AI for Everyone

Concepts, Tools and Real-World Applications



- Foundations of AI
- Machine Learning
- Modern AI (GenAI & LLMs)
- Real-World Applications
- Responsible AI and Society

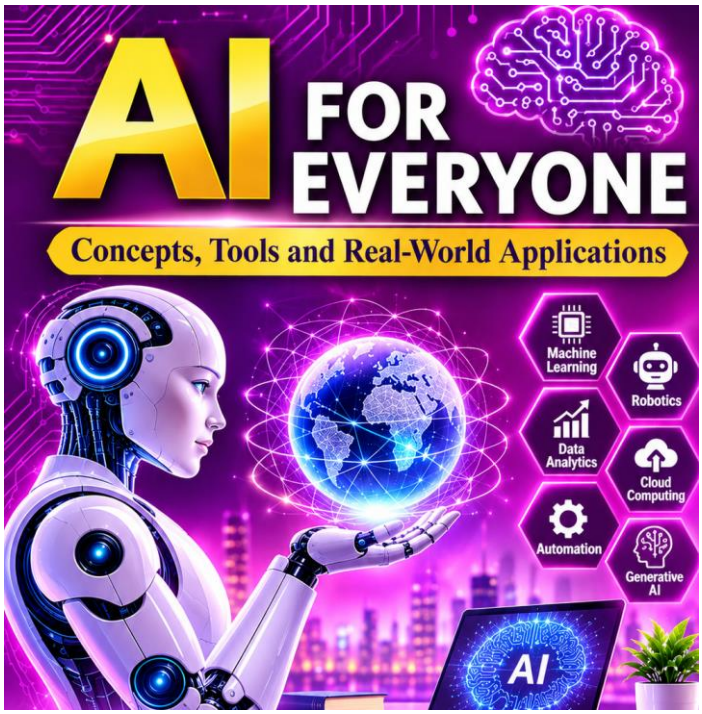


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PREFACE

Dear Reader,

Artificial intelligence has moved, in a few years, from research laboratories into everyday life. It checks our digital payments for fraud, translates between Indian languages, screens chest X-rays, forecasts electricity demand, recommends what we watch and, through chat assistants, helps millions of people to write, learn and code. Every engineer will work with AI, and every citizen is affected by decisions that AI helps to make. Yet AI is often presented either as magic or as menace. This book aims to replace both with understanding: what AI is, how it works, what it can and cannot do, how to use it well, and how to build it responsibly.

The book is arranged in five parts. **Part I, Foundations** (Chapters 1–4), explains what AI is and how it developed, why data are the fuel of AI, the few mathematical ideas behind it (vectors, matrices, probability, statistics and optimization) and the tools used to build it, from Python notebooks to no-code platforms. **Part II, Machine Learning** (Chapters 5–8), covers supervised learning, unsupervised learning and recommendation, the evaluation of models, and neural networks and deep learning. **Part III, Modern AI** (Chapters 9–12), explains computer vision, language and speech with attention to Indian languages, generative AI and large language models, and the practical use of AI tools for study and work. **Part IV, Applications** (Chapters 13–16), shows AI at work in every branch of engineering and in health, agriculture, education, finance and governance, connects AI with sensors, robots and vehicles, and follows a complete project from idea to deployment. **Part V, AI and Society** (Chapters 17–18), treats responsible AI, covering ethics, bias, privacy, safety and law, and closes with the future of AI and careers.

Each chapter begins with a short story and learning objectives, and ends with a summary, a list of key terms, review questions in three parts (short answer, descriptive, and numerical and practical problems with answers) and references for further reading. Worked examples follow the ideas they illustrate. Equations, figures, tables, examples and program listings are numbered by chapter. Boxes labelled *Try It Yourself* suggest activities, with or without code; *Myth vs Fact* boxes correct common misconceptions; and *Case Study* boxes describe real applications, mostly from India, with their sources. Six appendices support the

chapters: a Python quick start (A), a mathematics refresher (B), a directory of datasets and tools (C), twelve laboratory experiments (D), a glossary (E) and twelve mini-projects for different branches (F).

A note on the programs. All program listings were run with Python 3.13, NumPy 2.5, pandas 3.0, Matplotlib 3.11, scikit-learn 1.9, TensorFlow 2.21 and Gradio 6.31, and the outputs shown are those obtained. Programs that use random numbers set a seed, so that their results can be reproduced, but results may still differ slightly with other library versions, operating systems or hardware. Several examples use small synthetic datasets generated by programs, so that every result can be reproduced without personal data; this is stated wherever it applies, and real datasets for further practice are listed in Appendix C.

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How to Use This Book

Reading paths. The chapters are designed to be read in order, but different readers can take different routes:

- *A first course in AI for all branches* (one semester): Chapters 1–8 and 11, with selected sections of Chapters 13 and 17, and Experiments D.1–D.7 and D.10.
- *AI literacy for general readers*: Chapters 1, 2, 11, 12, 14, 17 and 18, skipping the program listings and the more mathematical sections.
- *Applied AI for engineers*: Chapters 4–9 and 13–16, with the laboratory experiments and a mini-project from Appendix F.
- *Responsible AI and policy*: Chapters 1, 7, 11, 14 and 17, with the case studies of every chapter.

Mathematics. Equations appear only where they explain an idea, and each is followed by a numerical example. Readers who find a formula difficult can follow the worked example and the picture, and return to the formula later; Appendix B summarizes the mathematics in one place.

Programs. Listings are written in Python and can be run in a free Google Colab notebook without installing anything (Section 4.2 and Appendix A). Code appears in a monospaced font in shaded boxes; lines beginning with # after the code show the output that the program printed when it was run for this book. Short commands in the text, such as model.fit(), also appear in monospaced type.

Boxes. Three kinds of box appear throughout the book:

- *Try It Yourself*: hands-on activities, usually with one no-code option and one Python option.
- *Myth vs Fact*: common misconceptions about AI and the evidence that corrects them.
- *Case Study*: a real application or incident, with its source and its lessons.

Review questions. Part A questions check recall of key ideas; Part B questions ask for explanation and discussion, as in university examinations; Part C questions are numerical or practical, with answers given in brackets so that readers can check their work.

Using AI while studying this book. Readers are encouraged to use AI assistants to explain difficult passages, generate extra practice questions and check their own solutions, following the advice of Chapter 12: try first, ask for explanations rather than answers, and verify everything.

Table of Contents

CHAPTER 1 What Is Artificial Intelligence?	**1**
1.1 AI Around Us	1
1.2 Defining Intelligence and Artificial Intelligence	2
1.2.1 What is intelligence?	2
1.2.2 Definitions of AI	2
1.2.3 Agents and environments	3
1.3 A Short History of AI	4
1.4 AI, Machine Learning, Deep Learning and Generative AI	5
1.5 Types of AI	7
1.5.1 Narrow, general and super intelligence	7
1.5.2 Functional types	7
1.6 What AI Can and Cannot Do	7
1.7 Myths and Fears	8
1.8 Why Everyone Needs AI Literacy	9
Summary	9
Key Terms	10
Review Questions	10
References and Further Reading	11
CHAPTER 2 Data: The Fuel of AI	**12**
2.1 From Data to Wisdom	12
2.2 Types of Data	13
2.2.1 Structured and unstructured data	13
2.2.2 Types of variables	14
2.3 Where Data Come From	14
2.3.1 Sources of data	14
2.3.2 Open datasets	15
2.3.3 Labelling data	15
2.4 Data Quality	15
2.4.1 Garbage in, garbage out	15
2.4.2 Inspecting and cleaning a dataset	16
2.5 Preparing Data for Learning	17
2.5.1 Encoding categories	17
2.5.2 Scaling numerical features	18
2.5.3 Training, validation and test sets	18

2.6 Exploring Data	19
2.7 The Data Pipeline	20
2.8 Big Data and Data Privacy	21
2.8.1 Big data	21
2.8.2 Personal data and privacy	21
Summary	22
Key Terms	22
Review Questions	22
References and Further Reading	23
CHAPTER 3 The Mathematics Behind AI, Without Fear	**24**
3.1 Numbers as Vectors	24
3.1.1 Everything becomes a list of numbers	24
3.1.2 Distance and similarity	25
3.2 Matrices: Many Weighted Sums at Once	26
3.3 Probability: Reasoning Under Uncertainty	26
3.3.1 Probability and conditional probability	26
3.3.2 Bayes' rule	27
3.4 Statistics: Describing Data	28
3.4.1 Centre and spread	28
3.4.2 The normal distribution	28
3.4.3 Correlation is not causation	28
3.5 Functions and Models	29
3.6 Learning as Optimization	30
3.6.1 Slopes tell us which way to go	30
3.6.2 Choosing the learning rate	31
Summary	32
Key Terms	32
Review Questions	32
References and Further Reading	33
CHAPTER 4 Tools of the Trade: Python, Notebooks and No-Code Platforms	**34**
4.1 The AI Toolbox	35
4.2 Notebooks: Code, Results and Explanation Together	36
4.3 Python in One Sitting	37
4.4 Essential Libraries	38
4.4.1 NumPy: arrays	38
4.4.2 pandas and Matplotlib: tables and charts	39
4.4.3 scikit-learn: one pattern for every model	40

4.4.4 Deep-learning frameworks	41
4.5 No-Code and Low-Code AI	41
4.6 Cloud AI Services and Model Hubs	42
4.7 Learning to Program with AI Assistants, Responsibly	44
Summary	45
Key Terms	45
Review Questions	45
References and Further Reading	46
CHAPTER 5 Learning from Examples: Supervised Learning	**48**
5.1 Learning from Labelled Examples	49
5.2 Regression: Predicting Numbers	49
5.2.1 The line of best fit	49
5.2.2 Multiple regression	50
5.3 Classification with Logistic Regression	51
5.4 k-Nearest Neighbours: Learning by Similarity	53
5.5 Decision Trees: Asking Good Questions	54
5.5.1 Reading a tree	54
5.5.2 How a tree chooses its questions	55
5.6 Ensembles: Many Models Are Better Than One	56
5.7 Support Vector Machines: The Widest Street	58
5.8 Naive Bayes: Classifying Text	59
5.9 Choosing an Algorithm	59
Summary	61
Key Terms	61
Review Questions	61
References and Further Reading	62
CHAPTER 6 Finding Patterns: Unsupervised Learning and Recommendations	**64**
6.1 Learning Without Labels	64
6.2 Clustering	65
6.2.1 The k-means algorithm	65
6.2.2 Choosing k: the elbow method	66
6.2.3 Hierarchical clustering	67
6.3 Dimensionality Reduction	68
6.4 Anomaly Detection	69
6.5 Association Rules: What Goes With What?	70
6.6 Recommender Systems	71

6.6.1 Content-based and collaborative filtering	71
6.6.2 Challenges of recommender systems	73
6.7 Reinforcement Learning in Brief	73
Summary	75
Key Terms	75
Review Questions	75
References and Further Reading	76
CHAPTER 7 Is the Model Any Good? Evaluation and Good Practice	**78**
7.1 Training, Validation and Test Data	78
7.2 Underfitting, Overfitting and the Bias–Variance Trade-off	79
7.2.1 Too simple, too complex and just right	79
7.2.2 Bias and variance	81
7.2.3 Regularization	81
7.3 Metrics for Regression	81
7.4 Metrics for Classification	82
7.4.1 The confusion matrix	82
7.4.2 Thresholds, precision–recall trade-off and the ROC curve	84
7.5 When Accuracy Misleads: Imbalanced Data	85
7.6 Cross-Validation and Hyperparameter Tuning	86
7.7 Explainability: Why Did the Model Decide That?	87
7.8 A Checklist for Trustworthy Results	88
7.8.1 Data leakage	88
7.8.2 The checklist	89
Summary	89
Key Terms	90
Review Questions	90
References and Further Reading	91
CHAPTER 8 Neural Networks and Deep Learning	**93**
8.1 Inspiration from the Brain	94
8.2 The Perceptron	94
8.3 Multilayer Networks and Activation Functions	96
8.3.1 Layers	96
8.3.2 Activation functions	96
8.4 How Neural Networks Learn	97
8.4.1 Loss, forward pass and backpropagation	97
8.4.2 Epochs, batches and optimizers	98
8.5 Training a Network in Keras	98

8.6 Why Deep Learning Took Off	100
8.7 The Main Architectures	101
8.8 Training in Practice	102
8.8.1 Fighting overfitting	102
8.8.2 Transfer learning	102
8.9 The Limits of Deep Learning	103
Summary	104
Key Terms	104
Review Questions	104
References and Further Reading	105
CHAPTER 9 Computer Vision: Teaching Machines to See	**107**
9.1 Images as Data	107
9.1.1 Pixels, channels and resolution	107
9.1.2 Why vision is hard	109
9.2 Classical Image Processing	109
9.2.1 Filters and convolution	109
9.2.2 Other classical techniques	111
9.3 Convolutional Neural Networks	111
9.3.1 Learning the filters	111
9.3.2 A CNN in Keras	112
9.4 Vision Tasks	113
9.5 Transfer Learning with Pre-trained Models	114
9.6 Face Recognition and Its Controversies	115
9.7 Applications of Computer Vision	115
Summary	116
Key Terms	117
Review Questions	117
References and Further Reading	118
CHAPTER 10 Language and Speech: Teaching Machines to Read, Listen and Talk	**119**
10.1 Why Language Is Hard for Machines	119
10.2 Text Preprocessing	120
10.3 Representing Text as Numbers	121
10.3.1 Bag of words and TF-IDF	121
10.3.2 Word embeddings	123
10.4 Classic NLP Tasks	124
10.4.1 Sentiment analysis	124

10.4.2 Other tasks	125
10.5 Machine Translation	126
10.6 Speech: Listening and Talking	127
10.6.1 Sound as data	127
10.6.2 Speech recognition and synthesis	128
10.7 AI for Indian Languages	130
10.7.1 Challenges	130
10.7.2 Initiatives	130
Summary	131
Key Terms	131
Review Questions	132
References and Further Reading	133
CHAPTER 11 Generative AI and Large Language Models	**134**
11.1 What "Generative" Means	134
11.2 From Prediction to Generation	135
11.2.1 Language models predict the next token	135
11.2.2 Choosing the next token: temperature	136
11.3 Inside a Large Language Model	137
11.3.1 Tokens	137
11.3.2 Embeddings and attention	138
11.3.3 The transformer and scale	139
11.4 How Large Language Models Are Trained	140
11.5 Prompt Engineering	141
11.5.1 The anatomy of a good prompt	141
11.5.2 Prompting techniques	142
11.6 Hallucinations and Other Limitations	143
11.6.1 Why language models make things up	143
11.6.2 How to verify	143
11.7 Retrieval-Augmented Generation	144
11.8 AI Agents and Tool Use	146
11.9 Images, Audio and Video	146
11.9.1 Diffusion models	146
11.9.2 Audio, video and their risks	147
11.10 Open and Closed Models	147
Summary	148
Key Terms	148
Review Questions	149

References and Further Reading	150
CHAPTER 12 AI Tools for Study, Work and Everyday Life	**151**
12.1 Choosing an AI Tool	151
12.1.1 Categories of tools	151
12.1.2 How to choose	152
12.2 AI for Learning	153
12.2.1 Ways AI can help	153
12.2.2 A study workflow	154
12.3 AI for Writing and Communication	154
12.3.1 Drafting, editing and summarizing	154
12.3.2 Academic integrity	155
12.4 AI for Data and Spreadsheets	156
12.5 AI for Presentations, Images and Design	157
12.6 AI for Programming	157
12.7 AI for Research	158
12.8 Automating Workflows	159
12.9 Safe and Responsible Use	160
12.9.1 Privacy and sensitive data	160
12.9.2 Verification, disclosure and citation	160
Summary	161
Key Terms	161
Review Questions	161
References and Further Reading	162
CHAPTER 13 AI in Engineering	**164**
13.1 How AI Changes Engineering Practice	164
13.1.1 Physics-based, data-driven and hybrid models	164
13.1.2 Digital twins	165
13.1.3 A common pattern	166
13.2 Civil Engineering	167
13.2.1 Structural health monitoring	167
13.2.2 Concrete strength prediction	168
13.2.3 Other civil applications	169
13.3 Mechanical and Manufacturing Engineering	170
13.3.1 Predictive maintenance	170
13.3.2 Quality inspection, generative design and process optimization	171
13.4 Electrical Engineering	172
13.4.1 Load and renewable forecasting	172

13.4.2 Other electrical applications	173
13.5 Electronics and Communication Engineering	173
13.6 Computer Science and Information Technology	174
13.7 Chemical, Biotechnology and Materials Engineering	174
13.8 Choosing Problems Where AI Helps	175
13.8.1 Questions to ask	175
13.8.2 Working with domain knowledge	176
Summary	176
Key Terms	177
Review Questions	177
References and Further Reading	178
CHAPTER 14 AI for Society: Health, Agriculture, Education, Finance and Governance	**180**
14.1 Healthcare	181
14.1.1 Applications	181
14.1.2 Caution	181
14.2 Agriculture	182
14.3 Education	183
14.4 Finance and Banking	184
14.4.1 Fraud detection in digital payments	184
14.4.2 Other financial applications	186
14.5 Governance and Public Services	186
14.5.1 AI on digital public infrastructure	186
14.5.2 Applications in government	187
14.6 Smart Cities, Transport and Disaster Management	187
14.7 Environment and Climate	188
14.8 Media and Entertainment	188
14.9 Benefits, Risks and Safeguards	188
Summary	190
Key Terms	190
Review Questions	190
References and Further Reading	191
CHAPTER 15 AI in the Physical World: IoT, Edge AI, Robotics and Autonomous Systems	**193**
15.1 Sensors and the Internet of Things	193
15.1.1 From sensor to cloud	193
15.1.2 Why process data at the edge?	194
15.2 Edge AI and TinyML	195

15.2.1 Running models on small devices	195
15.2.2 Model compression	196
15.3 Robotics	197
15.3.1 The sense–perceive–plan–act loop	197
15.3.2 Path planning with A*	198
15.3.3 Kinds of robots	199
15.4 Autonomous Vehicles	200
15.4.1 Levels of automation	200
15.4.2 Perception and sensor fusion	200
15.4.3 Safety challenges and Indian roads	201
15.5 Human–Robot Collaboration and Safety	202
Summary	203
Key Terms	203
Review Questions	203
References and Further Reading	205
CHAPTER 16 Building an AI Project from Idea to Deployment	**206**
16.1 The AI Project Life Cycle	206
16.2 Framing the Problem	207
16.2.1 Questions to ask	207
16.2.2 Writing a problem statement	208
16.3 Collecting and Preparing Data	208
16.3.1 Sources, consent and ethics	208
16.3.2 Preparing the data	209
16.4 Building a Baseline and Improving It	209
16.4.1 Baselines	209
16.4.2 Training and evaluating a model	210
16.4.3 Improving the model	211
16.5 Deploying the Model	211
16.5.1 A web application with Gradio	211
16.5.2 Hosting and integration	212
16.6 Monitoring and Maintenance	213
16.6.1 Drift and feedback	213
16.6.2 Feedback loops and MLOps	214
16.7 Documenting the Project	214
16.8 Presenting the Work	215
Summary	217
Key Terms	217

Review Questions	217
References and Further Reading	218
CHAPTER 17 Responsible AI: Ethics, Bias, Privacy, Safety and Law	**220**
17.1 Why AI Ethics Matters	220
17.2 Principles of Responsible AI	221
17.3 Bias and Fairness	222
17.3.1 Sources of bias	222
17.3.2 Measuring fairness	223
17.3.3 Mitigation	225
17.4 Privacy and Data Protection	225
17.4.1 The limits of anonymization	225
17.4.2 India's Digital Personal Data Protection Act, 2023	226
17.5 Misinformation and Deepfakes	227
17.6 Intellectual Property	228
17.7 Safety, Security and Misuse	229
17.8 Environmental Cost	229
17.9 AI Regulation	230
17.9.1 The EU AI Act	230
17.9.2 India and other approaches	231
17.10 A Responsible-AI Checklist for Projects	232
Summary	232
Key Terms	233
Review Questions	233
References and Further Reading	234
CHAPTER 18 The Future of AI and Careers	**236**
18.1 Trends to Watch	237
18.2 The AGI Debate	237
18.3 AI and Jobs	238
18.3.1 What the evidence says	238
18.3.2 Thinking in tasks	239
18.4 Careers in AI	240
18.5 Skills for an AI-Shaped World	241
18.6 A Learning Roadmap	242
18.6.1 Resources	242
18.6.2 A one-year plan	242
18.7 Starting Up with AI	243
18.8 Lifelong Learning in a Fast-Moving Field	244

Summary	245
Key Terms	245
Review Questions	245
References and Further Reading	246
APPENDIX A Python for AI: A Quick Start	**248**
A.1 Setting Up	248
A.2 Python Essentials	248
A.3 NumPy Quick Reference	249
A.4 pandas Quick Reference	250
A.5 Matplotlib Quick Reference	251
A.6 scikit-learn Quick Reference	251
A.7 Common Errors and How to Fix Them	252
APPENDIX B Mathematics Refresher	**254**
B.1 Vectors	254
B.2 Matrices	254
B.3 Functions, Exponentials and Logarithms	255
B.4 Derivatives and Gradients	255
B.5 Probability	256
B.6 Statistics	256
B.7 Information and Entropy	257
APPENDIX C Datasets and Tools Directory	**258**
C.1 Datasets Used in This Book	258
C.2 General Repositories	258
C.3 Indian Datasets and Platforms	259
C.4 Datasets for Engineering Projects	259
C.5 Tools	260
C.6 Using Datasets Responsibly	261
APPENDIX D AI Laboratory: Twelve Experiments	**262**
D.1 Exploring and Cleaning a Dataset	262
D.2 Vectors, Similarity and Gradient Descent	262
D.3 Linear and Logistic Regression	263
D.4 Comparing Classifiers	263
D.5 Clustering, PCA and Anomaly Detection	264
D.6 Evaluating Models Properly	264
D.7 A Neural Network in Keras	265
D.8 Image Processing and a CNN	265
D.9 Text Classification and Speech Signals	266

D.10 Working with Language Models	266
D.11 AI for Engineering Data	267
D.12 From Model to App, Responsibly	267
APPENDIX E Glossary	**268**
APPENDIX F Twelve Mini-Projects	**277**
F.1 Concrete Mix Strength Predictor (Civil)	277
F.2 Road-Damage Spotter (Civil)	277
F.3 Predictive Maintenance for a Motor or Pump (Mechanical/Electrical)	277
F.4 Day-Ahead Campus Electricity Forecast (Electrical)	278
F.5 Solar Panel Fault and Dust Detection (Electrical/Electronics)	278
F.6 Keyword-Spotting Voice Switch (Electronics)	278
F.7 Civic Complaint Router in Indian Languages (Computer Science)	278
F.8 College Handbook Assistant with RAG (Computer Science)	278
F.9 Crop-Disease Advisor (Agriculture/Biotechnology)	279
F.10 Process Soft Sensor (Chemical)	279
F.11 Fair Shortlisting Audit (Any Branch)	279
F.12 Personal Study Assistant with Verification (Any Branch)	279
INDEX	**280**

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