Seminar Hora Informaticae — Institute of Computer Science, Prague

Tuesday, November 4, 2025, 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=x2QIz4F42BxlMSmWc1HOwHHA7Uw7PN.1

František Hakl (ICS CAS, Prague) & Vít Fojtík (LMU, München).

A General Constructive Upper Bound on Shallow Neural Nets Complexity.

We present a constructive method for estimating the size of a shallow neural network with two layers, which is capable of approximating any continuous function on a compact set of n-dimensional Euclidean space. The link between the properties of the approximated function and the size of the estimate depends on the overall property of the approximated function, which is known as the inverse modulus of continuity. The motivation for our results was the effort to obtain a general estimate of the size of a neural network, further a constructive procedure for the initial setting of the network weights with the potential to accelerate the learning process of the network and last but not least filling a gap in theoretical procedures studying the approximation properties of neural networks (application of the Stone-Weierstrass theorem for the transition from one-dimensional approximation to approximation on a multidimensional space).

References:

[1] Hakl, F., Fojtík, V. "A General Constructive Upper Bound on Shallow Neural Nets Complexity." arXiv:2510.06372 (2025).

[2] Brosowski, B., Deutsch, F. "An Elementary Proof of the Stone-Weierstrass Theorem." Proceedings of the American Mathematical Society, pp. 89-92, 1981.

[3] Ellacott., S. W., "Aspects of the numerical analysis of neural networks." Acta Numerica, pp. 145-202, 1994.

František Hakl (https://www.cs.cas.cz/staff/hakl/en) is a researcher at the Institute of Computer Science of the Czech Academy of Sciences and a lecturer at the FNSPE CTU in Prague. His research interests include machine learning, specifically the theoretical aspects of deep learning methods, the approximation potential of these methods, and lower and upper bounds on the complexity of their architectures, as well as estimates of the number of learning patterns required to guarantee a predefined accuracy of learning. He uses these methods in the detection of physical processes in high-energy physics. He designed a specific neural network that enables high-speed data processing, making it suitable for the online evaluation of high-speed physical phenomena. This neural network model is patent-protected.

Vít Fojtík (Vít Fojtík home page**)** is currently a researcher at the Department of Mathematics of the Faculty of Mathematics, Computer Science and Statistics at LMU Munich. He is part of the research group Mathematical Data Science and Artificial Intelligence.

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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