ENCOUNTERS
STŘEDA 21.5.
14.00

UČENÁ SPOLEČNOST
ČESKÉ REPUBLIKY

SETKÁNÍ

MFF UK, Malostranské náměstí 25

Věda, umělá inteligence a umění

Tři mimořádné přednášky propojují matematiku, fyziku, umělou inteligenci i umění.

- **Marc Mézard otevře setkání Matematickým kolokviem Statistical Physics of Generative Diffusion, kde pomocí metod statistické fyziky zkoumá principy generativní umělé inteligence – technologií schopných vytvářet nový text, obraz či kód, který je podobný obsahu v již existující databázi.**
- **Lenka Zdeborová naváže přednáškou Towards Understanding of Scaling, Emergence and Transformers, v níž ukáže, jak statistická fyzika pomáhá porozumět hlubokému učení a jazykovým modelům.**
- **Annie Cohen-Solal zakončí večer pohledem do světa umění v přednášce o Pablu Picassovi jako cizinci ve Francii a o jeho osudovém setkání s českým historikem umění Vincencem Kramářem.**

PROGRAM

- **14.00** **127th Mathematical Colloquium: Statistical Physics of Generative Diffusion**
  Marc Mézard, *Bocconi University, Milano*
- **15.15** **Towards Understanding of Scaling, Emergence and Transformers**
  Lenka Zdeborová, *EPFL Lausanne*
- **16.15** **přestávka na kávu**
- **17.00** **38th ISTS Colloquium: Kramář and Pablo Picasso**
  A Magical Encounter During the Darkest Times of Cubism in France
  Annie Cohen Solal, *Bocconi University, Milano*

Pražská setkání pořádá Učená společnost České republiky,
MFF UK a Interdisciplinární seminář ISTS.

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Malostranské náměstí 25

UČENÁ SPOLEČNOST ČESKÉ REPUBLIKY

Statistical Physics of Generative Diffusion

Marc Mézard, Bocconi University, Milano

Generative models, in which one trains an algorithm to generate fake samples ‘similar’ to those of a data base, is a major new direction developed in machine learning in the recent years. In particular, generative models based on diffusion equations have become the state of the art for image generation. However, the reasons for this spectacular technological success are not well understood, and neither are its limitations.

While the theory of stochastic processes asserts that a perfect guidance of the diffusion should lead back to samples of the database, this “condensation” phenomenon is avoided in practice by the “imperfection” of the algorithms used in machine learning.

After an introduction to this topic, the talk will focus on the behavior of generative diffusion in the high-dimensional limit, where data are formed by a very large number of variables. Using methods from statistical physics, we explain the various dynamical regimes that occur during the generation and show how the condensation phenomenon is related to a glass phase transition.

Towards Understanding of Scaling, Emergence and Transformers

Lenka Zdeborová, EPFL Lausanne

For over four decades, statistical physics has studied exactly solvable models of artificial neural networks. In this talk, we will explore how these models offer insights into deep learning and large language models. Specifically, we will examine a research strategy that trades distributional assumptions about data for precise control over learning behavior in high-dimensional settings.

We will discuss several types of phase transitions that emerge in this limit, particularly as a function of data quantity. In particular, we will highlight how discontinuous phase transitions are linked to algorithmic hardness, impacting the behavior of gradient-based learning algorithms.

Finally, we will cover recent progress in learning from sequences and advances in understanding generalization in modern architectures, including the role of dot-product attention layers in transformers.

Vincenc Kramář and Pablo Picasso – A Magical Encounter During the Darkest Times of Cubism in France

Annie Cohen-Solal, Bocconi University, Milano

When 19-year-old Pablo Picasso arrived in Paris in 1900, he spoke no French and knew little of the country’s cultural codes. France, shaken by social unrest, was guarded by institutions that sought to protect national identity – through the “Police of Foreigners” and the conservative Académie des beaux-arts. Though Picasso’s first Paris exhibition in 1901 was praised by critics, the police opened a file on him, labeling him an “anarchist under surveillance.” For over four decades, despite global fame, Picasso remained a marginalized foreigner in France.

In 1940, seeking French citizenship to avoid Franco’s regime, his application was rejected – marked by xenophobic prejudice. At a time when cubism was blamed for the “moral and aesthetic decline” of France, Picasso found a rare ally in Czech art historian and collector Vincenc Kramář. Director of Prague’s Picture Gallery and trained in the interdisciplinary Vienna School, Kramář recognized the brilliance of Picasso’s early, radical work – calling Head of a Woman “superb” while others called it “ugly.”

Picasso the Foreigner, based on new archival research, explores the artist’s life through the lens of immigration, nationalism, and identity. It traces his artistic and political evolution across wars and crises, highlighting not just his genius, but also his strategic response to a hostile world.