The success enjoyed over the last decade by deep neural networks in machine learning tasks raises fundamental questions about their working principle. Their surprising generalization capability and the reason why they work optimally in a strongly overparametrised regime are still largely open problems. The architecture and training protocol for a given task are still chosen mainly by empirical knowledge, rather than based on theoretical guidelines.

Methods rooted in statistical physics, such as disordered systems, phase transitions or chaos theory, have begun to provide conceptual insights into these questions. At the same time, deep learning algorithms have been applied to a wide array of different problems faced by physicists, ranging from particle physics and cosmology to many-body physics and biological physics. Neural networks are thus becoming an important topic in the training of physicists, computer scientists and applied mathematicians. The school is designed to give an overview of the statistical-mechanical principles underlying deep learning.

The school is aimed primarily at the growing audience of early-stage researchers (graduate students, advanced master students and postdocs) interested in fundamental aspects of machine learning, beyond a simple black-box approach. Our lectures will provide a critical introduction to deep neural network rooted in a statistical physics perspective. It will expose the participants to applications to a wide range of problems, mainly of physical nature.

The school is addressed to PhD students and postdocs and it is designed to have lectures, hands on tutorials and some seminars on specific topics.
Lecturers

Main Lecturers
- Sebastian Goldt (SISSA, Trieste Italy)
- Andrew Saxe (University College London, UK)
- Simona Cocco (Ecole Normale Superieure, Paris, France)

Topic Lecturers
- Massimo Cencini (CNR, Rome, Italy)
- Simona Cocco (Ecole Normale Superieure, Paris, France)
- Claudio Nordio (Chief Risk Officer, Illimity Banca, Milan, Italy)
- Riccardo Zecchina (Universita' Bocconi, Milano, Italy)
- Francesca Mignacco (IPhT/CEA, Saclay, France)
- Pietro Rotondo (INFN Sezione di Milano, Italy)
Organizing Committee

- Francesco Ginelli (Università dell’Insubria, Como, Italy)
- Marco Gherardi (Università di Milano, Italy)
- Guido Tiana (Università di Milano, Italy)
- Alessandro Laio (SISSA, Trieste, Italy)
Program

TBA

Monday 13th to Thursday 16th: Lectures will begin at 9.00 and conclude by 18.00, with breaks for Lunch and coffee gathered at school venue.

Friday 17th: Lectures will begin at 9 and conclude by 14.00

Click Program