
Contents

Preface	xiii
Devasis PRADHAN and Prasanna Kumar SAHU	
Introduction	xv
Devasis PRADHAN, Prasanna Kumar SAHU, Hla Myo TUN and Prasenjit CHATTERJEE	
Chapter 1. Artificial Intelligence and its Application in Healthcare Systems	1
Manthan GHOSH, Deepa DAS, Rohit DEY and Nitish SINHA	
1.1. History of healthcare system	2
1.2. Literature studies.	3
1.3. Evolution of AI	3
1.3.1. Advantages and disadvantages.	4
1.3.2. Components of AI	5
1.4. Machine learning	7
1.4.1. Categories of ML	7
1.4.2. Supervised learning.	7
1.4.3. Unsupervised learning	11
1.4.4. Reinforcement learning.	12
1.5. Application of ML.	14
1.6. Application of AI in healthcare.	16
1.6.1. Digital health	16
1.6.2. Genetic solutions	16
1.6.3. Bio-medical visualization	16
1.7. Conclusion	19
1.8. References	20

Chapter 2. Medical Laboratory Artificial Intelligence: The Applicability in Nigerian Medical Laboratories	25
Uchejeso Mark OBETA, Nkereuwem Sunday ETUKUDOH, Obiora Reginald EJINAKA and Amaechi Eze ODONO	
2.1. Introduction	26
2.2. Historical trend of artificial intelligence (AI)	29
2.3. AI in medical science/medical laboratory science in history.	30
2.4. Medical Laboratory Information Management System, centralized data and WWW	31
2.5. Artificial intelligence methodologies and their application in medical laboratory science.	33
2.6. Nigerian medical laboratory intelligence before, now and future	36
2.7. Medical laboratory services where AI is used in Nigeria.	37
2.8. AI and Internet of medical laboratory things	40
2.9. Opportunities and challenges of AI for Nigerian medical laboratories	41
2.10. Risks/limitations and challenges associated with AI in Nigerian medical laboratories	43
2.11. AI and digitalization of Nigerian medical laboratories	44
2.12. Conclusion	45
2.13. References	46
 Chapter 3. Machine Learning and Deep Learning for Smart City Services	 53
Shweta Mayor SABBHARWAL, Manpreet Kaur AIDEN and Sonia CHHABRA	
3.1. Introduction	53
3.2. Basics of machine learning and its implications in smart cities	56
3.3. Basics of deep learning and its implications in smart cities	58
3.4. Algorithms of machine learning and deep learning.	60
3.4.1. Classification	61
3.4.2. Clustering	61
3.4.3. K-nearest neighbors.	62
3.4.4. Naive Bayes	62
3.4.5. The support vector machine	62
3.4.6. Linear regression	63
3.4.7. Random forest.	63
3.4.8. K-means	64
3.4.9. Artificial neural network	64
3.4.10. Multi-layer perceptron	66
3.5. Applications in smart cities using machine learning and deep learning.	67
3.5.1. Safety of the public	67
3.5.2. Intelligent traffic management.	68
3.5.3. Water management strategy	68

3.5.4. Smart street lights	69
3.5.5. Intelligent parking devices	69
3.5.6. Smart waste and disposal management system.	69
3.6. Future challenges and research directions	69
3.7. Conclusion	70
3.8. References	71
Chapter 4. An Intelligent Healthcare System Based on Machine Learning Models for Accurate Detection of Heart Disease.	75
Madhumita PAL, Smita PARIJA, Ganapati PANDA and Ranjan K. MOHAPATRA	
4.1. Introduction	76
4.2. Literature survey.	77
4.3. Features of the dataset.	78
4.4. Proposed system	82
4.5. ML models used for the experimental work.	83
4.5.1. Support vector machines (SVM)	83
4.5.2. Random forest (RF).	83
4.5.3. Stochastic gradient descent (SGD) method.	84
4.5.4. Multilayer perceptron (MLP)	85
4.5.5. Naive Bayes (NB).	86
4.6. Performance parameters of ML models	86
4.6.1. Confusion matrix	86
4.6.2. Accuracy.	87
4.6.3. F1-score	87
4.6.4. AUC	87
4.7. Result and analysis	88
4.8. Conclusion	90
4.9. References	91
Chapter 5. 3D Volume Rendering of MRI Images for Tumor Detection and Segmentation using nnUnet	93
Sai AYUSH, Sai Sreeram GADDE, RAJESWARI and Shivarudraiah SUMALATHA	
5.1. Introduction	93
5.2. Methodology	95
5.2.1. Segmentation	96
5.2.2. Overlapping the scans	97
5.2.3. 3D reconstruction.	97
5.3. Results and discussion.	98
5.4. Conclusion and future scope	101
5.5. References	102

Chapter 6. Implementation of Key Generation in Kyber for Post-Quantum Cryptography using VIVADO.	105
Srinivasa Murthy OMKAR, Siddabassappa Manjunath SUJAN, RAJESWARI and Shivarudraiah SUMALATHA	
6.1. Introduction	106
6.2. Methodology	107
6.2.1. RTL design	108
6.2.2. True random number generator and (SHA-512) HASH.	108
6.2.3. Pseudo random number generator	109
6.2.4. Numeric theoretic transform	109
6.2.5. Matrix multiplication	109
6.3. Results and discussion.	110
6.3.1. Design outcomes	110
6.3.2. Board specifications	111
6.3.3. Interfacing with processor core using AXI	111
6.3.4. Area utilization	113
6.3.5. Power utilization	114
6.3.6. Timing utilization	115
6.4. Conclusion and future scope	116
6.5. References	117
Chapter 7. Computational Intelligence and Big Data Analytics for Smart Healthcare: A Comprehensive Study	119
Bhawna KAUSHIK and Mayank SAINI	
7.1. Introduction	120
7.1.1. Computational intelligence in smart healthcare	120
7.1.2. Big Data analytics in smart healthcare	120
7.1.3. Challenges and future directions.	121
7.1.4. The landscape of smart healthcare.	121
7.2. Computational intelligence techniques in healthcare.	122
7.2.1. Machine learning	122
7.2.2. Natural language processing (NLP)	124
7.2.3. Expert systems	125
7.2.4. Robotic process automation (RPA)	127
7.2.5. Physical robots	129
7.3. Applications of intelligence and Big Data analytics in healthcare.	131
7.4. Benefits of computational intelligence and Big Data analytics in healthcare.	132
7.5. Challenges in implementing computational intelligence and Big Data analytics	132

7.6. Future aspect of computational intelligence and Big Data analytics in smart healthcare	133
7.7. Conclusion	134
7.8. References	135
Chapter 8. Bioinformatics, Healthcare Informatics and Analytics: An Imperative for Improved Healthcare System	139
Pushpendra Pal SINGH and Rakesh Kumar DIXIT	
8.1. Introduction	140
8.1.1. Justification for computational biology	142
8.1.2. Computational biology and its impact	142
8.2. Healthcare informatics	144
8.3. Health analytic	147
8.3.1. Healthcare analytics and its contribution to healthcare framework.	150
8.4. The intersection amidst bioinformatics, healthcare informatics and analytics	150
8.5. Future prospects of healthcare informatics and analytics.	151
8.6. Conclusion	152
8.7. References	153
Chapter 9. Natural Language Processing in Healthcare: A Systematic Review	155
Bhanudas Suresh PANCHBHAI and Varsha Makarand PATHAK	
9.1. Introduction	155
9.2. Materials and methods	157
9.3. Data sources and searches strategy	158
9.3.1. Requirements for inclusion.	160
9.3.2. Exclusion standards.	160
9.3.3. Study selection	160
9.3.4. Data extraction and synthesis	161
9.4. Results and discussion.	183
9.5. Conclusion	190
9.6. References	191
Chapter 10. Artificial Intelligence and Large Language Models in Mental Healthcare: A Systematic Review	195
Mansi CHITGOPEKAR, Abdul Raffie NAIK and Mahimna VYAS	
10.1. Introduction.	195
10.1.1. Objectives	197
10.1.2. Methods	197

10.1.3. Inclusion criteria	198
10.1.4. Exclusion criteria	199
10.1.5. Discussion	199
10.2. AI as an advantage for users.	199
10.3. Ethical implications of AI	200
10.4. AI chatbot and its functions in diagnosing and intervention	201
10.5. Machine learning as a base of AI for mental healthcare	202
10.6. Forms of AI as a mental healthcare support mechanism	202
10.7. AI as a support for mental health professional.	204
10.7.1. Implication	204
10.7.2. Limitations	205
10.8. Suggestions for future studies	205
10.9. Conclusion	205
10.10. Appendix	206
10.11. References	210
Chapter 11. Unleashing the Future: Exploring the Transformative Potential of 5G Technology in Healthcare	217
Varalakshmi DANDU	
11.1. Introduction to 5G technology	217
11.2. Definition of 5G	219
11.3. History of 5G evolution	219
11.3.1. 1G to 3G (1980s–2000s)	219
11.3.2. 4G and LTE (late 2000s–early 2010s).	220
11.3.3. The path to 5G (2010s)	220
11.3.4. Key milestones towards 5G (2016–2019).	220
11.3.5. 5G deployment and expansion (2020s)	221
11.4. 5G bands	223
11.5. 5G use cases and spectrum band relevance	224
11.6. 5G for industries	224
11.7. Importance	225
11.7.1. Faster data speeds	225
11.7.2. Ultra-low latency	225
11.7.3. Massive device connectivity	226
11.7.4. Industrial automation and IoT	226
11.7.5. Healthcare advancements	226
11.7.6. Autonomous vehicles	226
11.7.7. Smart cities.	226
11.7.8. Remote work and education	226
11.7.9. Entertainment and media	227
11.7.10. Economic growth and innovation.	227
11.7.11. Global competitiveness	227

11.8. Key features of 5G	227
11.9. Intel 5G technologies and solutions.	230
11.10. Healthcare	232
11.11. 5G technology’s impact on healthcare: a comprehensive overview	234
11.12. Conclusion.	237
11.13. References.	238
List of Authors	241
Index.	245