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PREFACE

Artificial Intelligence has rapidly evolved from a speculative concept to a transformative force reshaping industries, societies, and our everyday lives. This book, **Artificial Intelligence-Theory and Practice**, is designed as a comprehensive introduction to the foundational principles, core techniques, and real-world applications of AI, tailored for students, educators, and practitioners who seek both breadth and depth in their understanding of this dynamic field. The structure of the book reflects a deliberate progression-from fundamental ideas to specialized domains and advanced topics. It begins with the essential concepts and mathematical tools that underpin AI, ensuring that readers develop a solid theoretical base. It then explores classical AI techniques such as search, problem solving, and knowledge representation, followed by a deep dive into machine learning, which is at the heart of most modern AI systems. The subsequent sections cover specialized areas including natural language processing, and computer vision that exemplify the power and versatility of AI technologies.

ACKNOWLEDGMENTS

The development of **Artificial Intelligence-Theory and Practice** has been a rewarding and intellectually stimulating process. This work is the result of sustained effort, critical reflection, and the synthesis of knowledge built over decades in the field of artificial intelligence. We acknowledge the vast body of research, theory, and application that has shaped the modern understanding of AI. The ideas presented in this book are deeply rooted in the contributions of the global academic and research communities. The collective progress in areas such as machine learning, natural language processing, and computer vision, provided the foundation upon which this text is built. Gratitude is extended to the many educators, students, and professionals who have contributed indirectly to this work through their questions, discussions, and engagement with the subject matter. Their curiosity and dedication to learning continue to shape how AI is taught and understood.

Thanks are also due to those involved in the preparation and refinement of this book, including those who worked on editing, formatting, and quality assurance. Their commitment to clarity and accessibility has been instrumental in bringing this book to completion. This project has also benefited from the quiet support and encouragement that makes focused work possible. While not named individually, that support has been deeply appreciated throughout every stage of this endeavor. It is our hope that this book will serve as a meaningful resource for those seeking to explore, understand, and contribute to the evolving field of artificial intelligence.

ABOUT THIS BOOK

Artificial Intelligence-Theory and Practice offers a comprehensive journey through the key areas of artificial intelligence, providing readers with both foundational knowledge and insights into advanced topics. The book begins with an overview of AI as a discipline, exploring its definition, historical development, types of intelligence, and major milestones. It introduces core mathematical concepts essential to understanding AI systems, such as linear algebra, probability, statistics, calculus, and optimization techniques. These tools form the analytical basis for many AI methods and models. The book proceeds to discuss classical AI approaches to problem solving, including state-space search techniques and both uninformed and informed algorithms. It examines adversarial search strategies used in competitive environments and dives into knowledge representation and reasoning-focusing on logic-based systems, ontologies, and probabilistic reasoning methods that enable machines to draw conclusions and make decisions.

A significant portion of the book is devoted to machine learning. Readers are introduced to key learning paradigms-supervised, unsupervised, and reinforcement learning-and the process of model selection and evaluation. It explains classical machine learning algorithms such as regression, decision trees, support vector machines, and clustering techniques. The book then explores deep learning, covering artificial neural networks, convolutional and recurrent architectures, autoencoders, generative adversarial networks (GANs), and transfer learning, all of which have enabled breakthroughs in modern AI applications. Specialized fields such as natural language processing and computer vision are explored in depth. Topics include tokenization, syntactic analysis, word embeddings, and powerful transformer models like BERT and GPT. The computer vision section discusses image analysis techniques, convolutional neural networks, and newer architectures like vision transformers.