Contents

Chapter 1. Decoding the Market's Noise: AI Tools for Clarifying Sound Financial Decision-Making 1
Monu BHARDWAJ and Rupa Khanna MAHLOTRA

1.1. Introduction 1
1.2. The problem of market noise 2
1.3. Foundations of AI in finance 3
1.3.1. Machine learning and pattern recognition 3
1.3.2. Natural language processing and sentiment analysis. 4
1.3.3. Probabilistic reasoning and uncertainty quantification 4
1.4. AI tools for clarifying financial signals 5
1.4.1. Signal extraction and noise reduction 6
1.4.2. Risk modeling and scenario analysis 6
1.4.3. Portfolio optimization under uncertainty 7
1.4.4. Anomaly detection and fraud prevention 7
1.5. Evidence from empirical studies 8
1.6. Practical considerations and implementation challenges 8
1.7. Ethical and regulatory considerations 9
1.8. Case studies 9
1.9. Future directions 10
1.10. Conclusion 10
1.11. References 11

Chapter 2. Neuromorphic Computing: Brain-Inspired Intelligence and Next-Generation AI Systems 13
Samiksha WALIA, Samdisha WALIA, Law Kumar SINGH and Rekha SINGH

2.1. Introduction 13
2.2. Biological inspiration and theoretical foundations 15
2.2.1. Neuron models 16

2.2.2. SNN 17
2.2.3. Synaptic plasticity and learning 19
2.2.4. Neural coding 20
2.3. Core principles of neuromorphic computing 21
2.3.1. Event-driven computation 22
2.3.2. Massive parallelism 22
2.3.3. Temporal dynamics 23
2.3.4. Plasticity and adaptability 24
2.3.5. Hardware–software co-design 24
2.4. Neuromorphic hardware implementations 25
2.4.1. Digital neuromorphic processors 26
2.4.2. Analog and mixed-signal circuits 27
2.4.3. Memristor-based systems 28
2.4.4. Scalability and integration challenges 29
2.5. Software frameworks and simulation tools 30
2.5.1. Simulation frameworks 30
2.5.2. Hardware-specific SDKs 31
2.5.3. Hybrid AI frameworks 31
2.5.4. Programming challenges 31
2.6. Prospects and challenges 32
2.6.1. Ethical, legal and societal considerations 33
2.6.2. Future directions 33
2.7. Conclusion 34
2.8. References 34

Chapter 3. EduFAITH: A Requirements Engineering Framework for Ethical and Human-Centered AI in Educational Decision Systems 37
Tanu SINGH and Aashna SUMAN

3.1. Introduction 38
3.2. Current practices and related work 40
3.3. Limitations in current RE for AI in education 42
3.4. The FAITH architecture 43
3.5. Methodology and outcomes 44
3.6. EduFAITH 47
3.7. Solutions, conclusion and future directions 47
3.8. References 50

Chapter 4. Applications of AI in Healthcare Decision Support: A Systematic Review 53
Sakshi, Sakshi GUPTA and Hilal Ahmad SHAH

4.1. Introduction 53

4.2. ML algorithms: a new frontier in medical diagnostics 55
4.2.1. Advances in research on TB and important motivations 58
4.2.2. Objectives and contribution 59
4.3. Contemporary approaches in ML 62
4.3.1. Traditional ML algorithms 62
4.3.2. Deep learning algorithms. 65
4.3.3. Decision pipeline with a brief quantitative analysis 66
4.3.4. Simulated decision-impact quantification. 68
4.3.5. Practical implementation checklist for TB decision support with ML . . . 70
4.4. ML in the identification, diagnosis, treatment and control of TB 72
4.4.1. TB diagnosis and detection using ML. 72
4.4.2. TB treatment adherence control and monitoring using ML 73
4.5. Ethics, bias, privacy and clinical decision consequences. 74
4.5.1. Clinical consequences of performance failures. 74
4.5.2. Mitigation and responsible-deployment strategies 75
4.6. Future prospects and conclusion 75
4.7. References 76

Chapter 5. Systematic Review Synthesizes Recent Advances in Computer Vision Decision Systems 81
Neelam KUMARI, Sunil Kumar CHAWLA and Shivani WADHWA

5.1. Introduction 81
5.1.1. Application of computer vision for decision system 85
5.1.2. Computer vision techniques for decision-making 86
5.1.3. Challenges in computer vision for decision-making 89
5.1.4. Research opportunities and future directions 89
5.2. Literature survey 90
5.2.1. Dataset summary 95
5.2.2. Research gap 96
5.3. Conclusion 96
5.4. References 97

Chapter 6. Machine Learning Insights Regarding the Impact of Weather and Region on Crops 101
Nidhi Bansal GARG, Atul GARG and Anurag JAIN

6.1. Introduction 101
6.2. Literature review. 103
6.3. Methodology 105
6.4. Results and discussion. 106
6.5. Conclusion 111
6.6. References 111

Chapter 7. AI-Enabled IoT Decision Support in Smart Agriculture: Strategies, Challenges and Case Studies 115
Tarun KUMAR, Sonia SUNEJA, Jyoti SAINI, Kanwal GARG, Rutuja Subhash MAGAR and Dolly RANI

7.1. Introduction 116
7.1.1. Background and motivation 116
7.1.2. Role of decision sciences in smart agriculture 116
7.1.3. Problem statement 117
7.1.4. Objectives and scope 118
7.1.5. Chapter organization 118
7.1.6. AI–IoT decision support framework: A conceptual figure 119
7.2. Literature review 120
7.2.1. Introduction to AI–IoT integration in smart agriculture 120
7.2.2. Evolution of decision-support systems (DSS) in agriculture 121
7.2.3. Architectural models for AI–IoT-based DSS 121
7.2.4. AI techniques in agricultural decision-making 122
7.2.5. IoT-driven data management and edge intelligence 123
7.2.6. Communication technologies and networking in smart agriculture 124
7.2.7. Data security, privacy and trust in agricultural IoT systems 125
7.2.8. Sustainable smart farming and energy optimization 126
7.2.9. Global case studies of AI–IoT decision-support applications 127
7.2.10. Research gaps and future directions 128
7.3. AI-enabled decision support systems in smart agriculture 129
7.3.1. Introduction 129
7.3.2. Framework of AI-enabled DSS 130
7.3.3. Machine learning and deep learning in agricultural DSS 130
7.3.4. AI-driven DSS for sustainable agriculture 132
7.3.5. Edge and federated intelligence in DSS 133
7.3.6. Challenges and future directions 134
7.4. Challenges and limitations of AI-enabled IoT decision support systems in smart agriculture 135
7.4.1. Data-related challenges 135
7.4.2. Technical and infrastructure constraints 136
7.4.3. Ethical, privacy and security concerns 138
7.4.4. Economic and social limitations 139
7.4.5. Environmental and sustainability concerns 139
7.4.6. Discussion: mitigation strategies and research directions 140
7.5. Sustainability and energy optimization in AI-enabled IoT decision support systems for smart agriculture 141
7.5.1. Introduction 141
7.5.2. Sustainable computing and green AI principles 141

7.5.3. Energy efficiency in IoT communication and sensing 142
7.5.4. Hardware sustainability and circular economy models 143
7.5.5. Renewable energy integration in agricultural DSS. 144
7.5.6. Sustainable AI governance and policy frameworks 145
7.6. Case studies, implementation frameworks and future directions 145
7.6.1. Introduction 145
7.6.2. Global case studies 146
7.6.3. Indian case studies 147
7.6.4. Comparative analysis of architectural frameworks. 147
7.6.5. Challenges observed across implementations 148
7.6.6. Future research and deployment directions 149
7.7. Conclusion and policy implications 150
7.7.1. Overview 150
7.7.2. Integrated summary of findings 150
7.7.3. Policy and institutional recommendations 150
7.7.4. Research opportunities 151
7.7.5. Concluding remarks 151
7.8. References 151

Chapter 8. AI in Manufacturing and Supply Chain Management 159
Neetika JAIN

8.1. Introduction 159
8.2. Literature review. 161
8.2.1. Manufacturing – equipment monitoring and predictive maintenance . . . 162
8.2.2. Manufacturing operational efficiency – process optimization 166
8.2.3. Manufacturing – quality control and inspection 167
8.2.4. Generative AI in manufacturing industries 169
8.2.5. Supply chain – demand forecasting and inventory management 170
8.2.6. Supply chain – fulfillment and logistics. 171
8.2.7. Supply chain – supplier risk monitoring and fraud detection 171
8.2.8. Generative AI in supply chain operations. 172
8.3. Discussion – AI transformation for manufacturing and supply chain 173
8.3.1. Design and prototype 173
8.3.2. Manufacturing process optimization and operational efficiency 173
8.3.3. Quality control and inspection 174
8.3.4. Predictive maintenance 174
8.3.5. Vision-based safety control 174
8.3.6. Sourcing and procurement 174
8.3.7. Supplier risk analysis 175
8.3.8. Demand forecasting and inventory management. 175

8.3.9. Fulfillment and logistics optimization. 175
8.3.10. Customer service 175
8.4. Conclusion 177
8.5. References 178

Chapter 9. AI in Educational Decision Systems 185
Anik ACHARJEE

9.1. Introduction 185
9.2. Literature review. 188
9.3. Conclusion 192
9.4. References 193

Chapter 10. Reinforcement Learning-Driven Frameworks for Adaptive and Explainable Decision Intelligence 195
Basant Kumar VERMA, Parveen Kumar SHARMA, Shekhar SINGH, Dinesh Kumar GARG and Hemlata

10.1. Introduction 196
10.2. Literature review 199
10.3. Theoretical background 202
10.3.1. Policy, value function and reward models. 203
10.4. Methodology 205
10.5. Proposed reinforcement learning-driven framework 208
10.6. Experimental implementation and results 210
10.7. Discussion. 213
10.8. Applications and case studies 214
10.9. Challenges and future work 219
10.10. Conclusion. 220
10.11. References 221

Chapter 11. Explainable AI for High-Stakes Decision-Making in Healthcare and Finance 225
Abdul Malik ANSARI

11.1. Introduction 226
11.2. Literature review 228
11.3. Research gap 231
11.4. Proposed methodology/framework 232
11.5. Results and discussions 235
11.6. Conclusion and future work 240
11.7. References 241

Chapter 12. AlzCare: Smart Assistance System for Daily Activities in Alzheimer's Patients 243
Riya KANSAL, Jappanjot KAUR, Parampreet KAUR, Law Kumar SINGH and Rekha SINGH

12.1. Introduction 243
12.1.1. Motivation 245
12.1.2. Contribution 245
12.2. Literature review 246
12.3. System architecture 249
12.3.1. Convolutional neural network (CNN) 249
12.3.2. Long short-term memory (LSTM) 250
12.3.3. Random Forest (RF). 251
12.3.4. Implementation libraries and technologies 252
12.4. Proposed methodology. 253
12.4.1. Custom dataset preparation for Alzheimer's-oriented abnormal activity recognition 255
12.4.2. Data loading 255
12.4.3. Feature selection and feature scaling 255
12.4.4. Dataset splitting 256
12.4.5. Model architecture. 256
12.4.6. Training setup 257
12.4.7. Evaluation metrics. 257
12.4.8. Model deployment preparation 258
12.4.9. Activity classification 258
12.4.10. Abnormal activity detection and alert mechanism 258
12.4.11. API endpoint for activity prediction 258
12.4.12. System deployment and real-time operation. 259
12.4.13. Mobile application development: AlzCare App 260
12.4.14. Technological stack and architecture. 260
12.4.15. User interface and accessibility considerations 260
12.5. Results and discussion 260
12.5.1. Detailed comparative analysis 261
12.5.2. Application flow and navigation structure 264
12.5.3. Live activity tracking and abnormal behavior alert system 265
12.5.4. Emergency alert button 266
12.5.5. Cognitive engagement: MindMaze Game Suite 267
12.5.6. Diary module for memory preservation 268
12.5.7. Daily living support tools 269
12.5.8. Live feed services: inform, motivate and educate 269
12.5.9. Navigation panel. 270
12.6. Conclusion 271

12.7. Acknowledgments 272
12.8. Declarations 272
12.9. References 273

Chapter 13. A Comprehensive Survey on Sentiment Analysis: Evolution from Machine Learning and Deep Learning to Large Language Models 275
Wesam AHMED

13.1. Introduction 275
13.2. Background 277
13.2.1. Introduction to sentiment analysis 277
13.2.2. Sentiment analysis levels 278
13.2.3. Approaches for text representation 279
13.2.4. Techniques for analyzing sentiment 280
13.2.5. Recent trends in sentiment analysis 282
13.3. Real-world applications 284
13.4. Challenges and limitations 286
13.5. Key future directions 288
13.6. Conclusion 289
13.7. References 290

Chapter 14. Generative AI in Creative Industries 295
Gautam DAS, Prachi MISHRA, Shailja SAINI and Avneet KAUR

14.1. Introduction 295
14.1.1. Generative AI as paradigm shift 296
14.1.2. The history of innovation and technology 297
14.1.3. Socio-economic generative AI, creative industry 297
14.1.4. Ethical and legal implications 298
14.1.5. Study goals 298
14.1.6. Chapter structure 299
14.2. Technical generative AI 299
14.2.1. Large language models (LLMs) 300
14.2.2. Generative adversarial networks (GANs) 300
14.2.3. Diffusion models 301
14.2.4. Hybrid architectures and new trends 302
14.3. Generative AI 303
14.3.1. Visual arts and design 303
14.3.2. Music and sound creation 304
14.3.3. Literature and storytelling 304
14.3.4. Film, animation and gaming 305
14.3.5. Conclusion 305

14.4. Creativity, ethical and legal issues 306
14.4.1. Intellectual property 306
14.4.2. Ethical concerns 307
14.4.3. Models of human–AI collaboration 308
14.4.4. Applications of collaboration models 309
14.4.5. Conclusion 309
14.5. Case studies in industry 310
14.5.1. Arts and art gallery 310
14.5.2. Music and entertainment industry 311
14.5.3. Publishing, literature and journalism 312
14.5.4. Movie, animation and virtual production 313
14.5.5. Gaming and interactive media 313
14.5.6. Case studies conclusion 314
14.5.7. Decision-making implications of generative AI 314
14.5.8. Case study 1: creativity – advertising concept selection 317
14.5.9. Case study 2: art – museum curation and decision exhibition 317
14.5.10. Case study 3: music – release strategy decisions and playlist 318
14.5.11. Case study 4: literature – manuscript evaluation in publishing. 318
14.5.12. Summary of decision-making implications 319
14.5.13. Decision-oriented case studies conclusion 319
14.6. Future directions 320
14.6.1. Changing technical horizons 320
14.6.2. Regulatory and legal frameworks 321
14.6.3. Responsible AI and frameworks 322
14.6.4. Human–AI collaboration as the staple model 323
14.6.5. Immersive and customized media 323
14.6.6. Cultural and philosophical implications 324
14.6.7. Future action conclusion 324
14.7. Conclusion 325
14.8. References 327

List of Authors 329

Index 333