Institut für Geometrie und Topologie

Sommersemester 2025

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## Neural Network Approximations on Manifolds

## 13. Mai 2025– 16:15 Uhr Raum 7.530

Abstract: A fundamental open question in deep learning is why neural networks perform so remarkably well on high-dimensional input data, such as images or sequences. A common informal explanation is the manifold hypothesis, which posits that such data lies near low-dimensional submanifolds embedded in high-dimensional space. In this talk, we explore the geometric Whitney problem, which provides a theoretical foundation for the existence of these approximating manifolds. We further examine the regularity properties of these manifolds, which, in turn, ensure the existence of neural networks capable of accurately approximating C<sup>2</sup> functions defined on them. Notably, in this setting, the approximation guarantees can be made independent of intrinsic properties of the underlying manifold and dependent only on extrinsic metric properties of the approximated data.



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