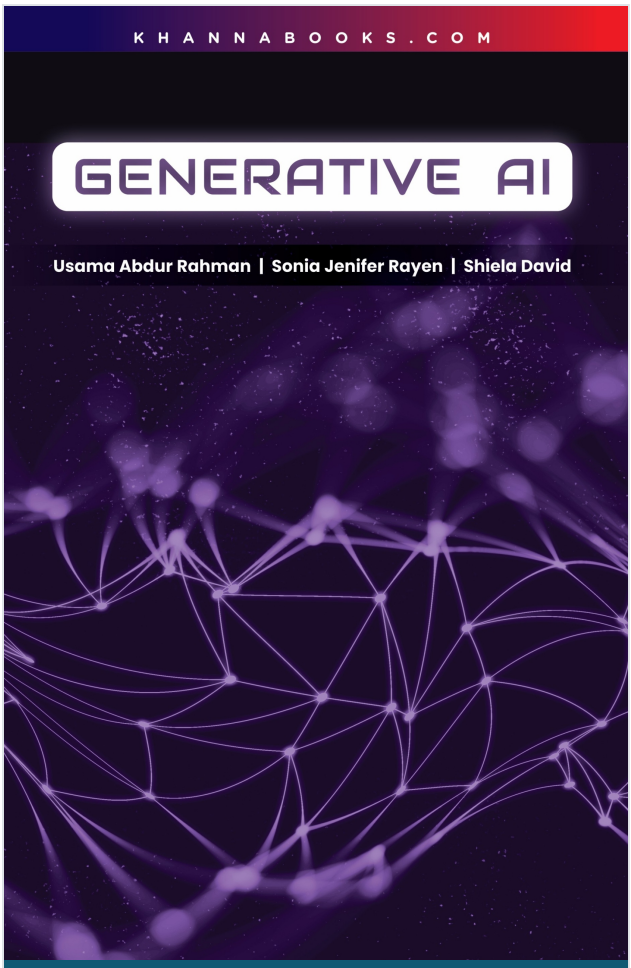


Sonia Jenifer Rayen, Shiela David, Usama Abdur Rahman

Generative AI

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Product Description

Generative AI (Gen AI) has rapidly evolved from a theoretical concept into a transformative technology capable of simulating human creativity, generating content, producing innovative ideas, and enabling autonomous decision-making. This book serves as a comprehensive and structured guide to understanding the foundations, architectures, applications, and future directions of Generative Artificial Intelligence. Designed for students, researchers, professionals, and technology enthusiasts, it provides both theoretical insights and practical perspectives on one of the most influential fields in modern computing.

The text begins by tracing the historical evolution of Artificial Intelligence, highlighting key milestones that shaped the development of machine learning and intelligent systems. It then builds a strong conceptual foundation by introducing Neural Networks and the revolutionary Transformer Architecture, which forms the backbone of modern generative systems. Special emphasis is placed on the Attention Mechanism, encoder-decoder architectures, and the emergence of Large Language Models (LLMs) that power advanced conversational and content-generation systems.

Beyond foundational concepts, the book explores advanced generative techniques such as Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs), explaining their architectures, workflows, and practical applications. Readers gain insights into how generative models create realistic text, images, and multimedia content, while also understanding the principles behind AI Agents, prompt engineering, and modern AI development frameworks.

The practical relevance of Generative AI is demonstrated through extensive real-world applications across healthcare, finance, manufacturing, software engineering, media, and entertainment. The text also addresses critical contemporary topics including model

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evaluation metrics, ethical considerations, responsible AI development, and emerging innovations such as Quantum AI and Neuromorphic Computing. By combining academic rigor with practical implementation, this book provides a complete roadmap for mastering the rapidly evolving landscape of Generative Artificial Intelligence.

Salient Features:

- Foundational AI Concepts: Provides a detailed overview of the history and evolution of Artificial Intelligence, establishing a strong foundation in neural networks, machine learning, and the development of generative technologies.
- Transformer Architecture Deep Dive: Thoroughly explains Transformer Models, the Attention Mechanism, and the distinctions between encoder-based architectures (such as BERT) and decoder-based Large Language Models.
- Large Language Model Mastery: Covers the principles, architectures, and applications of LLMs, including their use in natural language processing, content generation, summarization, translation, and conversational AI systems.
- Advanced Generative Models: Presents comprehensive coverage of Variational Autoencoders (VAEs) and Generative Adversarial Networks (GANs), detailing their components, workflows, training methodologies, and practical applications.
- Practical AI Agents & Frameworks: Introduces AI Agents and modern development frameworks such as Lang Chain, enabling readers to build scalable and production-ready Generative AI applications.
- Cross-Industry Applications: Demonstrates the transformative impact of Generative AI across multiple sectors, including healthcare, manufacturing, finance, software development, and digital media.
- Model Evaluation Techniques: Explains important evaluation metrics such as Perplexity, BLEU Score, and ROUGE Score, helping readers assess and benchmark the performance of generative and language models.

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- Future & Ethical Directions: Explores emerging topics including Multimodal AI, prompt optimization techniques (Top-K and Top-P sampling), ethical AI practices, Quantum AI, and Neuromorphic Computing.

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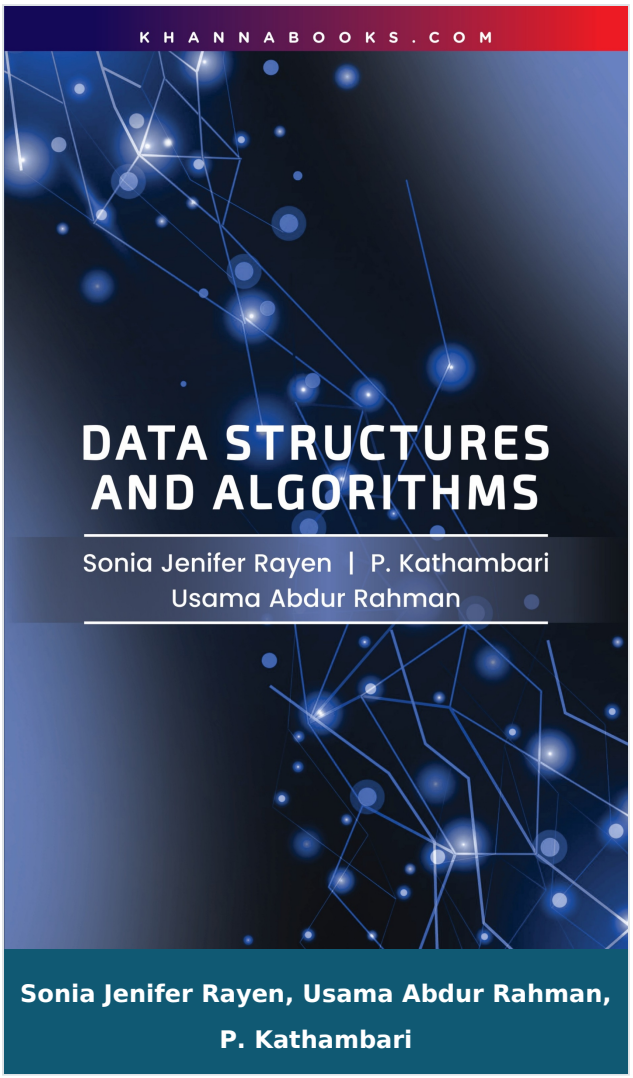
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Product Description

In the rapidly evolving landscape of computer science and technology, a foundational mastery of data structures and algorithms is paramount for efficient problem-solving and system design. This essential textbook is specifically designed to offer Computer Science, Information Technology, and allied students, along with educators and aspiring programmers, a broad and easy-to-understand exposition of these key principles.

The book's core purpose is to build a strong, clear, and practical understanding of fundamental concepts, integrating theoretical principles with applied implementation so readers can not only grasp the inherent logic but also implement solutions in real-world computing environments. The text systematically covers traditional structures like Arrays, Linked Lists, Stacks, and Queues, alongside complex non-linear structures such as Trees and Graphs. It then advances to essential algorithm design techniques, including Divide and Conquer, Greedy Algorithms, and Dynamic Programming, and comprehensively covers Searching and Sorting methods.

A key highlight is the dedicated focus on Algorithm Analysis, thoroughly explaining concepts like Time and Space Complexity and Big O notation to ensure readers can develop efficient, optimized solutions. Maintaining an academic yet friendly tone, the book ensures clarity by breaking down complex concepts, supplemented with numerous diagrams, real-life examples, and code snippets, primarily using Python for readability. This text is an indispensable guide for establishing the analytical and coding skills necessary for academic and professional success.

Salient Features:

• Foundational DS: Systematically covers primitive and non-primitive structures like arrays, linked lists, stacks, queues, trees, and graphs, forming the core of computing.

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• Performance Analysis: Explains the crucial concepts of Big O notation, time, and space complexity analysis, enabling the design of optimized and efficient coding solutions.

• Advanced Techniques: Details advanced algorithm design paradigms, including Divide and Conquer, the Greedy approach, Dynamic Programming, and Backtracking for complex problem-solving.

• Practical Coding: Adopts a hands-on approach with numerous code snippets, examples, and diagrams, utilizing Python for clear, readable implementation of concepts.

• Search & Sort Mastery: Provides clear, step-by-step coverage of fundamental operations like linear search, binary search, and various efficient sorting methods (Quick, Merge, Heap).

• Applied Solutions: Explores real-world applications of data structures, such as polynomial manipulation via lists and shortest path problems using Dijkstra's algorithm.

• Conceptual Clarity: Establishes a strong basis by thoroughly defining and differentiating between data, information, and Abstract Data Types (ADT) before implementation.

• Student Focused: Includes chapter-end exercises and problems to reinforce learning, making it an ideal, syllabus-aligned guide for academic and professional preparation.

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