Artificial Intelligence for Class IX

Textbook to learn the basics of AI

Dr. Harsh Bhasin

Vishal Deshwal

www.bpbonline.com

First Edition 2025

ISBN: 978-93-65897-739

LIMITS OF LIABILITY AND DISCLAIMER OF WARRANTY

The information contained in this book is true to correct and the best of author's and publisher's knowledge. The author has made every effort to ensure the accuracy of these publications, but publisher cannot be held responsible for any loss or damage arising from any information in this book.

All trademarks referred to in the book are acknowledged as properties of their respective owners but BPB Publications cannot guarantee the accuracy of this information.

Dedicated to

To my mother, and my sister

– Dr. Harsh Bhasin

To my parents

Babita** and **Balram Deshwal

– Vishal Deshwal

About the Authors

- **Dr. Harsh Bhasin** is a researcher and practitioner. Dr. Bhasin is currently associated with Bennett University. Dr. Bhasin has completed his Ph. D. in Diagnosis and Conversion Prediction of Mild Cognitive Impairment Using Machine Learning from Jawaharlal Nehru University, New Delhi. He worked as a deep learning consultant for various firms and taught at various universities including Jamia Hamdard, MRU, MRIIRS, and DTU.

  He has authored 11 books including programming in C#, Oxford University Press, 2014; Algorithms, Oxford University Press, 2015; Python for Beginners, New Age International, 2018; Python Basics, Mercury, 2019; Machine Learning, BPB, 2020, to name a few.

  Dr. Bhasin has authored more than 40 papers published in conferences and renowned journals including Alzheimer's and Dementia, Soft Computing, Springer, BMC Medical Informatics and Decision Making, AI and Society, etc. He is the reviewer of a few renowned journals and has been the editor of a few special issues. He has been a recipient of Visvesvaraya fellowship.

  His areas of expertise include deep learning, algorithms, and medical imaging. Outside work, he is deeply interested in Hindi Poetry: the progressive era, and Hindustani Classical Music: percussion instruments.

- **Vishal Deshwal** is a researcher and industry professional in the fields of deep learning and natural language processing. He is currently pursuing a PhD in periodic activation functions at the **International Centre for Neuromorphic Systems** (**ICNS**), Sydney, and works as a Senior Data Scientist at Western Sydney University. His research focuses on innovative neural network architectures and their applications in various domains.

  Vishal's published work includes research on the diagnosis of **Mild Cognitive Impairment** (**MCI**) using deep learning and dimension reduction techniques, as well as the classification of MCI subtypes with advanced neural network models and local binary patterns. At Western Sydney University, his work involves natural language processing and predictive modeling, contributing to the development of sophisticated models for analyzing text data and making accurate predictions.

About the Reviewer

- **Mahesh Chandran G** is an AI associate at Zappyhire with a strong focus on Recommendation Systems and Generative AI. His expertise lies in **Retrieval Augmented Generation** (**RAG**), as well as the fine-tuning, and inference optimization of Large Language Models. With a deep interest in cloud-native solutions and the latest AI technologies, Mahesh is dedicated to driving innovation in his field. Beyond his professional pursuits, he is an avid reader of fantasy and science fiction books and a passionate video gamer.

Acknowledgements

❍ **"Feeling gratitude and not expressing it is like wrapping a present and not giving it."**

– William Arthur Ward

I am blessed to have met people who encouraged me to learn continuously. First of all, I would like to thank Professor Moin Uddin, former Pro-Vice-Chancellor, Delhi Technological University for his unconditional support. He has deposed his faith in me when no one else did. Had it not been for his encouragement, I would not have been able to achieve whatever I did. I would also like to express my sincere gratitude to the late Professor A. K. Sharma, former Dean, and Chairperson, the Department of Computer Science, YMCA, Faridabad, for his constant encouragement. Professor R. K. Agrawal, SCSS, JNU, inspired me to work on the problems that affect the society.

Likewise, I am also thankful to the following academicians and professionals for encouragement and providing unconditional support to me:

- Prof. I. K. Bhat, Vice Chancellor, MRU, India
- Prof. Prashant Jha, King's College London
- Prof. Tapas Kumar, Associate Dean, SET, MRIIRS, India.
- Prof. Maneesha Singh, ESIC, Faridabad
- Prof. Naresh Chauhan, former Head and Chairperson, Department of Computer Science, YMCA University of Science and Technology
- Dr. S K. Pal, Scientist, Defense Research and Development Organization
- Prof. Ranjeet Biswas, Former Professor, IIT Kharagpur

I am thankful to Mr. Nishant Kumar, The NorthCap University, India, for his contribution to editing, formatting, and developing some programs for this book. Also, I would like to thank my students and colleagues, for their critical reviews. Moreover, I am also very thankful to the editorial team of BPB publications for providing valuable assistance

I would like to express my sincere gratitude to my Mother, Sister, and the rest of the family including my pets: late Zoe and Xena, and friends for their unconditional support to me.

The authors would greatly appreciate any comments or suggestions you may have, which can be incorporated into future editions of this book.

– Dr. Harsh Bhasin

- Writing this book has been a rewarding journey, and I am deeply grateful to those who have supported and guided me along the way.

  I would like to express my sincere gratitude to Dr. Harsh Basin. I have learned a great deal from him, and his guidance throughout both, my academic journey and the writing process, has been invaluable. His mentorship has played a crucial role in shaping my work.

  Moreover, I am also deeply thankful to my PhD supervisor, Paul Hurley, from the Western Sydney University, Sydney. His support and expertise have been crucial to my research.

  Additionally, I would like to extend my heartfelt thanks to my wife, Manshi Panth Deshwal, for her unwavering support and encouragement throughout this journey. Her belief in me has been a constant source of motivation and strength.

  I am very thankful to the editorial team at BPB Publications for their valuable assistance.

  Furthermore, I would like to express my sincere gratitude to my parents, my brother, Ishan, my sister, Milimuskan, and my aunt and uncle, Savita and Ashok Malik, for their unwavering and unconditional support.

  To everyone who contributed to this endeavor, I extend my deepest thanks. This book is a testament to your generosity and support.

  – Vishal Deshwal

Preface

Artificial Intelligence has become an integral part of our lives. From the recommendations at Netflix and Amazon, to the advertisements you see on YouTube; from the face recognition systems in you devices to the Biometrics your parents use in their workplaces; from the analytics accountants use to ascertain the economic health of a company to the models doctors use for disease progression and detection, AI is everywhere. Let us dive into this fascinating field and pave way for your glossy career.

As AI continues to evolve and integrate into various aspects of society, it becomes increasingly important for young minds to understand the fundamentals of this transformative field. This book, Artificial Intelligence for Class IX, is designed to introduce students to the fascinating world of AI, equipping them with the knowledge and skills they need to explore its potential and understand its impact.

Divided into four comprehensive sections, this book begins by laying the groundwork for understanding AI. In **Section I: Artificial Intelligence**, students will embark on a journey through the foundational concepts of AI, including its lifecycle, the importance of problem scoping, and the processes of data acquisition, exploration, and modeling. These chapters will help students grasp how AI systems are developed and how they function.

Section II: Neural Networks delves into the core technology that powers much of modern AI—Neural Networks. Here, students will be introduced to the basic principles of Neural Networks, the building blocks of Deep Learning, enabling them to appreciate the complexities and capabilities of AI systems.

Recognizing the importance of practical skills, **Section III: Basics of Programming** focuses on essential programming concepts, with a particular emphasis on Python, a language widely used in AI development. Through chapters on basic programming and lists, students will gain hands-on experience in coding, laying the foundation for further exploration of AI and other computational disciplines.

Finally, **Section IV: Employability Skills** is designed to prepare students for the real world by fostering vital skills such as communication, management, entrepreneurship, and environmental awareness. These skills are crucial not only in the context of AI but also in any future career path students may choose to pursue.

By blending theoretical knowledge with practical skills, this book aims to inspire students to think critically, innovate, and become active contributors to the ever-evolving world of AI.

I hope this book serves as a valuable resource for students, teachers, and anyone interested in the exciting field of Artificial Intelligence. May it ignite curiosity, encourage exploration, and empower the next generation to harness the power of AI for the betterment of society.

The detailed description of the topics in the book is as follows:

Section I: Artificial Intelligence

Chapter 1: Introduction to Artificial Intelligence - This chapter lays the foundation for understanding **Artificial Intelligence** (**AI**) and **Machine Learning** (**ML**). It explores varying interpretations of intelligence, using Galileo as an exemplar. It dissects AI into four dimensions: thinking and acting like humans, and thinking and acting rationally, providing a comprehensive understanding of AI.

The chapter also demystifies Machine Learning - a process where computers learn from past data to enhance task performance. The different learning paradigms, including supervised learning (using the Fisher IRIS dataset example), unsupervised learning, and reinforcement learning, are expounded.

The chapter also culminates with a look at the diverse applications of AI such as medical diagnosis, expert systems, pattern recognition, and language processing, setting the groundwork for upcoming chapters on deep learning and natural language processing. Self-assessment exercises, including multiple-choice and theoretical questions, are provided to reinforce the concepts presented.

Chapter 2: Artificial Intelligence Life Cycle - This chapter covers the life cycle of an AI project. The steps have been discussed in detail, and ample examples have been included. It discusses scoping in detail, followed by a discussion on stakeholders. This is followed by the problem analysis, setting up of goals and the possible actions that can be taken to achieve the goals.

Chapter 3: Problem Scoping - This chapter explores problem scoping, an essential tool in project management. It underscores that accurately defining a problem allows for a comprehensive understanding of its evolution. The chapter introduces the 4 Ws of problem scoping - Who, What, Where, Why - each playing a pivotal role in problem analysis.

The chapter also introduces project scoping components: context, need, outcome, and vision, stressing the significance of a well-defined scope in aligning stakeholders, enabling efficient task allocation, maintaining team focus, and preventing scope creep.

It concludes by asserting the indispensability of problem scoping in project planning, paving the way for data acquisition and exploration discussed in the following chapter. Comprehension exercises, including multiple-choice and theoretical questions, provide a deeper understanding of the concepts discussed.

Chapter 4: Data Acquisition - This chapter emphasizes data acquisition, starting with an explanation of data types: qualitative and quantitative, supplementing with relevant examples. The process of data acquisition, involving collection from reliable primary and secondary sources via varied means such as sensors, surveys, web scraping, and APIs, is underlined, stressing the need to align methods with project needs.

The chapter introduces the idea of a dataset, exemplifying with toddler toy choices, and distinguishes between training and testing datasets used for model creation and evaluation, respectively. The relevance of features and their relationships are highlighted through system maps, which use circles, arrows, loops, and signs to denote elements, relationships, interdependencies, and direction of relationships.

Concluding with a summary of key points, the chapter bridges to the next topic, data exploration and visualization, and includes exercises and multiple-choice questions to consolidate understanding.

Chapter 5: Data Exploration - This chapter elucidates data exploration, emphasizing the need to comprehend problem context and associated data before initiating any task. The chapter also explores data visualization methods like box plots, bar charts, pie charts, and histograms, highlighting their ability to uncover variable relationships, spot data issues, and reveal dataset characteristics.

It employs examples, like comparing data in a spreadsheet versus a bar chart, to underscore the benefits of data exploration. It breaks down various visualization methods, explaining bar charts using a student beverage preference survey, pie charts using monthly expenditure data, histograms with student weight ranges, and box plots to summarize data distribution.

Additionally, it mentions renowned visualization tools like Tableau, Infogram, Power BI, and Chart Blocks, facilitating effective decision-making through easier data visualization and analysis.

Chapter 6: Data Modeling - *Chapter 6* illuminates the topic of data modeling, distinguishing between terms like AI, ML, DL, and DS. It presents two primary data modeling strategies: rule-based modeling and learning-based modeling. Rule-based models, operating on predefined rules, are exemplified by a self-driving car following traffic signals.

Conversely, learning-based models learn from data and recognize patterns, illustrated by fruit image classification. The chapter explores decision tree-based modeling, a prevalent machine learning algorithm, explaining associated terms such as root node, splitting, decision node, and terminal/leaf node.

The chapter concludes by underlining data middling's pivotal role in intelligent machine creation and preparing the ground for further neural network exploration. Comprehension tests, including theory and multiple-choice questions, bolster understanding.

Section II: Neural Networks

Chapter 7- Introduction to Machine Learning and Neural Networks: This chapter introduces the reader to one of the most important topics in Machine Learning and Deep Learning: Neural Networks. These models are inspired by the neurons present in the human body and are extensively used in image processing, medical diagnosis, natural language processing.

Section III: Programming Skills

Chapter 8: Basics of Programming - This chapter discusses the programming process, stressing problem identification and algorithm creation, and differentiates between low-level languages (like machine and assembly languages) close to machine code, and high-level languages (like Java, Python, C++) resembling human language. The chapter underscores the advantages of high-level languages, including improved readability, portability, and auto-translation.

Concluding with a hint at upcoming Python exploration, it tests understanding through multiple-choice and theory questions. This chapter provides a solid grounding in programming, its history, and language types, preparing readers for further programming exploration and application.

Chapter 9: Introduction to Python - In this chapter we will create continuous integration setup using AWS service called CodeBuild. We will build a sample application with some unit tests and then host this application on GitHub. We will then setup the CodeBuild service in such a way that any push to the repository should trigger the build and run the tests.

Chapter 10: Lists - *Chapter 10* introduces Python lists as mutable sequence objects that can contain diverse types of elements. The creation of various lists, including empty, homogeneous, heterogeneous, and nested lists, is explained, along with accessing list elements via indexing. The concept of slicing for extracting sub-lists is also discussed.

The chapter elucidates the mutability of lists, with examples on updating individual elements. It explores list operators such as concatenation (+), repetition (*), and membership testing (in, not in).

It explores the several built-in list functions like append, extend, insert, remove, pop, clear, index, count, sort, reverse, and copy, with appropriate examples for each. The chapter concludes with exercises including multiple-choice questions, theoretical questions, and programming exercises to consolidate the understanding of Python lists.

Section IV: Employability Skills

Chapter 11: Communication Skills - This chapter focuses on the essence of effective communication. It explains the communication cycle involving a sender, message, and receiver, and highlights the importance of two-way interaction and feedback. It emphasizes the need for a common language, clear messaging, and active listening for effective communication.

The chapter discusses the significance of communication in expressing thoughts, ideas, and developing empathy. It identifies common barriers such as attention deficits, lack of transparency, differing communication styles, cultural differences, and physical disabilities, suggesting strategies like using simple language, active listening, and providing feedback to overcome them.

Lastly, it introduces the 7 Cs of communication - clarity, conciseness, concreteness, correctness, coherence, completeness, and courtesy - as key principles for clear, respectful communication. Overall, *Chapter 11* delivers an insightful look into the communication process, its significance, and strategies for improvement.

Chapter 12: Self-Management Skills - This chapter explores the importance of self-management, covering its definition and various aspects. Self-management involves controlling thoughts, feelings, and behaviours to achieve goals. It emphasizes personal responsibility and understanding internal processes. Benefits of self-management include improved organization, initiative, accountability, and effective time management. Knowing oneself is crucial, recognizing strengths, weaknesses, and reactions to success and failure. Self-awareness helps align actions with goals and overcome limiting beliefs. Confidence is essential, enabling individuals to take risks and believe in their abilities. Factors like social, cultural, and physical aspects can influence self-confidence. Strategies for boosting self-confidence include positive thinking, a growth mindset, achievable goals, self-care, and seeking support. Ultimately, mastering self-management and building self-confidence promote personal growth, goal achievement, and effective navigation of life's challenges.

Chapter 13: Communication Technologies - This chapter focuses on **Information and Communication Technology Skills** (**ICT**) and covers effective communication. The chapter begins with an introduction to communication, emphasizing its significance in conveying messages and exchanging information. It explains the roles of the sender and receiver in the communication process and the goal of ensuring message understanding. The basics of communication are explored, including the communication cycle and elements like sender, message, receiver, and channel. Effective communication is discussed, highlighting the importance of clarity, conciseness, concreteness, correctness, coherence, completeness, and courtesy.

The chapter then explore the different types of communication. Verbal communication, which includes oral and written forms, is examined, with examples such as conversations, speeches, emails, contracts, and letters. Advantages and disadvantages of each mode are highlighted, emphasizing the importance of selecting the appropriate method for different contexts. Non-verbal communication is also explored, focusing on gestures, body language, eye contact, and facial expressions. The significance of non-verbal cues in conveying meaning and emotions is discussed. Visual communication, involving visual aids like diagrams, charts, and graphs, is introduced as an effective way to present complex information clearly.

The chapter concludes by introducing the 7 Cs of communication: clarity, conciseness, concreteness, correctness, coherence, completeness, and courtesy. These principles are essential for effective communication, ensuring messages are delivered and understood effectively.

In summary, *Chapter 13* i provides an overview of communication, covering its basics, various types, and the principles of effective communication. This knowledge is crucial for successful communication in personal and professional settings.

Chapter 14: Entrepreneurship Skills - This chapter begins with an introduction to entrepreneurship and the story of Ratan Tata, highlighting the ability of entrepreneurs to convert ideas into action and their role in business development.

The chapter then explores the basics of business activities, starting with an explanation of entrepreneurship, entrepreneurs, and enterprises. It explores the structure of business organizations, including sole proprietorship, partnership, corporation, and limited liability company, discussing their advantages and disadvantages. Next, the chapter identifies different types of business activities, namely service, merchandising, manufacturing, and hybrid. Each type is defined and accompanied by examples to illustrate their nature. The features of entrepreneurship are then explored, highlighting the process of identifying

market gaps, planning and organizing resources, directing the enterprise, and controlling its operations. The importance of adaptability to changing conditions is emphasized. The factors affecting entrepreneurship are discussed, including economic, social, and psychological factors. The impact of these factors on business growth and development is examined.

The chapter concludes by discussing the ideal characteristics of a successful entrepreneur, such as high confidence, risk tolerance, perseverance, vision, optimism, and willingness to change. It emphasizes the significance of entrepreneurship in terms of psychological, social, and economic benefits. The rewards of entrepreneurship are also highlighted, including work-life autonomy, leadership experience, flexibility, networking opportunities, and personal satisfaction. Overall, the chapter provides an overview of entrepreneurship skills, covering various aspects such as business activities, organization structure, factors affecting entrepreneurship, and the characteristics and rewards of being an entrepreneur.

Chapter 15: Green Skills - This chapter introduces Green Skills, which are essential for understanding and addressing environmental change. The chapter covers various aspects related to the environment, ecosystem, human-environment relationship, causes of ecological imbalance, protection of natural resources, steps for environmental protection, green economy, and government initiatives. It begins by explaining the natural and human-made environments and their components. The concept of an ecosystem is introduced, highlighting the interdependence between living and non-living elements. The chapter emphasizes the dependence of living organisms on the environment and the impact of human activities on ecological balance. The importance of the 3 Rs (Reduce, Recycle, Reuse) for resource management is discussed. The concept of a green economy is introduced, aiming for economic growth with reduced carbon footprints and pollution. The chapter concludes by discussing India's initiatives, including the Green Skill Development Program, to promote green skills and a sustainable future.

In summary, *Chapter 15* explores the importance of Green Skills in understanding and addressing environmental change. It covers topics such as the environment, ecosystem, ecological imbalance, resource protection, green economy, and government initiatives. Understanding and developing these skills are crucial for promoting sustainable practices and achieving a greener future.

Coloured Images

Please follow the link to download the
Coloured Images of the book:

https://rebrand.ly/f0f2f8

We have code bundles from our rich catalogue of books and videos available at **https://github.com/bpbpublications**. Check them out!

Errata

We take immense pride in our work at BPB Publications and follow best practices to ensure the accuracy of our content to provide with an indulging reading experience to our subscribers. Our readers are our mirrors, and we use their inputs to reflect and improve upon human errors, if any, that may have occurred during the publishing processes involved. To let us maintain the quality and help us reach out to any readers who might be having difficulties due to any unforeseen errors, please write to us at :

errata@bpbonline.com

Your support, suggestions and feedbacks are highly appreciated by the BPB Publications' Family.

Piracy

If you come across any illegal copies of our works in any form on the internet, we would be grateful if you would provide us with the location address or website name. Please contact us at **business@bpbonline.com** with a link to the material.

If you are interested in becoming an author

If there is a topic that you have expertise in, and you are interested in either writing or contributing to a book, please visit **www.bpbonline.com**. We have worked with thousands of developers and tech professionals, just like you, to help them share their insights with the global tech community. You can make a general application, apply for a specific hot topic that we are recruiting an author for, or submit your own idea.

Reviews

Please leave a review. Once you have read and used this book, why not leave a review on the site that you purchased it from? Potential readers can then see and use your unbiased opinion to make purchase decisions. We at BPB can understand what you think about our products, and our authors can see your feedback on their book. Thank you!

For more information about BPB, please visit **www.bpbonline.com**.

Join our book's Discord space

Join the book's Discord Workspace for Latest updates, Offers, Tech happenings around the world, New Release and Sessions with the Authors:

https://discord.bpbonline.com

Table of Contents

1. Introduction to Artificial Intelligence 1
Introduction 1
Structure 2
Objectives 2
Defining artificial intelligence 2
Thinking humanly *2*
Acting humanly *3*
Thinking and acting rationally *3*
Acting rationally *3*
Recap *3*
Explore *3*
Machine Learning *7*
Supervised learning *7*
Unsupervised learning *9*
Reinforcement learning *9*
Explore *9*
Applications of artificial intelligence 10
Conclusion 11
Multiple choice questions 11

2. Artificial Intelligence Life Cycle 15
Introduction 15
Structure 16
Objectives 16
Introduction to AI life cycle 16
AI life cycle *16*
Stages of AI life cycle 16
Problem scoping *17*
Data acquisition *18*

Data exploration *19*
Modeling *21*
Evaluation *22*
Automated attendance system 22
Sustainability Development Goals 24
Conclusion 24
Points to remember 25
Multiple choice questions 26
Case study 28
References 28

3. Problem Scoping 29
Introduction 29
Structure 31
Objectives 31
Understanding use case 31
Method of problem scoping 33
Components of project scoping 35
Importance of defining scope of the project 37
Conclusion 38
Points to remember 39
Multiple choice questions 40
Application 41

4. Data Acquisition 43
Introduction 43
Structure 43
Objectives 44
Data acquisition in daily life 44
Decoding data through practical scenarios *44*
Data: Essential element of digital era *45*
Engaging with data through a practical activity *46*
Types of data 46

Types of qualitative and quantitative data *48*
Exploring the different data types *48*
Categories of quantitative data *48*
Categories of qualitative data *49*
Comprehensive overview of data acquisition 50
Understanding data acquisition *50*
Navigating the data landscape *51*
Sources for acquiring data *51*
Choosing the right data source *52*
Diverse methods of data collection *52*
Alignment with project goals *53*
Dataset 54
Training and testing datasets *55*
System maps *56*
Properties of a system map *57*
Elements of a system map *57*
Conclusion 59
Points to remember 59
Multiple choice questions 60

5. Data Exploration 63
Introduction 63
Structure 64
Objectives 64
Data exploration 64
Visual exploration 65
Advantages of data exploration 67
Techniques for data visualization 68
Understanding data visualization 68
Key visualization techniques 69
Bar chart *69*
Pie chart *70*
Step 1 ..... *71*

Step 2 ..... *71*
Histogram *72*
Box plot and whisker plot *73*
Visualization tools 76
Conclusion 77
Points to remember 77
Exercises 78
References 79

6. Data Modeling 81
Introduction 81
Structure 82
Objectives 82
Evolution of decision-making 82
AI vs. ML vs. DL vs. DS 83
Artificial Intelligence *84*
Machine Learning *84*
Supervised learning *86*
Unsupervised learning *86*
Deep learning *86*
Data science *87*
Data modeling 87
Making smart robots *87*
Learning-based approach *87*
Rule-based approach *88*
Decision tree-based approach *88*
Rule-based systems *88*
Learning-based systems *89*
Decision tree *89*
Decision tree terminologies *90*
Conclusion 91
Points to remember 91
Multiple choice questions 92

7. Introduction to Machine Learning and Neural Networks 95
Introduction 95
Structure 96
Objectives 96
Artificial Intelligence 96
Machine Learning 98
Classification 98
Regression 98
Unsupervised learning 99
Reinforcement learning 99
Neural network 99
An analogy 101
Deep learning 103
Applications of Machine Learning 104
Conclusion 104
Points to remember 104
Multiple choice questions 105
Applications 107

8. Basics of Programming 109
Introduction 109
Structure 109
Objectives 110
Understanding programming 110
Evolution of programming 112
Process of programming 112
Exploring programming languages 114
Understanding programming languages 115
Low-level programming languages 115
Exploring low-level languages 115
Exploring high-level languages 116
Guidance for aspiring programmers 117
Introduction to Python 118

Conclusion 118
Points to remember 119
Multiple choice questions 119

9. Introduction to Python 121
Introduction 121
Structure 122
Objectives 123
Definition of Python 123
History 124
Organizations using Python 124
Features of Python 125
Platforms 126
Jupyter Notebook: Introduction and Installation 126
Google Colab 127
Executing a program in Python 128
Input function 129
Conclusion 130
Points to remember 130
Multiple choice questions 131
Explore 132

10. Lists 133
Introduction 133
Structure 133
Objectives 134
Introduction to lists 134
Display 134
Accessing elements: Indexing 135
Mutability 136
Slicing 136
List functions 137
Adding elements 137

Removing elements *138*
Finding index and sorting the list 139
Other functions *140*
List operators 140
The concatenation operator *140*
Repetition operator *141*
In operator *141*
Not in operator *141*
Conclusion 142
Points to remember 142
Multiple choice questions 142
Applications 144

11. Communication Skills 147
Introduction 147
Structure 147
Objectives 148
Communication and its types 148
Two-way communication *149*
Communication cycle 150
Features of effective communication 151
Importance of effective communication 152
Barriers to effective communication 153
Mastering the art of communication: The 7 Cs 154
Methods of communication 155
Written communication *157*
Oral communication *158*
Conclusion 160
Points to remember 161
Multiple choice questions 161

12. Self-Management Skills 163
Introduction 163
Structure 163
Objectives 164
Introduction to self-management 164
Self-management 165
Advantages of self-management 166
Unlocking your potential 168
Interest and abilities 169
Self-confidence and its significance 170
Lack of self-confidence 172
Boosting self-confidence 172
Conclusion 173
Points to remember 174
Multiple choice questions 174
Application 176

13. Communication Technologies 177
Introduction 177
Structure 178
Objectives 178
Fundamentals 178
Communication cycle and its elements 179
Verbal and non-verbal communication 181
Elements of effective communication 182
Significance of communication 183
Barriers to communication 184
7 Cs of communication 185
Conclusion 186
Points to remember 187
Multiple choice questions 187
Activities 189

14. Entrepreneurship Skills 191
Introduction 191
Structure 192
Objectives 192
Entrepreneurial inspiration 192
Entrepreneurship 193
Entrepreneur 193
Enterprise 193
Structure of business organizations 194
Identification of business activities 196
Features of entrepreneurship 197
Factors affecting entrepreneurship 199
Ideal characteristics of a successful entrepreneur 201
Significance of entrepreneurship 202
Rewards of entrepreneurship 203
Conclusion 204
Points to remember 204
Multiple choice questions 206

15. Green Skills 209
Introduction 209
Structure 209
Objectives 210
Green skills 210
Exploring our surroundings 210
Environment 210
Exploring the ecosystem 212
Fundamental habitat 214
Humans and the environment 215
Ecological balance 215
Dance of ecology 216
Reduce, recycle, reuse 217
Importance of the 3 Rs 218

Significance of 3 Rs *219*
Necessary steps for environment protection 219
Green economy and green skills *220*
Green economy *220*
India's initiatives towards green economy *221*
Conclusion 221
Points to remember 222
Multiple choice questions 223

APPENDIX 1 225
Projects 225
Project 1 225
Project 2 226

APPENDIX 2 229
Glossary 229

APPENDIX 3 241
Answer key 241

Index 247-253

Chapter 1
Introduction to Artificial Intelligence

Introduction

We all know that the earth revolves around the sun. This explains the astronomical phenomenon solar eclipse, and so, it seems rational. This was suggested by *Copernicus* and is known as *Copernican Heliocentrism*. This theory was explained and propagated by *Galileo*. The *Supreme Sacred Congregation of the Roman and Universal Inquisition* considered it absurd and thought it was foolish. Galileo guarded his thoughts and wrote a book, which further offended the establishment. He was punished and spent the rest of his life in house arrest. We all know that he was right and was probably punished as he questioned the status quo.

Read the above paragraph again and think if he was intelligent or not. The answer depends on how you perceive intelligence. You may consider being rational as intelligence, or the one supporting critical thinking as intelligent, or the ability to solve problems as intelligence. In which case you may perceive Galileo as intelligent. He was rational for sure. On the other hand, you may also consider his inability to agree to the majority, thus jeopardizing his own survival as not intelligent. Our perception of human intelligence include:

- Logic
- Learning
- Reasoning

- Problem solving outlook
- Critical thinking as intelligence

If you are logical and evolve with time, if you question the stories told to you and have problem solving capabilities, if you question everything that is told to you, you are intelligent. A machine capable of doing any of these should therefore be considered intelligent. This chapter introduces the reader to **Artificial Intelligence** (**AI**) and explains the ideas and types of **Machine Learning** (**ML**).

Structure

This chapter covers the following topics:

- Defining artificial intelligence
- Machine Learning
- Applications of artificial intelligence

Objectives

This chapter aims to make the reader understand the definition and types of AI. It also aims to define ML and explain its types. After reading this chapter, the reader should be able to classify a task, supervised or unsupervised, and appreciate the idea behind multiple definitions of AI.

Defining artificial intelligence

AI has many definitions, which majorly fall into one of the following four categories:

- Thinking humanly
- Thinking rationally
- Acting humanly
- Acting rationally

Let us try and understand each of the above.

Thinking humanly

According to *Bellman, the automation of activities that we associate with human thinking, activities such as decision-making, problem solving, learning etc.,* includes AI.

This definition includes the machines capable of solving specific problems and learning from experience. Here, learning means improving the performance with experience, for a given task. We will cover the definition of *experience*, *task*, and *performance* in the *Machine Learning* section of the chapter.