BOOK TITLE: Hands-On Deep Reinforcement Learning with Keras

Subtitle: Explore reinforcement learning algorithms and apply deep RL methods using the popular libraries Keras, Keras-RL and OpenAI Gym

AUTHOR: Brian Moore

ABOUT THE AUTHOR

In order for us to write your author bio we need a few details. Please remember that your answers should be *relevant* to the book. Your bio helps sell the book so please *only* include *relevant* information:

Full name	Brian Thomas Moore, I usually go by Brian Moore
What is your job title?	Technical Architect
What is the name of the organisation you work for?	Kutir Corporation
What is your skillset (as relevant to the book)?	Developing Deep networks in Keras
In which industry do you work?	Enterprise Software Development
What University degree do you have?	B.S. CIS, A.A. Network Programming, A.A. Systems Programming
What professional qualifications do you have?	E.g. MVP, Oracle certified
PLease detail your *relevant* work history	I've developed deep networks in both Keras and Tensorflow at Monetize Solutions and Kutir Corporation
Relevant projects projects you have worked on:	
1	Image processing web application that takes input images and reads information visible on specific images. The final project uses Keras and Nvidia RTX 2080 GPU acceleration.
2	Prediction deep network deployed in the Google cloud using TensorFlow. It augments marketing demographic data, filling in missing values with

	predictions based on a company's existing user base
3	Several Kaggle competitions, my best so far I am in the top 15%: https://www.kaggle.com/ldm314/competitions
Would you like to include your social media details (optional)?	Linked in profile: https://www.linkedin.com/in/ldm314/

Can you recommend a good technical reviewer for your book?

[INSERT HERE: *Name & Contact details*]
I have some contacts that may know someone who could do this. I will reach out and add here.

PART ONE: BACKGROUND RESEARCH

TARGET AUDIENCE

Describe your target reader: what you assume about their knowledge of the topic, related topics, and technical topics generally; why they want to learn the technology; what will they want to do with it?

Answer the following:

Who is your audience?

1	This book is suitable for Deep Learning, Reinforcement Learning researchers, Sr. ML Scientist, AI Engineer with basic knowledge of Keras and TensorFlow.
2	Having sound knowledge of linear algebra, calculus, Python programming language, deep learning and exposure to Keras framework will help you grasping the concept better.Also, a basic introduction of reinforcement learning would be beneficial.

What is important to them?

1	The audience would want to understand and implement basic to advanced reinforcement learning concepts with use cases in Keras.
2	I. Understanding the complexity of problems, II. Access to a GPU (recommended), III. Provision for efficient scaling for larger problem.

3	Python framework, understanding of linear algebra and statistics, sound knowledge of machine learning and deep learning approaches.

COMPETITIVE BOOK TITLES

What is unique about your book? You will need to look on Amazon at books that have been well-received – what are the top three market leading books that your book will compete with? Examine the description, table of contents and book reviews.

List the books here:

1	[INSERT HERE: Competitor 1]
2	Reinforcement Learning with TensorFlow: S. Dutta, Packt
3	Keras Reinforcement Learning Projects: G. Ciaburro, Packt

Please ensure that you have looked at the **description**, **table of contents** and **book reviews** for each of these books.

PART TWO: BOOK OVERVIEW

Having looked at your **target audience** and **competitor's products**, now decide, what is the **purpose** of your book:

OVERVIEW

The long description is the device we use to describe the book on Amazon. Writing it is fairly systematic. Please answer the following questions using only one sentence.

TEMPLATE	EXAMPLE: Learn Python Programming	Your turn...
Explain / Introduce the tech	Python is an extremely flexible and powerful programming language	Deep Reinforcement Learning is a combination of the fields of Deep Learning and Reinforcement learning.
Why would a developer want to learn it?	that can be applied to many disciplines.	That can be used to solve complex tasks with above human-level performance
Product Breakdown: In 2	You'll learn how to write	In this book we will explore

sentences, describe the "journey" the book takes the reader on. Look at your section headings for help	programs, build websites, and work with data by harnessing Python's powerful data science libraries. Filled with real-world examples, the book covers applications such as web development, game development and data science, and concludes by building real-world projects.	commonly used RL algorithms like Monte Carlo Methods, Multi-Arm Bandit strategy, and DQN with practical examples. We will then cover Deep Learning examples with CNN, LSTM, as well as transfer learning from pretrained networks.
By the end of this book you will...	By the end of this book you will know how to manipulate Python to achieve real-world results.	Finally we will combine these examples to solve real world problems.
Anything else you would like to add?		I'd like to include a section on setup/configuration of GPU.

LEARNING OUTCOME - WHAT WILL THE READER LEARN AND DO?

Consider the competing books; in particular the **description**, **table of contents** and **book reviews**.

Decide what the key learning objectives will be for your book. List them below:

1	Overview of reinforcement Learning, deep learning, and deep reinforcement learning
2	Overview of Keras framework, GPU setup
3	Using Keras-RL, OpenAI Gym, RL algorithms
4	Deep learning in Keras, custom models, pretrained models
5	Apply to real world problems, using openai gym-retro. DQN, Rainbow

PART THREE: BOOK STRUCTURE

Using your **overview**, and **learning outcomes** now decide on the structure of your book? What are your start and end points?

GENERAL STRUCTURE

Divide the book into approximately 3 parts. The **learning outcomes** you listed previously will help to inform these. These "parts" are a group of chapters that work toward the same goal. Each part will consist of 3-5 chapters. For example: A book on Building Machine Learning Systems with Python might be split into 5 parts as follows: "The Basics"; "Book Learning"; "Numbers, Forecasts and Recommendations"; "Sound and Vision" and finally, "Practical Matters".

WRITE YOUR PART HEADINGS BELOW:

1	A practical overview of RL, deep learning, transfer learning, deep reinforcement learning with Keras
2	Problem Solving with deep reinforcement learning
3	Advanced Deep Reinforcement Learning

CHAPTER OUTLINE

Each chapter should have a clear focus. Each chapter title should clearly state what aspect of the overall topic the chapter deals with.. Continuing the example of *Building Machine Learning Systems with Python* your section on "Book Learning" might be broken down into 4 chapters as follows: "Clustering – sorting text into groups", "Topic Modeling – creating non-exclusive groups"; "Logistic Regression – evaluating text quality"; "Bayes Classification – sentiment analysis". *PLEASE NOTE: Chapter titles appear on Amazon*

PART ONE: A practical overview of RL, deep learning, transfer learning, deep reinforcement learning with Keras	
1	Deep Reinforcement Learning
2	Keras, Keras-RL, and the OpenAI Gym
3	Deep Learning and Transfer Learning
4	Guided Policy Search

PART TWO: Problem Solving with deep reinforcement learning
1	Markov Decision Process and Monte Carlo Methods
2	Temporal Difference Learning
3	The Continuous Action Space
4	The Actor-Critic Method

PART THREE: Advanced Deep Reinforcement Learning
1	Build your own AlphaZero AI
2	Deep Q-Network and Atari Games
3	Asynchronous Actor-Critic with gym-retro
4	Road Ahead

ADD OTHER PARTS/CHAPTERS ONLY IF YOUR TOPIC REQUIRES IT

PART FOUR: DETAILED OUTLINE

PART 1: A practical overview of RL, deep learning, transfer learning, deep reinforcement learning with Keras

Introduction to reinforcement learning, introduction to deep learning, brief introduction to Keras framework and the Open AI Gym environment.

CHAPTER 1: Deep Reinforcement Learning
- 15-20 pages

DESCRIPTION:

This chapter will start off by giving the reader an overview of Reinforcement Learning. The reader will then learn review deep learning. Finally, we will discuss the relationship of deep learning and reinforcement learning

Level: Basic

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Overview of Reinforcement Learning
2. HEADING 2: Overview of Deep Learning
3. HEADING 3: Deep Reinforcement Learning

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Understand the basic of Reinforcement Learning
2. SKILL 2: Understand the basics of Deep Learning
3. SKILL 3: Understand the relation of Reinforcement Learning, Deep Learning, and Deep Reinforcement Learning.

CHAPTER 2: Keras, Keras-RL, and Open AI Gym API
- 35 pages

DESCRIPTION:

This section will include an environmental setup on Keras which can be implemented on a personal system or in the cloud. We will also learn the basics of the OpenAI Gym API which includes randomly behaving agent and its implementation

Datset: https://gym.openai.com/

Level: Basic

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Overview to Keras and its advantages for Machine learning
2. HEADING 2: Setting up Keras using Tensorflow using the GPU
3. HEADING 3: Setting up Keras RL along with Jupyter Notebook
4. HEADING 4: Setting up your development environment
5. HEADING 6: The OpenAI Gym API
6.
7. HEADING 8: Setting up the deployment environment
8. HEADING 9: Playing with the Cart Pole

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Install a complete Keras development environment
2. SKILL 2: Optimize Keras workflow with existing GPU in system
3. SKILL 3: Set up Keras RL framework and Jupyter notebook
4. SKILL 4: Running in the cloud using Docker
5. SKILL 5: Understand the OpenAI Gym API
6. SKILL 6: Learn basic theories before setting up an environment
7. SKILL 7: Setting up an OpenAI environment
8. SKILL 8: Learn how to create your first environment

CHAPTER 3: Deep Learning and Transfer Learning
- 25-30 pages

DESCRIPTION:

In this chapter, we will review what deep learning is, and several types of deep networks. First the reader will construct a small CNN trained to recognize objects in images. The reader will then use pre-trained networks in Keras to perform the same task with minimal training.

Dataset: Imagenet dogs: http://vision.stanford.edu/aditya86/ImageNetDogs/

Level: Intermediate

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Deep Learning
2. HEADING 2: Building a convolutional deep network with Keras
3. HEADING 3: Using pretrained models
4. HEADING 4: [*INSERT HERE: Core topic*]
5. HEADING 5: [*INSERT HERE: Core topic*]

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Learn the components for deep networks using Keras
2. SKILL 2: Build a network to identify images
3. SKILL 3: Take advantage of transfer learning and pre-trained models
4. SKILL 4: [*INSERT HERE: Core topic*]
   SKILL 5: [*INSERT HERE: Core topic*]

CHAPTER 4: Guided Policy Search
- 25-30 pages

DESCRIPTION:

This chapter reviews what reinforcement learning is. First the difference between supervised and unsupervised learning. Then discuss Reward, Agent, and the Markov Process. Finally an overview of guided policy search.

Dataset: https://gym.openai.com/

Level: Basic

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: RL, supervised and unsupervised learning
2. HEADING 2: Action, Observation and the environment
3. HEADING 3: Reward, agent, and Markov Process
4. HEADING 4: Guided Policy Search

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Understand the difference between different learning paradigms
2. SKILL 2: Learn RL formalism and relations.
3. SKILL 3: Understand policy and Guided Policy Search

PART 2: Problem Solving with deep reinforcement learning

Here we would introduce several key reinforcement learning concepts with relevant and practical examples using Keras. Objective of this part is to give hands on experience to the users to apply the theoretical frameworks on real problems.

CHAPTER 5: Markov Decision Process and Monte Carlo Methods
- 25-30 pages

DESCRIPTION:

In this chapter, we will dive deeper into what the Markov Decision Process(MDP) is and how can we use it to solve reinforcement learning problems. The next section will include implementation of Monte Carlo method. The Monte Carlo Algorithm is used when the model of the environment is unknown. It is one of the most powerful algorithms, used in diverse fields of studies.

Dataset: https://gym.openai.com/envs/#toy_text

Level: Intermediate

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Deeper dive into Markov decision processes
2. HEADING 2: Overview to Monte Carlo methods
3. HEADING 3: Monte Carlo prediction
4. HEADING 4: Playing Black Jack with Monte Carlo

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Learn the advanced concepts of MDP
2. SKILL 2: Learn about Monte Carlo Methods
3. SKILL 3: Use Monte Carlo to make predictions
4. SKILL 4: Application of Monte Carlo to Blackjack

CHAPTER 6: Temporal Difference Learning
- 30 pages

DESCRIPTION:

This chapter will start of by giving the reader an overview of Temporal Difference (TD) learning. The Sarsa algorithm is an On-Policy algorithm for TD-Learning. The reader will also learn TD prediction and control and the readers will be Introduced to Deep Q learning and SARSA. The reader will also explore how to Solve the driver pick-up and drop-off problem using Deep Q learning and SARSA

Datasset: Taxi problem: https://gym.openai.com/envs/#toy_text

Level: Intermediate

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Overview to the Temporal Difference (TD) learning

2. HEADING 2: Learn TD prediction and control
3. HEADING 3: Overview to Deep Q learning and SARSA
4. HEADING 4: Solve the driver pick-up and drop-off problem using Q learning and SARSA

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Learn TD learning
2. SKILL 2: Understand Q learning
3. SKILL 3: Explore SARSA
4. SKILL 4: Application of Q learning and SARSA on driver pick-up and drop-off problem

CHAPTER 7: The Continuous Action Space
- 20 pages

DESCRIPTION:

In this chapter we shift from discrete action space to continuous action space, where we interact with the physical world. Here we would try to learn how to deal with this situation. The readers will also be introduced to the concepts of Deterministic Policy Gradient and Distributional Policy Gradient.
Dataset: https://gym.openai.com/envs/CarRacing-v0/

Level: Intermediate

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Overview of Continuous Action Space
2. HEADING 2: The Actor-Critic method on continuous action space
3. HEADING 3: Deterministic Policy Gradient
4. HEADING 4: Distributional Policy Gradient
5. HEADING 5: Lets train an agent to play a racing car

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Difference between a discrete and a continuous action space
2. SKILL 2: How to apply the Actor-Critic method on this problem
3. SKILL 3: Different policy gradient approaches for continuous action space
4. SKILL 4: Implementing an agent to learn how to play racing games

CHAPTER 8: The Actor-Critic Method
- 25-30 pages

DESCRIPTION:

In this chapter we introduce the method called Actor-Critic. It is one of the most powerful methods in Deep Reinforcement Learning. The reader will then learn about Q Actor-Critic, and how deep networks

are used. Finally, the user will be introduced to Asynchronous Advantage Actor-Critic where multiple actors are involved.

Dataset: Pendulum: https://gym.openai.com/envs/Pendulum-v0/ and Atari: https://gym.openai.com/envs/#atari

Level: Intermediate

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: The Actor-Critic method
2. HEADING 2: Q Actor-Critic and deep networks, DQN
3. HEADING 3: The Asynchronous Advantage Actor-Critic
4. HEADING 4: Actor Critic in Keras and OpenAI gym
5. HEADING 5: [*INSERT HERE: Core topic*]

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Actor-Critic method
2. SKILL 2: Understand how Deep Networks can be used with Actor-Critic
3. SKILL 3: Asynchronous Advantage Actor-Critic and performance
4. SKILL 4: [*INSERT HERE: Core topic*]
5. SKILL 5: [*INSERT HERE: Core topic*]

PART 3: Advanced Deep Reinforcement Learning

Here we would introduce advanced deep reinforcement learning concepts with practical examples using Keras. This part is targeted at the advanced audience to give hands on experience using Deep Reinforcement Learning on complex problems.

CHAPTER 9: Build your own AlphaZero AI
- 15 pages

DESCRIPTION:

In this chapter we will first learn the history and significance of AlphaZero. We will then learn how AlphaZero chooses its next move. Finally we build a replica of the AlphaZero methodology to play the game Connect4.

Dataset: None, rules of connect 4 the game.

Level: Advanced

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: History of Alpha Zero
2. HEADING 2: Connect 4 and it's rules
3. HEADING 3: Monte Carlo Tree Search
4. HEADING 4: Implementing your own version of the AlphaZero to play Connect4
5. HEADING 4: [*INSERT HERE: Core topic*]
6. HEADING 5: [*INSERT HERE: Core topic*]

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Why is AlphaZero so important in the history of AI
2. SKILL 2: Implementing an agent to play Connect4
3. SKILL 3: What Monte Carlo Tree Search is used for
4. SKILL 4: A detailed analysis of the project and results
5. SKILL 4: [*INSERT HERE: Core topic*]
6. SKILL 5: [*INSERT HERE: Core topic*]

CHAPTER 10: Deep Q-Network and Atari Game
- 30-35 pages

DESCRIPTION:

In this chapter, we will briefly review the model-based methods in Reinforcement Learning. The reader will learn about the advances in DRL made by DeepMind. Finally, we will reimplement the model proposed by DeepMind in Keras by adding imagination to its agents. After this section, we will review the rainbow algorithm that combines improvements in Deep Reinforcement Learning and discuss how it gives a state-of-the-art result on the Atari console.

Dataset: Atari: https://gym.openai.com/envs/#atari

Level: Advanced

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Model based approaches vs Model free approaches
2. HEADING 2: Overview of the imagination-augmented agent
3. HEADING 3: Deep Reinforcement Learning with Atari games
4. HEADING 4: Overview to rainbow approach
5. HEADING 5: A brief review of the 7 algorithms of the rainbow
6. HEADING 6: Best practice for rainbow
7. HEADING 7: Atari games, once more

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Model based approach

2. SKILL 2: Comparison between Model based and Model free approaches
3. SKILL 3: Imagination-augmented agent
4. SKILL 4: Building an agent to playing Atari with the imagination-augmented
5. SKILL 5: Introduction to rainbow
6. SKILL 6: Brief overview of DQN (Deep Q-Network), DDQN (Double Deep Q-Network. N-Step Q-Learning,Prioritized Experience Replay, Dueling Q-Network, Distributional RL, Noisy Network
7. SKILL 7: Learning the best practice for rainbow
8. SKILL 8: Implement an agent power by rainbow to play Atari

CHAPTER 11: Asynchronous Actor-Critic with gym-retro
- 30-35 pages

DESCRIPTION:

This chapter is a deeper dive into Asynchronous Actor-Critic Agents. The reader will learn how multithreading is applied to accelerate the learning process. Next the reader will implement the Atari game scenario with A3C agents. Finally, large deep networks will be used with A3C to learn a game from gym-retro

Dataset: gym-retro: https://github.com/openai/retro

Level: Advanced

Main Chapter Headings (3-5 main chapter headings)

1. HEADING 1: Asynchronous Actor-Critic Agents
2. HEADING 2: Atari with A3C
3. HEADING 3: Libretro and gym-retro
4. HEADING 4: A3C for gym-retro

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

1. SKILL 1: Learn the differences between Actor-Critic Agents and A3C.
2. SKILL 2: Use A3C with Atari
3. SKILL 3: What libretro and gym-retro provide
4. SKILL 4: Put together advanced deep networks and A3C to create deep reinforcement networks.

CHAPTER 12: Road Ahead
- 15 pages

DESCRIPTION:

In this final chapter we would briefly review all methods, that we discussed previously. We will then highlight some of the latest environments available for Deep Reinforcement Learning.

Level: Intermediate

Main Chapter Headings (3-5 main chapter headings)

7. HEADING 1: Deep Reinforcement Learning
8. HEADING 2: DeepMind Lab
9. HEADING 3: Unity Machine Learning Agents
10. HEADING 4: Conclusion
11. HEADING 5: [*INSERT HERE: Core topic*]

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

7. SKILL 1: Recall the core concepts of Deep Reinforcement Learning
8. SKILL 2: Know the latest DRL environments
9. SKILL 3: [*INSERT HERE: Core topic*]
10. SKILL 4: [*INSERT HERE: Core topic*]
11. SKILL 5: [*INSERT HERE: Core topic*]

CHAPTER *n:* [Insert your *chapter title here*]
- [Pages] pages

DESCRIPTION:

[INSERT HERE: **50-100** words, describing the content of the chapter]

Level: [*INSERT HERE: Basic, Intermediate, or Advanced with regard to the target readership of the book*]

Main Chapter Headings (3-5 main chapter headings)

6. HEADING 1: [*INSERT HERE: Core topic*]
7. HEADING 2: [*INSERT HERE: Core topic*]
8. HEADING 3: [*INSERT HERE: Core topic*]
9. HEADING 4: [*INSERT HERE: Core topic*]
10. HEADING 5: [*INSERT HERE: Core topic*]

Skills learned: *For each heading, insert what the reader will learn to DO in this chapter?*

5. SKILL 1: [*INSERT HERE: Core topic*]
6. SKILL 2: [*INSERT HERE: Core topic*]
7. SKILL 3: [*INSERT HERE: Core topic*]
8. SKILL 4: [*INSERT HERE: Core topic*]
9. SKILL 5: [*INSERT HERE: Core topic*]