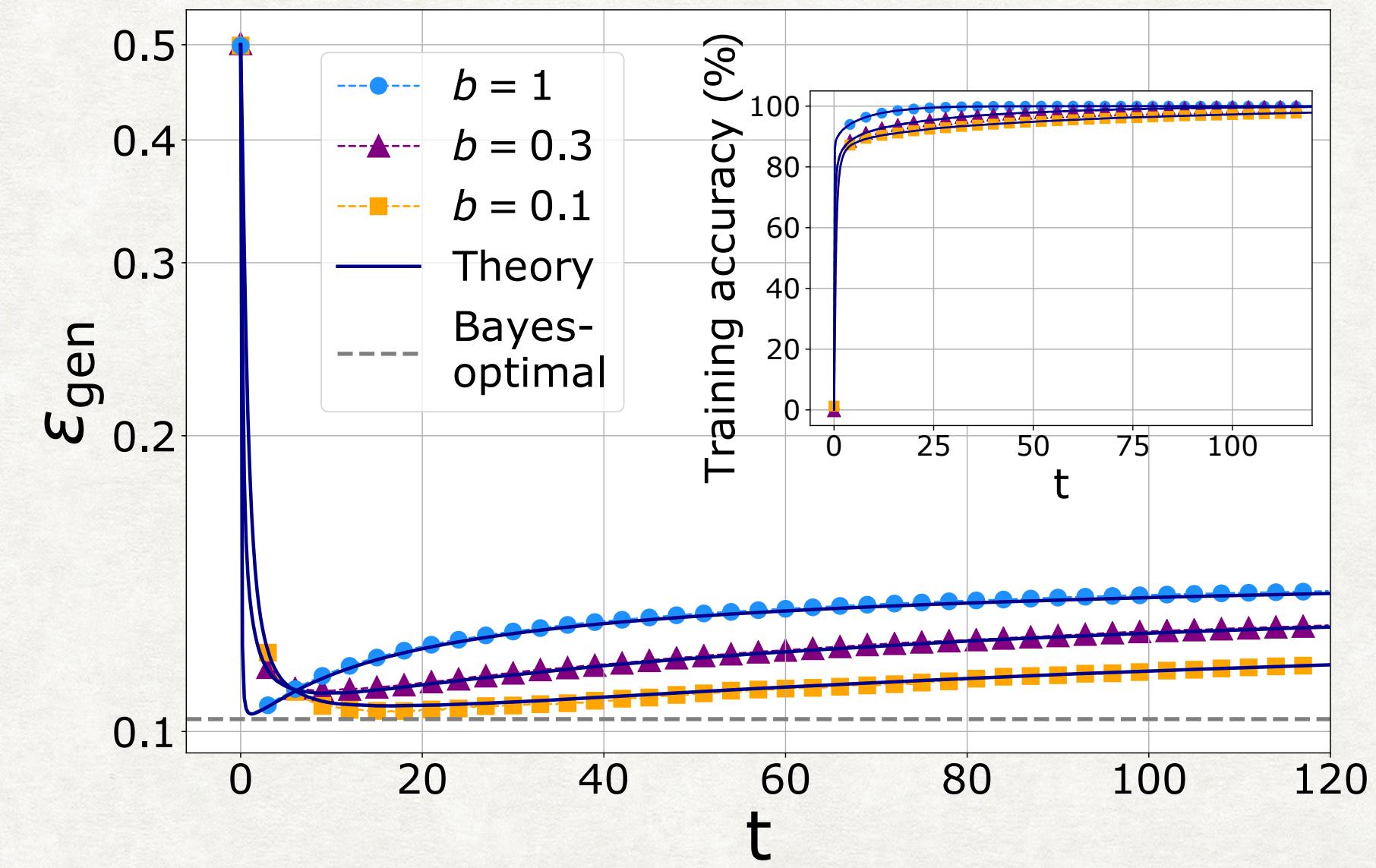


Francesca Mignacco

Ph. D. in *Statistical physics modelling of artificial neural networks*
under the supervision of Lenka Zdeborova & Pierfrancesco Urbani

Seminar on : *Dynamical mean-field theory for
stochastic gradient descent**
(Wed 12th)

* FM, F. Krzakala, P. Urbani, L. Zdeborová,
[arXiv:2006.06098](https://arxiv.org/abs/2006.06098)



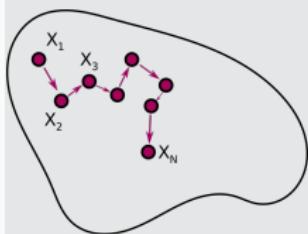
Athina Monemvassitis

LMBP / LPC (Université Clermont Auvergne, France)

Co-advisors : Arnaud Guillin, Manon Michel, Stephane Monteil

Exploration of energy landscapes in high-dimensions

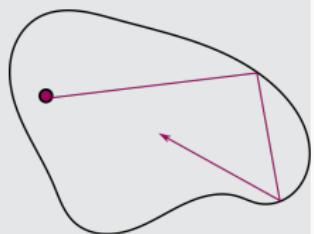
Monte Carlo



Metropolis



Irreversible (ECMC)



Perspectives

- Application to mean-field methods in deep neural networks
Alternative to Langevin dynamics ?
- Look at Coulomb gases
- ...

RUBEN OHANA - PHD STUDENT

- Supervised by F. Krzakala (LPENS), A. Rudi (DIENS - Inria), L. Daudet (LightOn)
- Two lines of work:
 - Optical Random Features (in collaboration with LightOn)
 - Theory of Random Features and Statistical learning theory
- Interested in the link between kernel methods and Neural Networks, adversarial attacks and Random Projections.



Leonardo Petrini



Currently PhD Student @
Physics of Complex Systems Lab
Advisor: Prof. Matthieu Wyart

Research Interests:

- Statistical Physics
- Neural Nets
- Reinforcement Learning
(very recently)

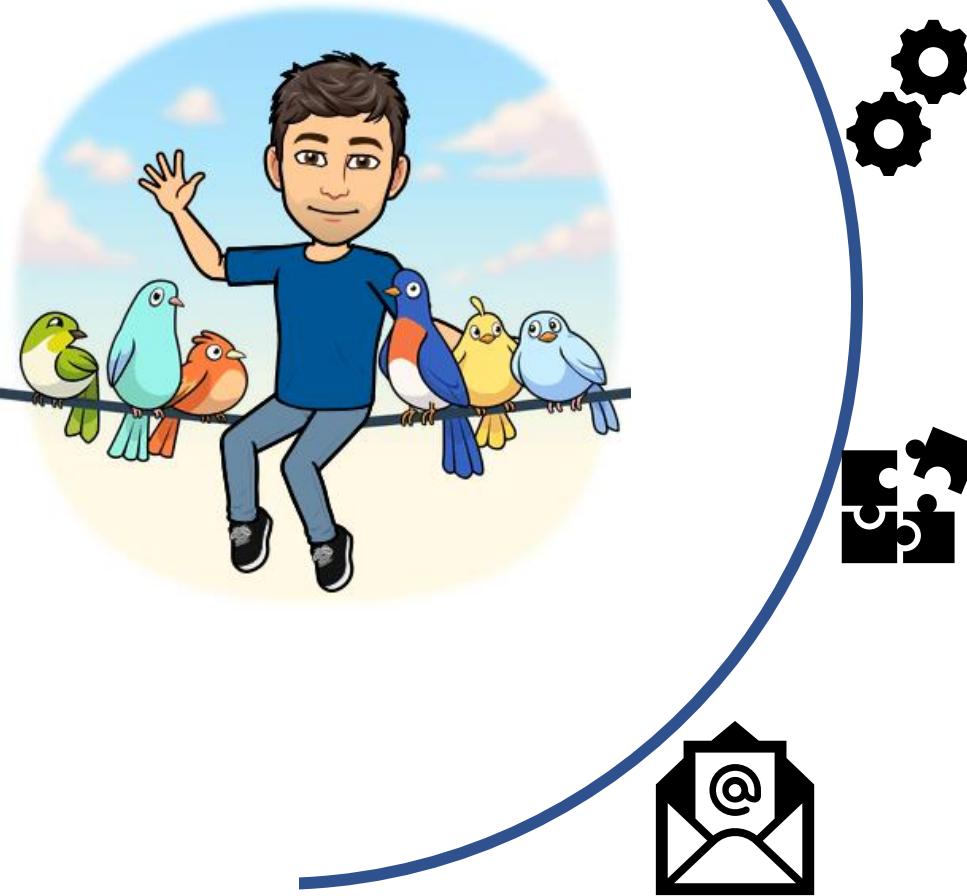


Other interests:

- Hiking
- Some climbing
- Pizza
- ...

About me

Giovanni Piccioli



Master's student in statistical physics at Sapienza
University of Rome

Statistical physics, inference and machine learning

Rock climbing, alpinism, hiking

giovannipiccioli@gmail.com

Hi everyone, I'm Mirko Pieropan

I'm a PhD candidate in Physics at [Politecnico di Torino](#), Italy

I work on **linear estimation problems** with [Andrea Pagnani](#) and [Alfredo Braunstein](#)

I hold a [M.Sc.](#) degree in Physics of Complex Systems from Politecnico di Torino and an [M2](#) degree in Physics from Université Paris Diderot (now Université de Paris)

I'm interested in **compressed sensing**, **approximate inference**, **message passing algorithms** and **neural coding**.

I'd like to work on **reinforcement learning** problems too in the future.

I'm excited to be here in Les Houches and I'm looking forward to knowing you!



Maria Refinetti



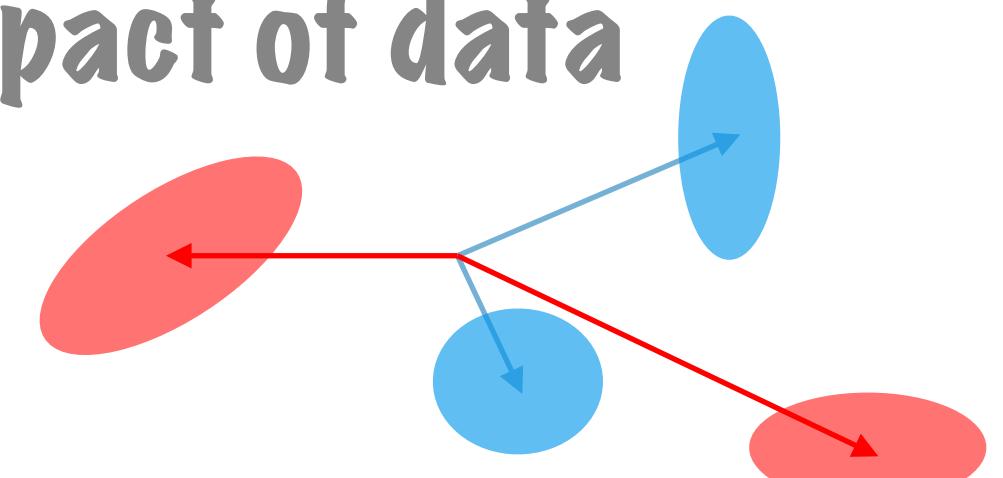
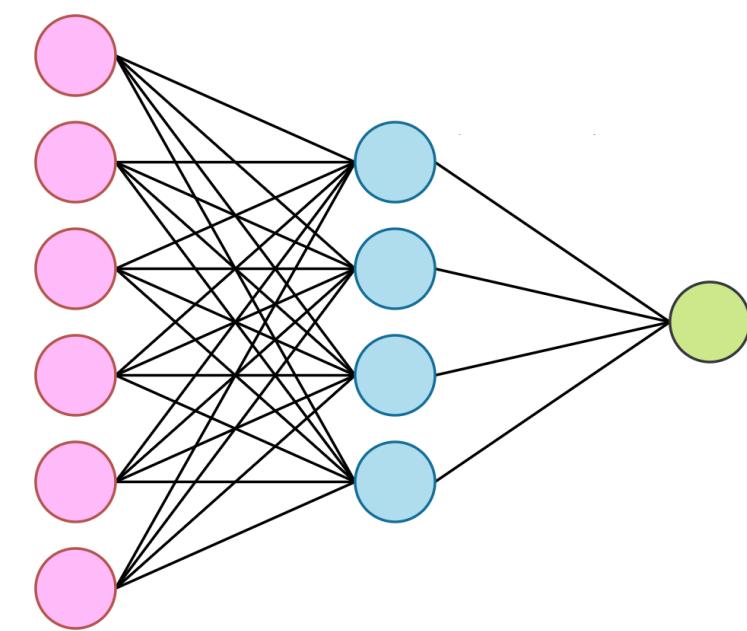
► 2019 - Master: EPFL High Energy Physics



► 2019 - PhD ENS Paris with F. Krzakala

→ Double Trouble in Double Descent (arXiv: 2003.01054)
Rethinking the Bias Variance trade-off Using Random Features

→ Learning from a Gaussian Mixture Models and the impact of data structure



Stefano Sarao Mannelli

For the next 3 months: PhD student at IPhT CEA Saclay
with Lenka Zdeborovà

Physicist by training: master in the Physics of Complex
Systems (Trieste, Torino, Paris)

Soon: postdoc at University of Oxford with Andrew Saxe

I like:

disordered systems in particular dynamical aspects

running, bike riding, ~~rock climbing~~.

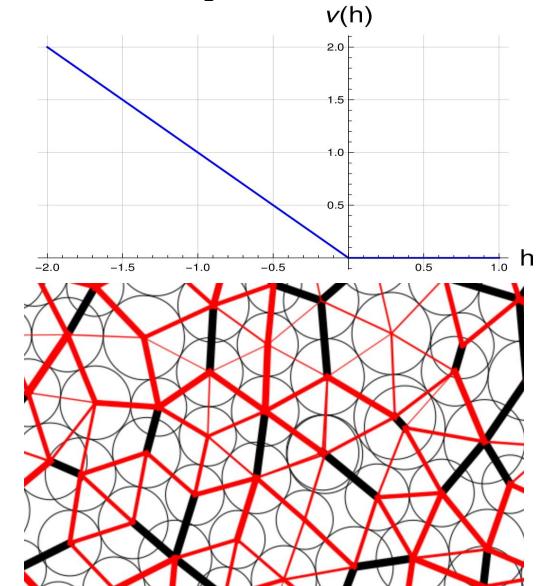


Antonio Sclocchi

PhD student @ LPTMS, Orsay (Université Paris-Saclay) supervised by Silvio Franz
and Pierfrancesco Urbani

Topics:

- Perceptron model with linear hinge loss (theory and simulations)
- Soft spheres with linear repulsive potential
- Jamming criticality

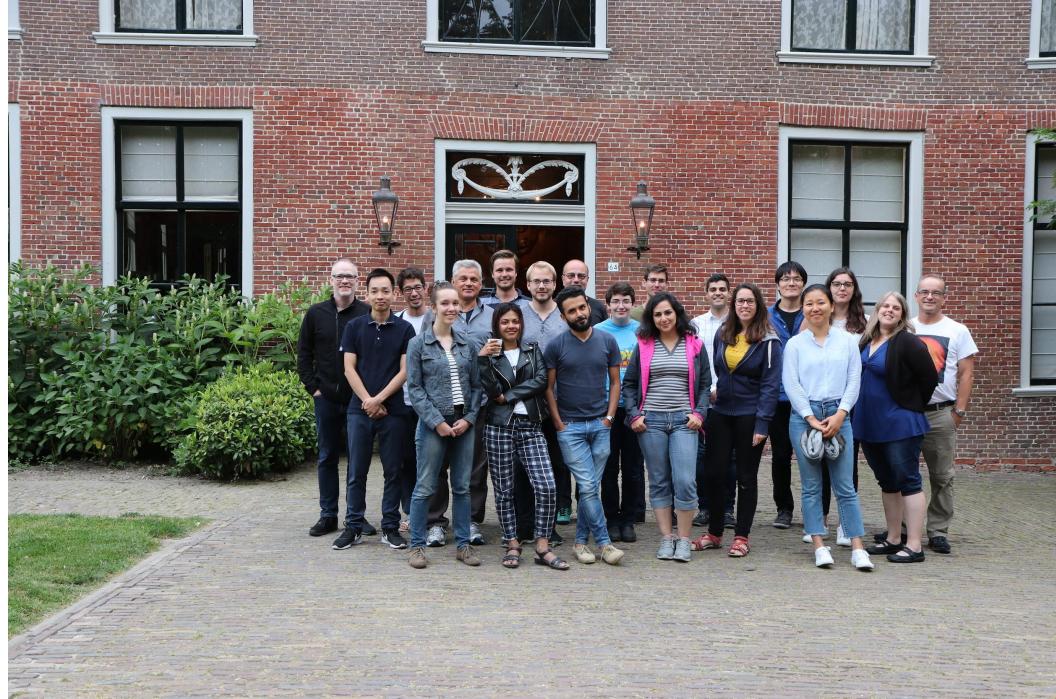


Next: from January 2021, post-doc with Matthieu Wyart @EPFL, Lausanne, studying learning in neural networks.



Michiel Straat

PhD student in the *Intelligent Systems* group
University of Groningen



Group picture *Intelligent Systems*

Interests

- Learning dynamics of machine learning algorithms, phase transitions
 - Neural networks, Learning Vector Quantization (model scenarios, student-teacher settings)
- Learning in the presence of concept drift, non-stationary situations.
- Predictive maintenance, automated control



Tiffany Vlaar

- Partitioned Integrators for Thermodynamic Parameterization of Neural Networks
- Constraint-Based Regularization of Neural Networks

Joint work with:

Benedict Leimkuhler, Charlie Matthews, Timothée Pouchon, Amos Storkey