

1. Record Nr.	UNINA9910830760503321
Autore	Hoang Dinh Thai <1986->
Titolo	Deep reinforcement learning for wireless communications and networking : theory, applications and implementation // Dinh Thai Hoang [and four others]
Pubbl/distr/stampa	Hoboken, New Jersey : , : John Wiley & Sons, Inc., , [2023] ©2023
ISBN	1-119-87374-6 1-119-87368-1 1-119-87373-8
Edizione	[First edition.]
Descrizione fisica	1 online resource (291 pages)
Disciplina	006.31
Soggetti	Reinforcement learning Wireless communication systems
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Cover -- Title Page -- Copyright -- Contents -- Notes on Contributors -- Foreword -- Preface -- Acknowledgments -- Acronyms -- Introduction -- Part I Fundamentals of Deep Reinforcement Learning -- Chapter 1 Deep Reinforcement Learning and Its Applications -- 1.1 Wireless Networks and Emerging Challenges -- 1.2 Machine Learning Techniques and Development of DRL -- 1.2.1 Machine Learning -- 1.2.2 Artificial Neural Network -- 1.2.3 Convolutional Neural Network -- 1.2.4 Recurrent Neural Network -- 1.2.5 Development of Deep Reinforcement Learning -- 1.3 Potentials and Applications of DRL -- 1.3.1 Benefits of DRL in Human Lives -- 1.3.2 Features and Advantages of DRL Techniques -- 1.3.3 Academic Research Activities -- 1.3.4 Applications of DRL Techniques -- 1.3.5 Applications of DRL Techniques in Wireless Networks -- 1.4 Structure of this Book and Target Readership -- 1.4.1 Motivations and Structure of this Book -- 1.4.2 Target Readership -- 1.5 Chapter Summary -- References -- Chapter 2 Markov Decision Process and Reinforcement Learning -- 2.1 Markov Decision Process -- 2.2 Partially Observable Markov Decision Process -- 2.3 Policy and Value Functions -- 2.4 Bellman Equations --

2.5 Solutions of MDP Problems -- 2.5.1 Dynamic Programming --  
2.5.1.1 Policy Evaluation -- 2.5.1.2 Policy Improvement -- 2.5.1.3  
Policy Iteration -- 2.5.2 Monte Carlo Sampling -- 2.6 Reinforcement  
Learning -- 2.7 Chapter Summary -- References -- Chapter 3 Deep  
Reinforcement Learning Models and Techniques -- 3.1 ValueBased  
DRL Methods -- 3.1.1 Deep QNetwork -- 3.1.2 Double DQN -- 3.1.3  
Prioritized Experience Replay -- 3.1.4 Dueling Network -- 3.2 Policy  
Gradient Methods -- 3.2.1 REINFORCE Algorithm -- 3.2.1.1 Policy  
Gradient Estimation -- 3.2.1.2 Reducing the Variance -- 3.2.1.3 Policy  
Gradient Theorem -- 3.2.2 ActorCritic Methods -- 3.2.3 Advantage of  
ActorCritic Methods.  
3.2.3.1 Advantage of ActorCritic (A2C) -- 3.2.3.2 Asynchronous  
Advantage ActorCritic (A3C) -- 3.2.3.3 Generalized Advantage  
Estimate (GAE) -- 3.3 Deterministic Policy Gradient (DPG) -- 3.3.1  
Deterministic Policy Gradient Theorem -- 3.3.2 Deep Deterministic  
Policy Gradient (DDPG) -- 3.3.3 Distributed Distributional DDPG (D4PG)  
-- 3.4 Natural Gradients -- 3.4.1 Principle of Natural Gradients --  
3.4.2 Trust Region Policy Optimization (TRPO) -- 3.4.2.1 Trust Region  
-- 3.4.2.2 SampleBased Formulation -- 3.4.2.3 Practical  
Implementation -- 3.4.3 Proximal Policy Optimization (PPO) -- 3.5  
ModelBased RL -- 3.5.1 Vanilla ModelBased RL -- 3.5.2 Robust Model  
Based RL: ModelEnsemble TRPO (METRPO) -- 3.5.3 Adaptive Model  
Based RL: ModelBased MetaPolicy Optimization (MBMPO) -- 3.6  
Chapter Summary -- References -- Chapter 4 A Case Study and  
Detailed Implementation -- 4.1 System Model and Problem Formulation  
-- 4.1.1 System Model and Assumptions -- 4.1.1.1 Jamming Model --  
4.1.1.2 System Operation -- 4.1.2 Problem Formulation -- 4.1.2.1  
State Space -- 4.1.2.2 Action Space -- 4.1.2.3 Immediate Reward --  
4.1.2.4 Optimization Formulation -- 4.2 Implementation and  
Environment Settings -- 4.2.1 Install TensorFlow with Anaconda --  
4.2.2 QLearning -- 4.2.2.1 Codes for the Environment -- 4.2.2.2  
Codes for the Agent -- 4.2.3 Deep QLearning -- 4.3 Simulation  
Results and Performance Analysis -- 4.4 Chapter Summary --  
References -- Part II Applications of DRL in Wireless Communications  
and Networking -- Chapter 5 DRL at the Physical Layer -- 5.1  
Beamforming, Signal Detection, and Decoding -- 5.1.1 Beamforming --  
5.1.1.1 Beamforming Optimization Problem -- 5.1.1.2 DRLBased  
Beamforming -- 5.1.2 Signal Detection and Channel Estimation --  
5.1.2.1 Signal Detection and Channel Estimation Problem -- 5.1.2.2 RL  
Based Approaches -- 5.1.3 Channel Decoding.  
5.2 Power and Rate Control -- 5.2.1 Power and Rate Control Problem  
-- 5.2.2 DRLBased Power and Rate Control -- 5.3 PhysicalLayer  
Security -- 5.4 Chapter Summary -- References -- Chapter 6 DRL at  
the MAC Layer -- 6.1 Resource Management and Optimization -- 6.2  
Channel Access Control -- 6.2.1 DRL in the IEEE 802.11 MAC -- 6.2.2  
MAC for Massive Access in IoT -- 6.2.3 MAC for 5G and B5G Cellular  
Systems -- 6.3 Heterogeneous MAC Protocols -- 6.4 Chapter Summary  
-- References -- Chapter 7 DRL at the Network Layer -- 7.1 Traffic  
Routing -- 7.2 Network Slicing -- 7.2.1 Network SlicingBased  
Architecture -- 7.2.2 Applications of DRL in Network Slicing -- 7.3  
Network Intrusion Detection -- 7.3.1 HostBased IDS -- 7.3.2 Network  
Based IDS -- 7.4 Chapter Summary -- References -- Chapter 8 DRL at  
the Application and Service Layer -- 8.1 Content Caching -- 8.1.1 QoS  
Aware Caching -- 8.1.2 Joint Caching and Transmission Control --  
8.1.3 Joint Caching, Networking, and Computation -- 8.2 Data and  
Computation Offloading -- 8.3 Data Processing and Analytics -- 8.3.1  
Data Organization -- 8.3.1.1 Data Partitioning -- 8.3.1.2 Data  
Compression -- 8.3.2 Data Scheduling -- 8.3.3 Tuning of Data

Processing Systems -- 8.3.4 Data Indexing -- 8.3.4.1 Database Index Selection -- 8.3.4.2 Index Structure Construction -- 8.3.5 Query Optimization -- 8.4 Chapter Summary -- References -- Part III Challenges, Approaches, Open Issues, and Emerging Research Topics -- Chapter 9 DRL Challenges in Wireless Networks -- 9.1 Adversarial Attacks on DRL -- 9.1.1 Attacks Perturbing the State space -- 9.1.1.1 Manipulation of Observations -- 9.1.1.2 Manipulation of Training Data -- 9.1.2 Attacks Perturbing the Reward Function -- 9.1.3 Attacks Perturbing the Action Space -- 9.2 Multiagent DRL in Dynamic Environments -- 9.2.1 Motivations -- 9.2.2 Multiagent Reinforcement Learning Models. 9.2.2.1 Markov/Stochastic Games -- 9.2.2.2 Decentralized Partially Observable Markov Decision Process (DPOMDP) -- 9.2.3 Applications of Multiagent DRL in Wireless Networks -- 9.2.4 Challenges of Using Multiagent DRL in Wireless Networks -- 9.2.4.1 Nonstationarity Issue -- 9.2.4.2 Partial Observability Issue -- 9.3 Other Challenges -- 9.3.1 Inherent Problems of Using RL in RealWorld Systems -- 9.3.1.1 Limited Learning Samples -- 9.3.1.2 System Delays -- 9.3.1.3 High Dimensional State and Action Spaces -- 9.3.1.4 System and Environment Constraints -- 9.3.1.5 Partial Observability and Nonstationarity -- 9.3.1.6 Multiobjective Reward Functions -- 9.3.2 Inherent Problems of DL and Beyond -- 9.3.2.1 Inherent Problems of DL -- 9.3.2.2 Challenges of DRL Beyond Deep Learning -- 9.3.3 Implementation of DL Models in Wireless Devices -- 9.4 Chapter Summary -- References -- Chapter 10 DRL and Emerging Topics in Wireless Networks -- 10.1 DRL for Emerging Problems in Future Wireless Networks -- 10.1.1 Joint Radar and Data Communications -- 10.1.2 Ambient Backscatter Communications -- 10.1.3 Reconfigurable Intelligent SurfaceAided Communications -- 10.1.4 Rate Splitting Communications -- 10.2 Advanced DRL Models -- 10.2.1 Deep Reinforcement Transfer Learning -- 10.2.1.1 Reward Shaping -- 10.2.1.2 Intertask Mapping -- 10.2.1.3 Learning from Demonstrations -- 10.2.1.4 Policy Transfer -- 10.2.1.5 Reusing Representations -- 10.2.2 Generative Adversarial Network (GAN) for DRL -- 10.2.3 Meta Reinforcement Learning -- 10.3 Chapter Summary -- References -- Index -- EULA.

---

### Sommario/riassunto

"This book provides fundamental background on Deep Reinforcement Learning (DRL) and then studies recent advances in DRL to address practical challenges in wireless communications and networking. In particular, this book first gives a tutorial of DRL from basic concepts to advanced modelling techniques to motivate and provide fundamental knowledge for the readers. The authors then provide case studies together with implementation details to help readers better understand how to practice and apply DRL to their problems. After that, they review DRL approaches that address emerging issues in communications and networking. Finally, the authors highlight important challenges, open issues, and future research directions of applying DRL in wireless networks."--

---