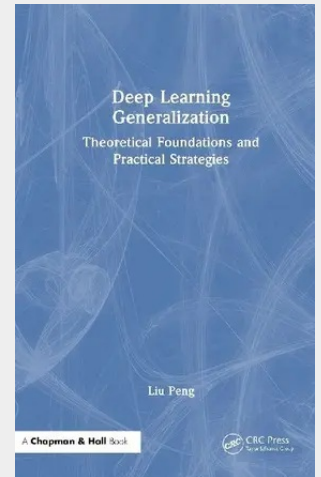


Peng

## Deep Learning Generalization

Theoretical Foundations and Practical Strategies

This book provides a comprehensive exploration of generalization in deep learning, focusing on both theoretical foundations and practical strategies. It delves deeply into how machine learning models, particularly deep neural networks, achieve robust performance on unseen data. Key topics include balancing model complexity, addressing overfitting and underfitting, and understanding modern phenomena such as the double descent curve and implicit regularization. The book offers a holistic perspective by addressing the four critical components of model training: data, model architecture, objective functions, and optimization processes. It combines mathematical rigor with hands-on guidance, introducing practical implementation techniques using PyTorch to bridge the gap between theory and real-world applications. For instance, the book highlights how regularized deep learning models not only achieve better predictive performance but also assume a more compact and efficient parameter space. Structured to accommodate a progressive learning curve, the content spans foundational concepts like statistical learning theory to advanced topics like Neural Tangent Kernels and overparameterization paradoxes. By synthesizing classical and modern views of generalization, the book equips readers to develop a nuanced understanding of key concepts while mastering practical applications. For academics, the book serves as a definitive resource to solidify theoretical knowledge and explore cutting-edge research directions. For industry professionals, it provides actionable insights to enhance model performance systematically. Whether you're a beginner seeking foundational understanding or a practitioner exploring advanced methodologies, this book offers an indispensable guide to achieving robust generalization in deep learning.



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