

Deep Learning With Evolutionary Computation Natural Computing Series

Deep learning and evolutionary computation are two powerful fields in computer science that have revolutionized the way machines learn and solve complex problems. When combined, these two fields can create even more powerful algorithms that can tackle even more challenging tasks. In this article, we will explore the concept of deep learning with evolutionary computation and its applications in various domains.

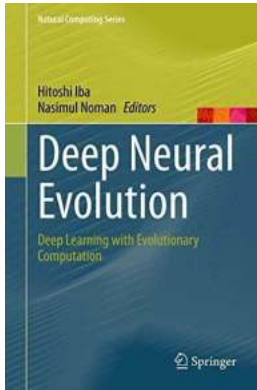
to Deep Learning

Deep learning is a subfield of machine learning that focuses on training artificial neural networks with multiple layers to learn from large amounts of data. These neural networks are inspired by the structure and function of the human brain, where information flows through connected neurons to perform complex computations. By mimicking this structure, deep learning algorithms are able to extract high-level features from raw data and make accurate predictions or classifications.

Deep learning has achieved remarkable success in various domains, including computer vision, natural language processing, speech recognition, and even game playing. For example, deep learning models have achieved human-level performance in image classification tasks, where they can accurately categorize images into thousands of classes.

Deep Neural Evolution: Deep Learning with Evolutionary Computation (Natural Computing Series) by Dante Alighieri (1st ed. 2020 Edition, Kindle Edition)

★★★★★ 5 out of 5



Language	: English
File size	: 55221 KB
Text-to-Speech	: Enabled
Enhanced typesetting	: Enabled
Print length	: 694 pages
Screen Reader	: Supported



to Evolutionary Computation

Evolutionary computation, on the other hand, is a subfield of artificial intelligence that is inspired by the process of natural evolution. It uses principles such as selection, crossover, and mutation to evolve a population of candidate solutions to a problem. Over successive generations, the algorithms improve the quality of the solutions by iteratively applying these evolutionary operators.

Evolutionary computation has been successfully applied to optimization problems, where the goal is to find the best solution for a given problem. Some popular evolutionary algorithms include genetic algorithms, genetic programming, and particle swarm optimization. These algorithms have been used to solve a wide range of problems, from engineering design to financial portfolio optimization.

Combining Deep Learning and Evolutionary Computation

The marriage of deep learning and evolutionary computation brings together the best of both worlds. Deep learning algorithms are excellent at learning from large amounts of data and making accurate predictions, while evolutionary computation

algorithms are excellent at exploring the solution space and finding the best possible solutions.

By combining these two fields, we can create algorithms that not only learn from data but also adapt and evolve over time. This allows us to solve complex problems that may have too many variables or unknowns to be explicitly programmed. Evolutionary deep learning algorithms are able to learn and evolve complex representations that improve their performance over time.

Applications of Deep Learning with Evolutionary Computation

Deep learning with evolutionary computation has been applied to various domains and has shown promising results. Here, we will explore some of the key applications of this hybrid approach:

1. Image generation and enhancement

Deep learning with evolutionary computation has been used to generate realistic images and enhance low-quality images. By training deep learning models on large image datasets and applying evolutionary operators, researchers have been able to create impressive image generation algorithms. These algorithms can generate images of objects or scenes that do not exist in the real world, but look incredibly real.

2. Robot control and optimization

Robots often face complex control and optimization problems, where traditional programming methods may not be sufficient. Deep learning with evolutionary computation has been used to train robots to perform complex tasks, such as object manipulation and navigation. By combining deep learning with evolutionary algorithms, robots are able to learn and adapt to their environment, improving their performance over time.

3. Drug discovery

Deep learning with evolutionary computation has shown promise in accelerating the drug discovery process. By training deep learning models on large databases of molecular structures and applying evolutionary operators, researchers have been able to generate novel drug candidates with high potential. This approach can significantly reduce the time and cost required for traditional drug discovery methods.

4. Financial forecasting

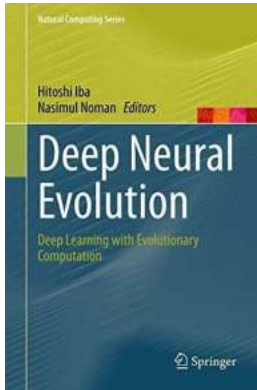
The financial markets are highly complex and dynamic, making accurate forecasting a challenging task. Deep learning with evolutionary computation has been used to predict stock prices, market trends, and optimize investment strategies. By combining deep learning with evolutionary algorithms, researchers have been able to improve the accuracy of financial forecasts and make smarter investment decisions.

Deep learning with evolutionary computation is a powerful approach that combines the strengths of both fields. By leveraging the learning capabilities of deep learning algorithms and the optimization capabilities of evolutionary algorithms, we can solve complex problems and unlock new possibilities. The applications of this hybrid approach are diverse and promising, spanning from image generation to drug discovery and financial forecasting. As research and development in these fields continue to progress, we can expect even more breakthroughs in the future.

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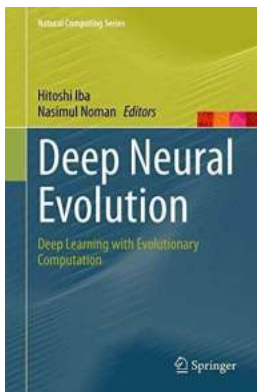
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This book delivers the state of the art in deep learning (DL) methods hybridized with evolutionary computation (EC). Over the last decade, DL has dramatically reformed many domains: computer vision, speech recognition, healthcare, and automatic game playing, to mention only a few. All DL models, using different architectures and algorithms, utilize multiple processing layers for extracting a hierarchy of abstractions of data. Their remarkable successes notwithstanding, these powerful models are facing many challenges, and this book presents the collaborative efforts by researchers in EC to solve some of the problems in DL.

EC comprises optimization techniques that are useful when problems are complex or poorly understood, or insufficient information about the problem domain is available. This family of algorithms has proven effective in solving problems with challenging characteristics such as non-convexity, non-linearity, noise, and irregularity, which dampen the performance of most classic optimization schemes. Furthermore, EC has been extensively and successfully applied in artificial neural network (ANN) research —from parameter estimation to structure optimization. Consequently, EC researchers are enthusiastic about applying their arsenal for the design and optimization of deep neural networks (DNN).

This book brings together the recent progress in DL research where the focus is particularly on three sub-domains that integrate EC with DL: (1) EC for hyper-parameter optimization in DNN; (2) EC for DNN architecture design; and (3) Deep neuroevolution. The book also presents interesting applications of DL with EC in real-world problems, e.g., malware classification and object detection. Additionally, it covers recent applications of EC in DL, e.g. generative adversarial networks (GAN) training and adversarial attacks. The book aims to prompt and facilitate the research in DL with EC both in theory and in practice.



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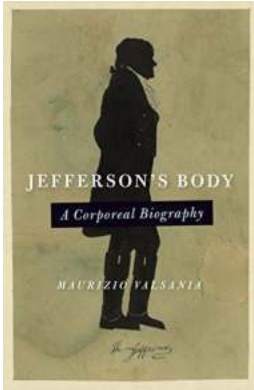
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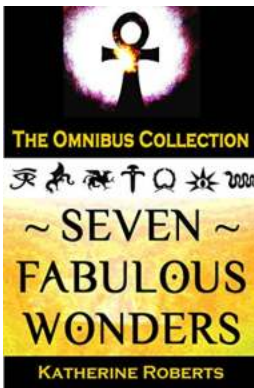
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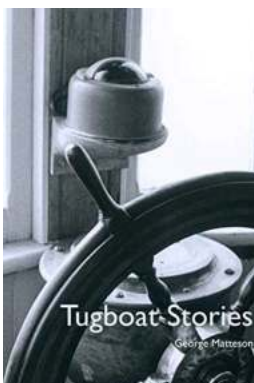
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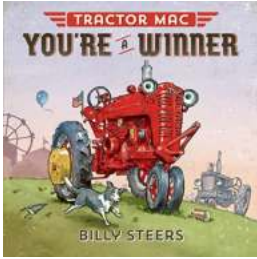
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