

Revolutionizing Healthcare Systems with Next-Generation Technologies

**The Role of Artificial Intelligence, Cloud
Infrastructure, and Big Data in Driving
Patient-Centric Innovation**

Karthik Chava

Revolutionizing Healthcare Systems with Next-Generation Technologies: The Role of Artificial Intelligence, Cloud Infrastructure, and Big Data in Driving Patient-Centric Innovation

Karthik Chava

Senior Software Engineer, Knipper Princeton, Atlanta GA



DeepScience

Published, marketed, and distributed by:

Deep Science Publishing
USA | UK | India | Turkey
Reg. No. MH-33-0523625
www.deepscienceresearch.com
editor@deepscienceresearch.com
WhatsApp: +91 7977171947

ISBN: 978-81-988918-7-7

E-ISBN: 978-81-988918-5-3

<https://doi.org/10.70593/978-81-988918-5-3>

Copyright © Karthik Chava

Citation: Chava, K. (2025). *Revolutionizing Healthcare Systems with Next-Generation Technologies: The Role of Artificial Intelligence, Cloud Infrastructure, and Big Data in Driving Patient-Centric Innovation*. Deep Science Publishing. <https://doi.org/10.70593/978-81-988918-5-3>

This book is published online under a fully open access program and is licensed under the Creative Commons "Attribution-Non-commercial" (CC BY-NC) license. This open access license allows third parties to copy and redistribute the material in any medium or format, provided that proper attribution is given to the author(s) and the published source. The publishers, authors, and editors are not responsible for errors or omissions, or for any consequences arising from the application of the information presented in this book, and make no warranty, express or implied, regarding the content of this publication. Although the publisher, authors, and editors have made every effort to ensure that the content is not misleading or false, they do not represent or warrant that the information-particularly regarding verification by third parties-has been verified. The publisher is neutral with regard to jurisdictional claims in published maps and institutional affiliations. The authors and publishers have made every effort to contact all copyright holders of the material reproduced in this publication and apologize to anyone we may have been unable to reach. If any copyright material has not been acknowledged, please write to us so we can correct it in a future reprint.

Preface

In the ever-evolving landscape of global healthcare, the convergence of Artificial Intelligence (AI), Cloud Infrastructure, and Big Data is reshaping how care is delivered, diseases are detected, and patient outcomes are improved. This book, *Revolutionizing Healthcare Systems with Next-Generation Technologies: The Role of Artificial Intelligence, Cloud Infrastructure, and Big Data in Driving Patient-Centric Innovation*, seeks to explore how these transformative technologies are enabling a shift from reactive to proactive, from generalized to personalized, and from fragmented to integrated healthcare systems. The vision for this work emerged from the growing realization that traditional models of care are no longer sufficient in addressing the complexities of modern medicine. Healthcare providers today must respond to an expanding population, an explosion of health data, and an increasing demand for more accessible, affordable, and individualized care. AI-driven diagnostics, predictive analytics powered by big data, and scalable cloud platforms have become essential tools in this transformation—making healthcare not only smarter but also more compassionate and responsive to individual needs.

This book is designed for a wide audience—from researchers, practitioners, and policymakers to technology innovators and students. It offers a comprehensive view of how next-gen technologies are being deployed across healthcare sectors including clinical decision-making, hospital operations, disease surveillance, remote patient monitoring, and precision medicine. It highlights successful implementations, emerging challenges, and ethical considerations, while emphasizing the need for a human-centered approach in tech-driven care. As we look toward the future, this work serves as both a roadmap and a call to action—urging stakeholders to embrace innovation, build interoperable systems, and ensure that the benefits of these technologies reach every patient, regardless of geography or income. With thoughtful collaboration between technologists, clinicians, and communities, we believe that the next revolution in healthcare is not only possible—it is already underway.

Karthik Chava

Table of Contents

Chapter 1: Understanding the digital transformation landscape in modern healthcare systems.....1

1.1. Introduction to Digital Transformation..... 1

1.2. Historical Context of Healthcare Technology2

1.3. Key Drivers of Digital Transformation in Healthcare3

1.4. Impact of Telemedicine on Patient Care.....4

1.5. Role of Electronic Health Records (EHR).....4

1.6. Data Analytics in Healthcare Decision Making.....5

1.7. Conclusion6

References7

Chapter 2: Enhancing clinical decision-making using artificial intelligence applications8

2.1. Introduction to Clinical Decision-Making8

2.2. Overview of Artificial Intelligence in Healthcare..... 10

2.3. Types of AI Applications in Clinical Settings 11

2.4. Benefits of AI in Clinical Decision-Making 14

2.5. Challenges and Limitations of AI in Healthcare..... 17

2.6. Conclusion20

References21

Chapter 3: Developing machine learning algorithms for improved diagnosis and prognosis.....22

3.1. Introduction22

3.2. Background.....24

3.3. Machine Learning Fundamentals.....26

3.4. Dataset Acquisition.....29

3.5. Feature Selection and Engineering31

3.6. Conclusion34

References35

Chapter 4: Architecting cloud-based infrastructure for scalable and secure health data storage36

4.1. Introduction36

4.2. Cloud Computing Fundamentals38

4.3. Health Data Storage Requirements40

4.4. Designing Scalable Cloud Architecture43

4.5. Security Considerations in Cloud Storage45

4.6. Data Backup and Disaster Recovery47

4.7. Conclusion49

References51

Chapter 5: Establishing best practices for securing sensitive healthcare information in the cloud.....52

5.1. Introduction52

5.2. Understanding Cloud Computing in Healthcare54

5.3. Regulatory Frameworks and Compliance55

5.4. Risks Associated with Cloud Storage58

5.5. Key Security Principles60

5.6. Conclusion62

References64

Chapter 6: Utilizing big data analytics for real-time patient monitoring and risk prediction.....65

6.1. Introduction65

6.2. Overview of Big Data in Healthcare67

6.3. Real-Time Patient Monitoring68

6.4. Risk Prediction Models..... 71

6.5. Data Analytics Frameworks..... 73

6.6. Conclusion 75

References 76

Chapter 7: Predictive models for early detection of diseases and managing public health crises.....77

7.1. Introduction 77

7.2. Overview of Predictive Modeling..... 79

7.3. Types of Predictive Models 80

7.4. Data Sources for Predictive Modeling 83

7.5. Model Development Process 85

7.6. Applications of Predictive Models..... 87

7.7. Conclusion 89

References 91

Chapter 8: Building end-to-end data engineering solutions for medical research and analysis92

8.1. Introduction to Data Engineering in Medical Research 92

8.2. Understanding Medical Data Types..... 94

8.3. Data Collection Techniques 96

8.4. Data Storage Solutions..... 99

8.5. Data Processing Frameworks..... 101

8.6. Conclusion 103

References 104

Chapter 9: Telemedicine and remote patient management through emerging digital platforms.....105

9.1. Introduction 105

9.2. Historical Context of Telemedicine 106

9.3. Current Trends in Telemedicine 107

9.4. Technological Advancements in Digital Platforms 108

9.5. Remote Patient Management Strategies 111

9.6. Conclusion 114

References 116

Chapter 10: Integrating advanced technologies into existing healthcare systems and workflows117

10.1. Introduction..... 117

10.2. Current State of Healthcare Systems 119

10.3. Advanced Technologies Overview 121

10.4. Integration Strategies 124

10.5. Case Studies..... 126

10.6. Conclusion 128

References 130

Chapter 11: Cross-disciplinary learnings from agricultural technologies for healthcare data management.....131

11.1. Introduction..... 131

11.2. Overview of Agricultural Technologies 133

11.3. Data Management in Agriculture..... 134

11.4. Healthcare Data Management..... 137

11.5. Comparative Analysis of Data Management 138

11.6. Technological Innovations in Agriculture 140

11.7. Conclusion 142

References 144

Chapter 12: Exploring the future of artificial intelligence, cloud, and data-driven innovation in healthcare delivery145

12.1. Introduction to Healthcare Innovation 145

12.2. The Role of Artificial Intelligence in Healthcare..... 147

12.3. Cloud Computing in Healthcare 149

12.4. Data-Driven Decision Making 152

12.5. Integration of AI and Cloud Technologies 154

12.6. Conclusion 156

References 158