ARTIFICIAL INTELLIGENCE

An Ethical, Spiritual and Philosophical Approach

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PREFACE

The International Institute of Islamic Thought was established as an educational trust in 1981 to promote research and publications to aid in the education of the ummah. As part of its IOK agenda, the IIIT has consistently called for a critical evaluation of existing disciplines and their methodologies - a call for epistemological reform based on twin sources of knowledge i.e. revelation and the universe. The aim was to re-mould disciplines taught in universities that would project the Islamic worldview in those disciplines for the betterment of the ummah and humanity at large.

The late Ismail Raji al-Faruqi, one of the founders of the IIIT, in his IOK- Principles and Workplan (1982) talked about the need to develop textbooks that required 'mastery of both modern knowledge and Islamic heritage' and based on a critical evaluation of both — to have creative synthesis. More recently, another co-founder of the IIIT — the late AbdulHamid Abu Sulayman (who was the 2nd Rector of the International Islamic University Malaysia from 1988–1998) — initiated the Textbook/Teaching Materials Project (TMP), that was meant to produce books to be utilised for courses being taught at the IIUM. This was backed up with generous research funding from the IIIT

Since late 2017, the TMP has been introduced not only in the IIUM, but also in a few other institutions of higher learning. Funds are granted to academics teaching a specific course/s to produce a course-book that would be used as a main reference in a particular course/s. Proposals and manuscripts were reviewed and feedback conveyed to the author. In many ways, these books are still 'a work in progress'. They are not meant for commercial purposes and have rather limited distribution. The aim is to utilise these materials in class, to receive further feedback from scholars and others and to keep improving these books until they do become standard textbooks to be used in the courses taught.

The book that you have in your hands now is a result of these efforts. The IIIT East and Southeast Asia Office is pleased to contribute to this project to realise the goals of its founders.

We look forward to constructive inputs for further improvement.

IIIT East and Southeast Asia Office
IIUM Gombak, Kuala Lumpur

Introduction

Purpose of the Book

This book aims to provide undergraduate and postgraduate students with a comprehensive, accessible introduction to the fields of Artificial Intelligence (AI), Machine Learning (ML), and Deep Learning (DL). It integrates perspectives from Islamic philosophy, enabling readers to explore the ethical, epistemological, and spiritual dimensions that underpin the development and application of contemporary intelligent systems. The goal is to demystify complex concepts and offer practical insights into these rapidly evolving fields. By covering foundational theories, practical applications, and hands-on examples, the book is designed to equip students with the knowledge and skills needed to pursue further study or enter the workforce in AI-related fields.

Target Audience

This book is primarily targeted at undergraduate and postgraduate students in computer science, engineering, or related disciplines with an interest in AI, ML, and DL. The content assumes basic familiarity with programming and mathematical concepts, but no prior specialised knowledge in AI or machine learning is required. Whether you are new to the field or seeking to deepen your understanding, this book is designed to guide you through the key principles, techniques, and challenges in these areas.

In addition to the theoretical foundations, the book integrates Islamic principles and philosophical perspectives to foster a holistic understanding of intelligent systems. This includes discussions on ethical responsibility, the nature of knowledge, inspirations of AI models, and the moral implications of technological advancement. By combining scientific rigor with Islamic epistemology, this book aims to cultivate both technical proficiency and ethically grounded decision-making.

Author's Profile

Amelia Ritahani Ismail is a Professor in the Department of Computer Science, Kulliyyah of Information and Communication Technology, International Islamic University Malaysia (IIUM). She holds a PhD in Computer Science from the University of York, United Kingdom, an MSc (Computer Science) from Universiti Teknologi Malaysia and a Bachelor Degree (MIS) from International Islamic University Malaysia. With over a decade of academic experience, she is recognised for her expertise in Artificial Intelligence specifically in Machine Learning, Deep Learning and Swarm Intelligence. Her current research explores the integration of agent-based models with Retrieval-Augmented Generation (RAG) and Language Models (LLMs), with a particular focus on healthcare applications, multi-agent systems, swarm intelligence and other deep learning applications.

Amir Aatieff Amir Hussin is an Assistant Professor at the Kulliyyah of Information and Communication Technology, International Islamic University Malaysia (IIUM). He earned his Ph.D. in Computer Science from Loughborough University, UK, focusing on Artificial Intelligence (AI) and coalition structure generation in multi-agent systems. He also holds a Master of Software Engineering from Open University Malaysia and a Bachelor's in Computer Science from the University of Portsmouth, UK. His research interests focus on AI areas such as deep learning, multi-agent systems, and optimization algorithms. He is particularly focused on AI applications in healthcare, industrial automation, and environmental monitoring, as well as AI ethics.

Mohamad Fauzan Noordin received his Ph.D. from the University of Wales, U.K.1997; MBA from the Central Missouri State University, USA 1991; and B.Sc.(Computer Science) from the University of Missouri Kansas City, USA 1989. He is a professor of knowledge technology at Kulliyyah of Information and Communication Technology, International Islamic University Malaysia. His book entitled "ICT and Islam" has been used as a textbook in several universities. He was awarded the Darjah Setia Pangkuan Negeri Award (DSPN) Pulau Pinang, which carries the title Dato, by TYT Yang Di-Pertua Negeri Pulau Pinang on 23 July 2022. Prof. Dato' Dr. Mohamad Fauzan Noordin was the Advisor of Artificial Intelligence and Digitalization for the Minister of Higher Education. He has been invited as a speaker to talk about Artificial Intelligence (AI) in various universities.

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List of Abbreviations

AINE Artificial Immune Network
AI Artificial Intelligence
AIS Artificial Immune Systems
ANN Artificial Neural Network
CLONALG Clonal Selection Algorithm
CNN Convolutional Neural Network
CSA Clonal Selection Algorithm
DCA Dendritic Cell Algorithm
DCs Dendritic Cells
DNN Deep Neural Network
GAN Generative Adversarial Networks
IoT Internet of Things
INT Immune Network Theory
LLM Large Language Model
NSA Negative Selection Algorithm
NLP Natural Language Processing
PSO Particle Swarm Optimisation
RNN Recurrent Neural Network
XAI Explainable AI

Part One

1. Humanising Artificial Intelligence

Chapter Objectives

The objectives of this chapter are to :

1. Introduce the field of Artificial Intelligence and provide an overview of its historical development.
2. Explain how human intelligence becomes an inspiration for Artificial Intelligence.
3. Discuss how humanising Artificial Intelligence can be achieved.

Learning Outcome

By the end of this chapter, you should be able to:

1. Relate human intelligence and artificial intelligence.
2. Understand the state-of-the-art of the current advancement of artificial intelligence.
3. Describe the ethical values and issues in humanising artificial intelligence from an Islamic perspective.

Introduction

Artificial intelligence, or AI is a cutting-edge technology that mimics human intelligence. AI, formed from computer science, mathematics, and algorithms, is reshaping industries, changing how people use technology, and solving intractable problems. As AI systems grow more incorporated into our daily lives, they are being "humanised" to match human values, emotions, and ethics. Humanising AI involves more than making machines comprehend and act like people; it also includes representing our values. This ensures that AI follows human well-being, social harmony, and ethical norms as it becomes more integrated into our world. Section 1.1 introduces Human and Artificial Intelligence. Section 1.2 discusses the advancements and progress made in Artificial Intelligence. Finally, Section 1.3 concludes with ethical, value, and Islamic issues related to humanising AI.

1.1 Human Intelligence and Artificial Intelligence

Human intelligence is a complex and multifaceted phenomenon encompassing various cognitive abilities such as perception, learning, reasoning, problem-solving, and creativity. It is a product of the intricate workings of the human brain, which consists of billions of neurons interconnected through neural networks. Human intelligence enables us to understand and navigate the world, adapt to new situations, and engage

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Artificial Intelligence (AI), machine learning, deep learning, metaheuristics, and generative AI are reshaping the technological landscape, driving innovations that impact nearly every aspect of modern life. AI encompasses a range of technologies designed to simulate human intelligence, enabling machines to perform tasks that typically require human cognition. Machine learning (ML), a subset of AI, focuses on the ability of systems to learn from data and improve their performance over time without being explicitly programmed. Deep learning (DL), a specialised area within ML, uses neural networks with many layers to analyse vast amounts of data and identify complex patterns. Metaheuristics, on the other hand, are optimisation techniques inspired by natural phenomena, providing solutions to problems where traditional methods may not be effective. Generative AI takes this further by enabling machines to create new, original content such as text, images, and videos, offering groundbreaking possibilities in content creation and design.

This book is intended for readers interested in exploring the moral and ethical dimensions of AI, with a particular focus on how these principles can be integrated with Islamic principles. It seeks to provide a comprehensive understanding of how AI technologies can be developed and deployed in ways that align with moral responsibility and ethical integrity. By incorporating Islamic principles, which emphasize justice, fairness, compassion, and the well-being of humanity, the book offers guidance on how to create AI systems that not only push the boundaries of technological innovation, but also contribute positively to the common good, while respecting human dignity and values.

Through case studies and examples, this book explores the intersection of technology, ethics, and spirituality, illustrating how AI is inspired by the human and nature around us. Whether you are a student, researcher, or practitioner, this book provides valuable insights into the importance of understanding the fundamental concepts of AI while highlighting the need to develop AI technologies with ethical foresight, aligning with both human values and Islamic principles, ultimately fostering a more just and equitable society.

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