ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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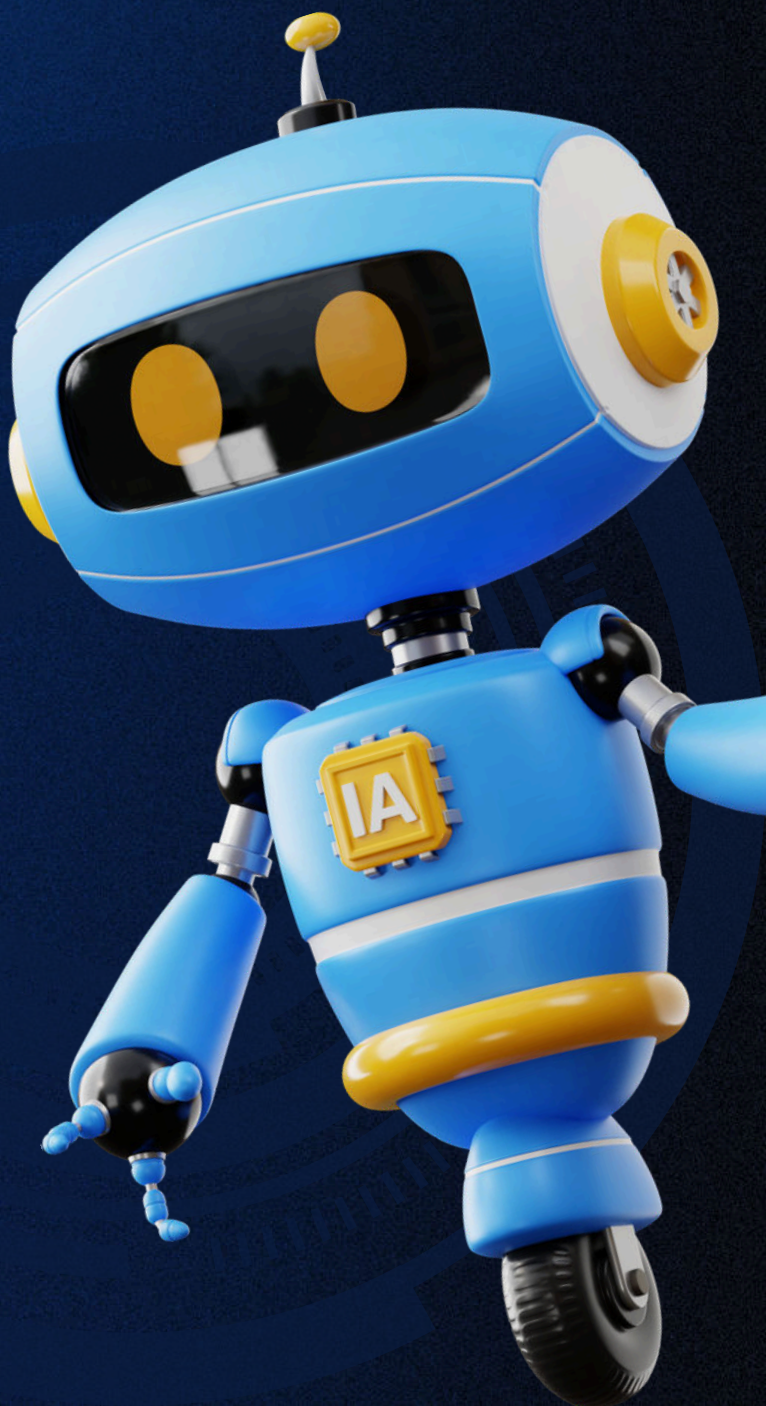
: FOUNDATIONS AND PRINCIPLES

(Textbook for Universities and Colleges)



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Artificial Intelligence and Machine Learning: Foundations and Principles

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Preface

Artificial Intelligence (AI) and Machine Learning (ML) have rapidly evolved from theoretical constructs into transformative forces shaping modern society. From healthcare and finance to education and governance, these technologies are redefining how we interact with data, make decisions, and solve complex problems. This book, Artificial Intelligence and Machine Learning: Foundations and Principles, has been developed to provide a clear, structured, and comprehensive understanding of the core concepts that underpin these dynamic fields.

The primary objective of this book is to bridge the gap between foundational theory and practical application. It introduces readers to essential principles such as data representation, algorithms, model building, and evaluation techniques, while also addressing the mathematical and statistical frameworks that support them. Care has been taken to present complex ideas in a logical and accessible manner, ensuring that both beginners and advanced learners can benefit from the content.

In an era where AI-driven systems increasingly influence critical aspects of life, it is not enough to merely use these technologies; one must understand their mechanisms, limitations, and implications. This book encourages readers to think critically about the ethical, social, and technical dimensions of AI and ML, fostering a deeper awareness of responsible innovation.

Each chapter is carefully organized to build upon prior knowledge, guiding the reader from fundamental concepts to more advanced topics. Real-world examples and practical insights have been incorporated to reinforce understanding and highlight the relevance of theoretical knowledge in real-life scenarios.

This work is intended for students, researchers, and professionals who seek a solid foundation in AI and ML. It is our hope that this book will serve not only as a learning resource but also as a catalyst for curiosity, innovation, and continued exploration in this ever-evolving domain.

Acknowledgement

The completion of Artificial Intelligence and Machine Learning: Foundations and Principles represents a significant academic and intellectual journey, made possible through the collective support, insight, and dedication of many individuals and institutions.

We extend our sincere gratitude to the scholars, researchers, and practitioners whose pioneering work in artificial intelligence and machine learning has laid the foundation upon which this book is built. Their contributions have shaped the evolution of this dynamic field and continue to inspire innovation and critical inquiry.

We are deeply thankful to the academic community, colleagues, and reviewers who provided valuable feedback, constructive criticism, and thoughtful suggestions throughout the development of this manuscript. Their perspectives have helped refine the content, ensuring both conceptual clarity and technical accuracy.

We also acknowledge the support of our institutions and professional networks, which provided an encouraging environment for research, writing, and collaboration. Access to academic resources, discussions, and interdisciplinary engagement has played a crucial role in shaping this work.

Special appreciation is extended to our editors and publishing team for their guidance, patience, and commitment to maintaining high standards of quality. Their efforts have been instrumental in transforming this manuscript into a coherent and accessible resource.

Finally, we express our heartfelt gratitude to our families and loved ones for their unwavering encouragement, understanding, and support throughout this journey. Their belief in our work has been a constant source of motivation.

This book is a collective effort, and we hope it serves as a valuable resource for students, educators, and professionals seeking to understand the principles and applications of artificial intelligence and machine learning.

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About the Authors

Huseynov Zakir Nasib - was born on July 2, 1955. He graduated from the Mathematics Faculty of Kirovabad State Pedagogical Institute named after H. Zardabi in 1980. Between 1989 and 1999, he taught mathematics and computer science at a secondary school in Ganja. He subsequently served as a school principal (1999–2012) and then as Head of the Ganja City Education Department (2012–2020). In 2006, he was awarded the honorary title of "Honoured Teacher of the Republic of Azerbaijan" by Presidential Decree. He defended his PhD dissertation on "Research of Performance Indicators of Priority Service Telecommunication Networks" in 2012, earning a Doctor of Philosophy degree in Technical Sciences. Since November 2020, he has been the Head of the Department of Information Technologies at Azerbaijan State Agricultural University.

Mammadov Mahil Isa (b. 01 May 1966) graduated from Azerbaijan Polytechnic Institute (now Technical University) in 1990, specialising in Electronic Computing Machines. He worked as an engineer-programmer at Azerbaijan Agricultural Institute (now State Agrarian University) from 1990–1994, then as leading specialist-programmer at Azerbaijan Agro-Industrial Bank's Ganja branch from 1994–1999. Since 1999, he has been at the Department of Information Technologies of Azerbaijan State Agricultural University, serving as senior teacher, acting associate professor, and associate professor. On 20 September 2013, he defended his PhD dissertation on "Improvement of the Technology for Preparing Feed Granules with Information and Software Support" in Agricultural Engineering (specialisation 3102.01), receiving his Doctor of Philosophy in Technical

Sciences. In 2017, he earned the title of Associate Professor in the same department and has served as such since April 2017.

Mammadov Mahmud Neyman - was born on March 20, 1963. In 1985, he graduated from the Faculty of Applied Mathematics of Baku State University. Between 1985 and 1988, he worked as a programming engineer at the "Khazri" Transcaucasian Technological Installation Administration, and from 1988 to 1992 as a software adjustment engineer at the same organisation. Since 1992, he has been employed at the Department of Information Technologies of Azerbaijan State Agricultural University. In 2009, he defended his dissertation and earned the degree of Doctor of Philosophy in Technical Sciences. Since 2017, he has held the position of Associate Professor at the Department of Information Technologies.

Masimov Afiq Qazanfar was born on May 18, 1963. He graduated from the Faculty of Applied Mathematics of Baku State University in 1985. From 1985 to 1990, he worked at the "MARS" Research Institute in Ulyanovsk, Russian Federation. Between 1990 and 2000, he served as a shop supervisor at the "Wine-1" production association in Ganja. From 2000 to 2017, he was a senior teacher at the Department of Information Technologies of Azerbaijan State Agricultural University. In 2013, he defended his PhD dissertation in Technical Sciences on "Energetic Assessment of the Technology and Mechanisation Means for Primary and Pre-sowing Soil Cultivation". In 2017, he received the academic title of Associate Professor in Information Technologies. Since 2017, he has been working as an Associate Professor at the same department.

Haciyev Teyyub Mammadtaqi - was born on June 1, 1958. In 1981, he graduated from the Azerbaijan Agricultural Institute (now Azerbaijan State Agrarian University) with a specialisation in Agricultural Mechanisation. From 1981 to 1995, he worked as an assistant and senior teacher at the Department of Livestock Mechanisation. Between 1995 and 2009, he served as Head of the Human Resources and Fee-Based Services Department at ASAU. In 2003, he defended his PhD dissertation on "Development and Parameter Justification of a Self-Feeder Device Used in Sheep Feeding". In 2005, he received the academic title of Associate Professor in Livestock Mechanisation. Since 2009, he has been working as an Associate Professor at the Department of Information Technologies.

Zeynalov Zaman Habib - was born on March 18, 1979. In 2002, he graduated from the Faculty of Engineering of Azerbaijan State Agricultural University. He defended his PhD dissertation in 2015 on "Development and Parameter Justification of a Device for Suckling Calves in Breeding Farms" and received the degree of Doctor of Philosophy. In 2019, he obtained the academic title of Associate Professor in the specialisation of Information Technologies. Since 2009, he has been working at the Department of Information Technologies of Azerbaijan State Agrarian University.

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