



Seminar Hora Informaticae

Institute of Computer Science, Prague

Tuesday, February 10, 2026, 13.30 – 15.30 (1.30 – 3:30 PM) CET

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

Meeting ID: 914 0834 4018, Passcode: 668534



<https://cesnet.zoom.us/j/91408344018?pwd=x2QlZ4F42BxlMSmWc1HOwHHA7Uw7PN.1>

Jan Vybíral, Department of Mathematics, FNSPE, CTU Prague:

Riesz basis of ReLU neural networks and its use in function recovery.

We present a survey of our recent study of the trigonometric-like system of piecewise linear functions introduced by Daubechies, DeVore, Foucart, Hanin, and Petrova [1]. In our previous work [2] we gave an alternative proof that this system forms a Riesz basis of $L_2([0,1])$. More importantly, we generalized this system to higher dimensions $d > 1$ by a construction, which avoids using (tensor) products. As a consequence, the functions from the new Riesz basis of $L_2([0,1]^d)$ can be easily represented by neural networks. As a byproduct, we also prove that the Riesz constants of this system are independent of d , making it an attractive building block regarding multivariate analysis of neural networks. In our recent work [3] we used this Riesz basis and investigated how well can a multivariate function of a limited smoothness be approximated by deep neural networks of given length and width. Such questions were recently intensively studied from many points of view. Our approach differs from most of these works by employing a basis, which lies on the interface between Fourier analysis and artificial neural networks. Finally, we report on a recent work [4], which studies the behavior of the same Riesz basis in Lebesgue spaces $L_p([0,1]^d)$ for $1 < p < \infty$.

References:

- [1] I. Daubechies, R. DeVore, S. Foucart, B. Hanin, and G. Petrova, Nonlinear Approximation and (Deep) ReLU Networks, *Constr. Appr.* 55 (2022), 127--172
- [2] C. Schneider and J. Vybíral, Multivariate Riesz basis of ReLU neural networks, *Appl. Comput. Harmonic Anal.* 68 (2024), 101605

[3] C. Schneider, M. Ullrich, and J. Vybiral, Nonlocal techniques for the analysis of deep ReLU neural network approximations, submitted

[4] V. Kulbatov, J. Lang, C. Schneider, and J. Vybiral, Bases of Lebesgue spaces formed by neural networks, submitted

Jan Vybíral (<https://kmlinux.fjfi.cvut.cz/~vybirja2/>) 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 INFORMATICAЕ (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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