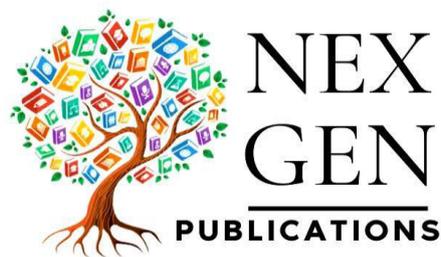# FOUNDATIONS AND PRINCIPLES OF

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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Foundations and Principles of Artificial Intelligence and Machine Learning

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Preface

Artificial Intelligence (AI) and Machine Learning (ML) have rapidly evolved from theoretical constructs into transformative forces reshaping industries, societies, and everyday life. From intelligent automation and predictive analytics to natural language processing and computer vision, these technologies are redefining how we interact with data, make decisions, and solve complex problems. Foundations and Principles of Artificial Intelligence and Machine Learning is designed to provide a comprehensive and structured understanding of these dynamic fields.

This book aims to bridge the gap between foundational theory and practical application. It introduces core concepts such as algorithms, data structures, probability, and optimization, while also exploring advanced topics including deep learning, reinforcement learning, and ethical considerations in AI. The intention is not only to explain how these systems work, but also to critically examine their implications, limitations, and potential risks.

A key focus of this work is clarity and accessibility. Complex ideas have been presented in a systematic and logical manner to support students, researchers, and professionals from diverse academic backgrounds. Mathematical foundations are integrated where necessary to strengthen conceptual understanding, without overwhelming the reader.

In an era where AI is influencing decision-making across domains such as healthcare, finance, transportation, and governance, it is essential to develop not only technical expertise but also responsible and ethical perspectives. This book encourages readers to think beyond algorithms and consider the broader societal impact of intelligent systems.

Ultimately, this text serves as both a learning resource and a reference guide for those seeking to understand and contribute to the evolving landscape of Artificial Intelligence and Machine Learning.

Ackowledgement

About the Authors

Dr. Shudhodhan Bokefode is an Assistant Professor in the Department of Computer Engineering at Terna Engineering College, Navi Mumbai. A distinguished academician and researcher, he holds a PhD in Computer Science and Engineering from MPU Bhopal and a Master's degree in the same discipline from JNTU Hyderabad.

With over a decade of experience in higher education and technical research, Dr. Bokefode has established himself as a prolific scholar, contributing more than 30 research papers to prestigious international journals and global conferences. His work is characterized by a commitment to advancing the practical applications of computational intelligence and data-driven decision-making.

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Dr. Kishor Sakure is an Assistant Professor in the Department of Computer Engineering at the Terna Engineering College in Navi Mumbai , Maharashtra ,India. He had completed Ph. D. (in Computer Science &Engineering) from MPU Bhopal and M. Tech. (in Computer Engineering) from D.B.A.T.U., Lonere. He holds B. E. (in Computer Science and Engineering) from Marathwada University, Aurangabad. He has 30+ years of teaching and research experience. His research interest areas includes Cloud Computing, Cyber security, Blockchain , AI and ML . He has authored 30+ research articles and conference papers in reputed international journals and conferences.

Dr. Dnyaneshwar M. Bavkar is a distinguished academician and researcher in Computer Science & Engineering with 18 years of teaching experience. He holds a Ph.D. from Amity University (2024) with specialization in Computer Science & Engineering, along with an M.E. (2013) in Computer Engineering from the University of Mumbai and a B.E. (2007) in Computer Science & Engineering from Dr. BAMU, Aurangabad. Currently he is working as an Associate Professor in the Department of Computer Engineering at MGM's College of Engineering & Technology, Navi Mumbai. He has published 26+ research papers in reputed, Scopus indexed international journals and conferences with significant citation impact. with specialization in Computer Science & Engineering, along with an M.E. (2013) in Computer Engineering from the University of Mumbai and a B.E. (2007) in Computer Science & Engineering from Dr. BAMU, Aurangabad. Currently he is working as an Associate Professor in the Department of Computer Engineering at MGM's College of Engineering & Technology, Navi Mumbai. He has published 26+ research papers in reputed, Scopus indexed international journals and conferences with significant citation impact.

Dr. Varsha Bodade brings over 24 years of teaching experience as a distinguished professor at Terna Engineering College in Nerul, Navi Mumbai. Her educational background includes a PhD in Electronics and Communication Engineering from Amravati University, an ME in Electronics & Telecommunication from Mumbai University, and a BE from Nagpur University.Specializing in wireless communication, computer network and security, Image processing, IoT in health applications, and wireless sensor networks, Dr. Bodade is a trailblazer in her field. She is an active member of numerous professional bodies and has made significant contributions to the academic community. Her research prowess is evident through the publication of over 60 papers in various international and national conferences and journals. Additionally, she has demonstrated her innovative spirit by filing 5 patents on diverse engineering and technology applications.

Dr. Rohini Palve is an Associate Professor in the Department of Computer Engineering at the Terna Engineering College in Navi Mumbai, Maharashtra, India. She had completed Ph. D. (in Electronics Engineering) from Mumbai University and M.E (in Electronics &Telecommunication Engineering) from Mumbai University. She holds B. E. (in Electronics Engineering) from Pune University. She has 27 years of teaching experience. Her research interest areas include wireless communication, image processing, AI and ML. She has authored 20+ research articles and conference papers in reputed international journals and conferences.

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