Contents

Preface ix
Anne FAUCHON

Introduction xi
Céline BLOUD-REY

Part 1. Artificial Intelligence to Support Diagnosis 1

Chapter 1. Healthcare Applications 3
Anne CAMMILLERI

1.1. The uses of a healthcare application 4
1.2. Applications at the service of hospitals (HR dimension) 6
1.2.1. Internal staff and patient management applications in public and private hospitals 6
1.2.2. Helpful applications to counter isolation and other vulnerabilities 10
1.3. Cybersecurity to reinforce the resilience of applications 13
1.3.1. The obligation to protect the health of minor children against content that may harm their health 14
1.3.2. Assessing health risks through digital services 16
1.4. Conclusion 21
1.5. References 21

Chapter 2. Behavioral Insurance: The Latest Trick of Capitalism? 25
Philippe BATIFOULIER and Nicolas DA SILVA

2.1. Introduction. 25
2.2. A new health insurance market 28

2.2.1. Healthy lifestyle behavior insurance: an overview 28
2.2.2. The importance of the institutional context. 30
2.3. Heading towards a great backward leap in health risk socialization?. 34
2.3.1. Artificial intelligence at the service of paternalism in insurance policies. 34
2.3.2. Building on social inequalities 36
2.4. Conclusion 38
2.5. References 40

Chapter 3. Artificial Intelligence and Health: Description of the Ecosystem Required for an Effective Use of AI 43
Thomas LEFÈVRE

3.1. General data ecosystem for data mining and algorithm development. 43
3.1.1. An ecosystem for a digital "revolution". 43
3.1.2. Some preliminary socio-historical and technical elements. 45
3.1.3. A digital approach from the inside of health… 45
3.1.4. …and an external approach to health 48
3.1.5. The evolution of regulatory aspects 49
3.2. From data to the algorithm at present: the role of research 50
3.2.1. What kind of research is there for health-related AI nowadays?. 51
3.2.2. Beyond research, the integration of algorithms in the practitioner's environment 52
3.2.3. An intermediate case for integrating AI into the practitioner's environment: learning systems 54
3.2.4. Articulation between research and practice. 54
3.3. Examining the quality of reporting of health-related AI research and the readiness of these AI forms through two medical examples 56
3.3.1. Screening or "predicting" post-traumatic stress disorder with AI 56
3.3.2. AI to assist the medical examiner in investigation 58
3.4. Integration and appropriation of algorithms. 59
3.4.1. Technical integration of algorithms, microsocial integration: about appropriation 60
3.4.2. An example of algorithm integration and socio-technical evaluation: the Big Data Drop IT project. 62
3.4.3. The contribution of mixed methods and the interdisciplinary approach for the end-to-end development of an algorithm – the I-ADViSe project 65

3.5. The integration of AI in a broader ecosystem than the practitioner's immediate environment: questions and perspectives 66
3.5.1. The illusions of immediacy and the dematerialized 67
3.5.2. An opposite problem: what place for health professionals in an ecosystem conducive to the use of AI? 68
3.5.3. AI as a technical object above all and technology as the common denominator for all our social activities 68
3.6. References 69

Part 2. Artificial Intelligence at the Service of Healthcare 73

Chapter 4. Legal Liability of Companion Robots 75
Guilhem JULIA

4.1. Introduction 75
4.2. Common law liability 84
4.2.1. The result of human activity 84
4.2.2. Caused by the thing 91
4.3. Special liability regimes 96
4.3.1. Caused by road accidents 96
4.3.2. Caused by a defective product 98
4.4. Conclusion 105
4.5. References 106

Chapter 5. From Computer-assisted Surgery to AI-guided Surgery 109
Thomas GRÉGORY, Younès BENNANI and Charles DACHEUX

5.1. Computer-assisted surgery 109
5.2. Mixed reality, a computer-assisted surgery tool and a key element of AI-guided surgery 109
5.3. The concept of AI-guided surgery 113
5.4. Conclusion 115
5.5. References 115

Chapter 6. Detection of Anatomical Structures and Lesions in Hand Surgery Through the Use of Artificial Intelligence 119
Léo DÉCHAUMET, Younès BENNANI, Joseph KARKAZAN, Nosseiba BEN SALEM, Abir BARBARA, Charles DACHEUX and Thomas GRÉGORY

6.1. Introduction 119
6.2. Context 120
6.2.1. Object detection 120

6.2.2. Contrastive self-supervised learning . . . 121
6.3. Problem 1: anatomical structure and lesion detection . . . 122
6.3.1. Overview of the problem . . . 123
6.3.2. Modular approach . . . 124
6.3.3. Separate approach . . . 126
6.3.4. Evaluation method . . . 128
6.3.5. Results and opening . . . 129
6.4. Problem 2: endoscopic carpal tunnel release . . . 132
6.4.1. Classic approach to object detection . . . 132
6.4.2. Self-supervised learning approach . . . 135
6.4.3. Results . . . 138
6.5. Conclusion . . . 139
6.6. Appendices . . . 139
6.7. References . . . 145

Chapter 7. Surgical Diagnosis Augmented by Artificial Intelligence . . . 149
Nosseiba BEN SALEM, Younès BENNANI, Joseph KARKAZAN, Léo DÉCHAUMET, Abir BARBARA, Charles DACHEUX and Thomas GRÉGORY

7.1. Introduction . . . 150
7.2. Fundamental framework and state of the art . . . 151
7.3. Modular learning for classification . . . 153
7.3.1. Methodology . . . 153
7.3.2. Results . . . 157
7.4. Self-learning for data labeling and segmentation . . . 164
7.4.1. Methodology . . . 164
7.4.2. Results . . . 167
7.5. Conclusion . . . 170
7.6. References . . . 170

Conclusion . . . 173
Didier GUÉVEL

List of Authors . . . 181

Index . . . 183