Seminar Hora Informaticae **Institute of Computer Science, Prague**

Tuesday, January 24, 2023, 14.00 – 15.30 (2 - 3:30 PM) CET

Meeting room 318, Address: Pod Vodárenskou věží 2, Prague 8

ZOOM:

https://cesnet.zoom.us/j/95478234977?pwd=dXoyekFHbDJ0MkNrTjVVS3F2STZqUT09

Meeting ID: 954 7823 4977 , Passcode: 712564

Jan Vybíral, Department of Mathematics, FNSPE, CTU :

From ridge functions to neural networks

The mathematics of the performance of neural networks in high-dimensional problems presents subtle challenges and many open problems. We start with a discussion of the so-called ridge functions, which are just a composition of a uni-variate function with an inner product. In some sense, they model one artificial neuron. We show that although this model looks rather simple, the identification of such function might suffer the curse of dimension. Next we discuss identification of a sum of ridge functions, which in turn corresponds to one layer of an artificial neural network. Finally, the last result, which we present in this talk, reveals a multivariate Riesz basis of ReLU neural networks, which performs equally well independently on the dimension.

References:

C. Schneider and J. Vybiral, Multivariate Riesz basis of ReLU neural networks, in preparation

M. Fornasier, J. Vybiral and I. Daubechies, Robust and resource efficient identification of shallow neural networks by fewest samples Information and Inference: a Journal of the IMA, 10(2), June 2021, 625-695

S. Mayer, T. Ullrich, and J. Vybiral Entropy and sampling numbers of classes of ridge functions Constructive Approximation 42 (2) (2015), 231-264

M. Fornasier, K. Schnass and J. Vybiral Learning functions of few arbitrary linear parameters in high dimensions Found. Comput. Math. 12 (2) (2012), 229-262

Jan Vybíral (https://people.fjfi.cvut.cz/vybirja2/cv.pdf) is affiliated with the Department of Mathematics, Faculty of Nuclear Sciences and Physical Engineering of the Czech Technical University in Prague. His main research interests are high-dimensional approximation theory, random matrix theory, information-based complexity, and computational mathematics.

HORA INFORMATICAE (meaning: TIME FOR INFORMATICS) is a broad-spectrum scientific seminar devoted to all core areas of computer science and its interdisciplinary interfaces with other sciences and applied domains. Original contributions addressing classical and emerging topics are welcome. Founded by Jiří Wiedermann, the seminar is running since 1994 at the Institute of Computer Science of the Czech Academy of Sciences in Prague.

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