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Altri autori (Persone)	CasacubertaCarles EscaleraSergio
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Nota di contenuto	Chapter 1. Introduction -- Part I Fundamentals -- Chapter 2. Deep Learning -- Chapter 3. Topological Data Analysis -- Part II Interactions -- Chapter 4. Challenges in Deep Learning -- Chapter 5. Input and Output Spaces -- Chapter 6. Internal Representations and Activations -- Chapter 7. Training Dynamics and Loss Functions -- Chapter 8. Challenges, Future Directions, and Conclusions.
Sommario/riassunto	This book offers a comprehensive presentation of methods from topological data analysis applied to the study of neural network structure and dynamics. Using topology-based tools such as persistent homology and the Mapper algorithm, the authors explore the intricate structures and behaviors of fully connected feedforward and

convolutional neural networks. The authors discuss various strategies for extracting topological information from data and neural networks, synthesizing insights and results from over 40 research articles, including their own contributions to the study of activations in complete neural network graphs. Furthermore, they examine how this topological information can be leveraged to analyze properties of neural networks such as their generalization capacity or expressivity. Practical implications of the use of topological data analysis in deep learning are also discussed, with a focus on areas including adversarial detection and model selection. The authors conclude with a summary of key insights along with a discussion of current challenges and potential future developments in the field. This monograph is ideally suited for mathematicians with a background in topology who are interested in the applications of topological data analysis in artificial intelligence, as well as for computer scientists seeking to explore the practical use of topological tools in deep learning.