

ALGORITHMS AND LAW

Algorithms permeate our lives in numerous ways, performing tasks that until recently could only be carried out by humans. Artificial Intelligence (AI) technologies, based on machine learning algorithms and big-data-powered systems, can perform sophisticated tasks such as driving cars, analyzing medical data, and evaluating and executing complex financial transactions – often without active human control or supervision. Algorithms also play an important role in determining retail pricing, online advertising, loan qualification, and airport security. In this work, Martin Ebers and Susana Navas bring together a group of scholars and practitioners from across Europe and the US to analyze how this shift from human actors to computers presents both practical and conceptual challenges for legal and regulatory systems. This book should be read by anyone interested in the intersection between computer science and law, how the law can better regulate algorithmic design, and the legal ramifications for citizens whose behavior is increasingly dictated by algorithms.

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Contents

<i>List of Figures and Tables</i>	<i>page</i> xi
<i>Notes on Contributors</i>	xiii
<i>Preface</i>	xvii
<i>Acknowledgments</i>	xxi
1 Robotics and Artificial Intelligence: The Present and Future Visions	1
<i>Sami Haddadin and Dennis Knobbe</i>	
1.1 Machine Intelligence: History in a Nutshell	1
1.1.1 Back to the Roots	1
1.1.2 The Modern Era of Robotics and AI	9
1.1.3 A Big Step Forward	13
1.2 Key Technologies in Modern Robotics and Artificial Intelligence	16
1.2.1 Trustworthy Artificial Intelligence	16
1.2.2 Safety in Physical Human–Robot Interaction	17
1.2.3 Robot Mechatronics As AI Embodiment	17
1.2.4 Multimodal Perception and Cognition	18
1.2.5 Navigation and Cognition	19
1.2.6 Modern Control Approaches in Robotics	20
1.2.7 Machine-Learning Algorithms	21
1.2.8 Learning in Intelligent and Networked Machines	24
1.3 Man and Machine in the Age of Machine Intelligence	25
1.3.1 Flying Robots	26
1.3.2 Mobile Ground Robots	27
1.3.3 Tactile Robots	27
1.4 Applications and Challenges of Robotics and AI Technologies	29
1.4.1 From Cleaning Robots to Service Humanoids	29
1.4.2 Production and Logistics	32
1.4.3 Robotic Disaster Relief	33

1.4.4	Multimodal Communication for AI-Enabled Telemedicine	34
1.4.5	The Future of Medicine with Molecular Robots	35
1.5	Conclusion	36
2	Regulating AI and Robotics: Ethical and Legal Challenges	37
	<i>Martin Ebers</i>	
2.1	Scenario	37
2.1.1	The Use of Algorithms by Businesses and Governments	37
2.1.2	Concepts and Definitions	40
2.1.3	Overview	44
2.2	The Problematic Characteristics of AI Systems from a Legal Perspective	44
2.2.1	Complexity and Connectivity	44
2.2.2	From Causation to Correlation	45
2.2.3	Autonomy	46
2.2.4	Algorithms As Black Boxes	48
2.3	Fundamental Questions	50
2.3.1	Replacement of Humans by Machines: To What Extent?	50
2.3.2	Brain–Computer Interfaces and Human Enhancement	52
2.4	Safety and Security Issues	53
2.4.1	Superintelligence As a Safety Risk?	53
2.4.2	Current Safety Risks	54
2.4.3	Security Risks Due to Malicious Use of AI	55
2.5	Accountability, Liability, and Insurance for Autonomous Systems	56
2.5.1	Emerging Questions	56
2.5.2	Overview of Opinions	57
2.5.3	Revising (Product) Liability Law in the European Union	57
2.5.4	A Specific Legal Status for AI and Robots?	60
2.6	Privacy, Data Protection, Data Ownership, and Access to Data	61
2.6.1	The Interplay between Data and Algorithms	61
2.6.2	Privacy, Data Protection, and AI Systems	62
2.6.3	Data Ownership v Data Access Rights	66
2.7	Algorithmic Manipulation and Discrimination of Citizens, Consumers, and Markets	70
2.7.1	Profiling, Targeting, Nudging, and Manipulation of Citizens and Consumers	71
2.7.2	Discrimination of Citizens and Consumers	76
2.7.3	Market Manipulation: The Case of Algorithmic Collusion	81
2.8	(International) Initiatives to Regulate AI and Robotics	83
2.8.1	Overview	83
2.8.2	European Union	86
2.8.3	International Organizations	89

2.8.4	Industry Initiatives and Self-Regulation at International Level	91
2.9	Governance of Algorithms: Regulatory Options	92
2.9.1	Should AI Systems and Robotics be Regulated by Ethics or Law?	92
2.9.2	General Regulation versus Sector-specific Regulation	93
2.9.3	Guiding Questions For Assessing the Need to Regulate	93
2.9.4	Level of Regulation: Global, International, National, or Regional?	94
2.9.5	Instruments for Modernizing the Current Legal Framework	95
2.9.6	A Plea for an Innovation-friendly Regulation	97
2.10	Outlook	98
3	Regulating Algorithms: How to Demystify the Alchemy of Code?	100
	<i>Mario Martini</i>	
3.1	Algorithms As Key to a Digital Cognitive World: Tomorrow's Leviathan?	100
3.2	Out of Control? Risk Potentials of AI As Prediction Machines	102
3.2.1	Opacity	102
3.2.2	Unlawful Discrimination As Ethical and Legal Challenge	104
3.2.3	Monopolization of Market Power and Knowledge: Influencing the Formation of Political Opinion	107
3.3	Regulatory steps and proposals for further legislative measures	108
3.3.1	Collective Data Protection As Part of Consumer Protection in the Digital World	109
3.3.2	Preventive Regulatory Instruments	112
3.3.3	Accompanying Risk Management and Supervision by Public Authorities	125
3.3.4	Ex-post Protection	128
3.3.5	Self-Regulation: Algorithmic Responsibility Code with a Declaration of Conformity	132
3.4	Conclusion	134
4	Automated Decision-Making under Article 22 GDPR: Towards a More Substantial Regime for Solely Automated Decision-Making	136
	<i>Diana Sancho</i>	
4.1	Algorithms and Decision-Making	136
4.2	Automated Processing, Profiling, and Automated Decision-Making	138
4.2.1	A Dynamic Process	138
4.2.2	The Procedural Design of Article 22	140
4.3	Which Decisions?	141
4.3.1	Classification	141

4.3.2	Analysis	142
4.4	The Right to Human Intervention and Article 22	147
4.4.1	Prohibition	147
4.4.2	Right	148
4.4.3	Derogations	148
4.4.4	The WP29 Guidelines	149
4.5	The Right to an Explanation and Article 22	150
4.6	Conclusion	155
5	Robot Machines and Civil Liability	157
	<i>Susana Navas</i>	
5.1	Robot Machines and Virtual Robots	157
5.1.1	Broad Notion of a Robot	158
5.1.2	Strict Notion of a Robot	160
5.1.3	European Notion of a Robot	162
5.2	Robots from a Legal Perspective	162
5.2.1	Current Legal Framework	162
5.2.2	Regulation of the Design and Production of Robot Machines	163
5.3	The Liability of the Owner of a Robot: Some Reflections	165
5.4	The Producer's Liability for Damage Caused by a Robot Machine: Review	166
5.4.1	Robot Machines As Products	167
5.4.2	Types of Defects	168
5.4.3	Notion of Producer: The 'Market Share Liability' Rule	169
5.4.4	The Consumer Expectations Test	171
5.4.5	Inclusion of Non-pecuniary Damages	172
5.5	Conclusions	173
6	Extra-Contractual Liability for Wrongs Committed by Autonomous Systems	174
	<i>Ruth Janal</i>	
6.1	Damage Wrought by Autonomous Systems	174
6.1.1	Robots As Legal Persons	175
6.1.2	The Players Involved in Autonomous Systems	176
6.1.3	Existing Liability Regimes	177
6.2	Traditional Concepts of Liability	178
6.2.1	Fault-Based Liability	178
6.2.2	Liability for Things	180
6.2.3	Liability for Employees and Other Assistants	185
6.2.4	Liability for Minors	188

6.3	Perspective: Liability for Autonomous Systems	190
6.3.1	How to Define ‘Wrong’ in the Context of Autonomous Systems	190
6.3.2	User of the Autonomous System	193
6.3.3	Keeper of the Autonomous System	194
6.3.4	The Operator’s Liability	202
6.4	No-Fault Compensation Schemes	205
6.5	Conclusion	205
7	Control of Algorithms in Financial Markets: The Example of High-Frequency Trading <i>Gerald Spindler</i>	207
7.1	Algorithms and Financial Markets	207
7.2	Control of Algorithms: High-Frequency Trading As a Blueprint for Regulation?	209
7.3	Risks and Impact of High-Frequency Trading on Markets	209
7.4	The German High-Frequency Trading Act	210
7.5	Regulation on the European Level	213
7.5.1	MiFID II	213
7.5.2	Delegated Act: The Regulation of the European Union	216
7.6	Outlook: High-Frequency Trading As a Blueprint?	219
8	Creativity of Algorithms and Copyright Law <i>Susana Navas</i>	221
8.1	Creativity	221
8.1.1	Definition: Types of Creativity	221
8.1.2	The Relationship between Creativity and Algorithms	223
8.1.3	Categories of Computational Art	225
8.2	Creation by Algorithms and Copyright	226
8.2.1	A Work Produced by an Algorithm as an Original ‘Work’	227
8.2.2	Authorship: Ownership and Exercise of Rights	230
8.3	Conclusion: Challenges for Copyright	232
9	“Wake Neutrality” of Artificial Intelligence Devices <i>Brian Subirana, Renwick Bivings, and Sanjay Sarma</i>	235
9.1	Wake Neutrality and Artificial Intelligence	235
9.1.1	Product and Name Wake Neutrality of Smart Speakers	236
9.1.2	Intelligence Wake Neutrality of Smart Speakers	237
9.1.3	Wake Neutrality Legal Compliance: Open versus Closed Approaches	238
9.1.4	A Voice Name System for Wake Neutrality	242

9.2	Six Requirements for Wake Neutrality of AI Devices in OCC	242
9.2.1	Requirements to Achieve Wake Neutrality	243
9.2.2	Requirements to Enforce Wake Neutrality	246
9.3	Net Neutrality and Wake Neutrality	247
9.4	Legal Programming Enablers of Wake Neutrality	252
9.5	Balancing Wake Neutrality with Automated Contracting	255
9.6	Implications of Wake Neutrality for the AI Architecture Stack	259
9.6.1	Wake Neutrality and the Sensor Stream	259
9.6.2	Wake Neutrality and the Cognitive Core	260
9.6.3	Wake Neutrality and the Brain Operating System	263
9.6.4	Wake Neutrality and the Expression Layer	266
9.7	Conclusion and Future Research	267
10	The (Envisaged) Legal Framework for Commercialisation of Digital Data within the EU: Data Protection Law and Data Economic Law As a Conflicted Basis for Algorithm-Based Products and Services	269
	<i>Björn Steinrötter</i>	
10.1	The Link between Data and Algorithms	269
10.2	Definition of Digital Data	271
10.3	Data Economic Law	272
10.3.1	Brief Description and Rationale	272
10.3.2	The Free Flow of Data Initiative of the European Commission	274
10.3.3	Non-personal Data Contract Law	287
10.4	Data Protection Law	289
10.4.1	Brief Description and Rationale	289
10.4.2	Personal Data Movement and Trading	289
10.4.3	Personal Data Ownership/Property in Personal Data?	292
10.4.4	Personal Data Contract Law	293
10.5	Conflicts	294
10.6	Alternatives	295
10.7	Conclusions	296

List of Figures and Tables

FIGURES

1.1 Overview of available mobile robotic systems	<i>page</i> 28
1.2 Overview of existing and upcoming service-oriented humanoid systems	31
1.3 Telemedicine case scenario	35

TABLES

9.1 Six legal requirements to achieve and enforce wake neutrality	243
9.2 Legal risks of AI agent-contracting processes	258

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Preface

ALGORITHMS AND LAW

Algorithms come in many different shapes and forms, ranging from software systems (e.g., data-mining programs, medical diagnosis systems, price algorithms, and expert trading systems) to embodied robots (e.g., self-driving cars, unmanned underwater vehicles, surgical robots, drones, and personal and social robots) and open-source machine-learning systems.¹ The increased use of these intelligent systems is changing our lives, society, and economy – while at the same time challenging the traditional boundaries of law. Algorithms are widely employed to make decisions which have increasingly far-reaching impacts on individuals and society, potentially leading to manipulation, biases, censorship, social discrimination, violations of privacy, property rights, and more.

This has sparked a global debate on how to regulate AI and robotics. Although many countries and sometimes also international/intergovernmental organizations have laws, rules, and norms that are relevant to AI and robotics, most of this legislation was not made with AI and smart robotics in mind. Accordingly, it is difficult to gauge the extent to which existing legislation adequately regulates the negative implications of intelligent machines. Since the beginning of 2017, many governments across the world have begun to develop national strategies for the promotion, development, and use of AI systems. The European Union, the United Nations, the OECD, and many other international organizations have also developed AI strategies, sometimes even with concrete suggestions of how to regulate AI and smart robotics in the future.

¹ For definitions of the terms “algorithms”, “artificial intelligence”, “robotics”, “machine learning”, etc., used in this volume, see 1.2.1, 1.2.3 and 2.1.2.

In this volume, German and Spanish scholars have collaborated to study the practical and legal implications that algorithms present for individuals, society, and political and economic systems – discussing the various policy options for future regulation and ethical codes.

CONTENT OF THIS VOLUME

In Chapter 1, *Sami Haddadin* and *Dennis Knobbe* provide a short history of intelligent machines and an overview of the present state of robotics and AI, discussing current research directions, outlining major technological challenges, and depicting the future of man and machine that is yet to be built. The authors point out that the large gap between the algorithmic and physical worlds leaves existing systems still far from the vision of intelligent and human-friendly robots capable of interacting with and manipulating our human-centered world. Against this backdrop, Haddadin and Knobbe look into the emerging discipline of machine intelligence which could provide a new holistic paradigm to address this issue, in particular by reunifying perception (sensing), AI (planning), and robotics (acting) with the pervasive roles of control and machine learning that are crucial if these intelligent systems are to become reality in our daily lives.

In Chapter 2, *Martin Ebers* outlines the most urgent ethical and legal issues raised by the use of self-learning algorithms, providing an overview of several key initiatives at the international and European levels on AI ethics and regulation. In the author's opinion, policy makers should avoid premature, innovation-inhibiting regulation. As there is no one-size-fits-all solution, the chapter underlines that the need for new rules should be evaluated for each sector and for every application separately, considering the respective risks and legal interests involved, in order to find the right balance between keeping up with the pace of change and protecting people from the harm posed by AI and robotic systems. At the same time a regulatory environment needs to be created that avoids over-regulation but allows for innovation and further development.

In Chapter 3, *Mario Martini* addresses the question “How to Demystify the Alchemy of Code” by looking at three specific legal issues: the opacity of machine-learning systems; unlawful discrimination; and monopolization of market power and knowledge. The author examines existing and potentially adaptable legal solutions and complements them with further proposals. The chapter designs a regulatory model in four steps along the time axis: preventive regulation instruments, accompanying risk management, ex post facto protection, and the vision of an algorithmic responsibility code. According to the author, these elements should form the legislative blueprint to regulate applications of artificial intelligence.

In Chapter 4, *Diana Sancho* focuses on one of the most important provisions for the algorithmic society we have so far, namely Article 22 of the European General Data Protection Regulation. The author shows that the European Union is a pioneer

in regulating automated (algorithmic) decision-making by setting not only formal but also substantial standards, endorsing a non-strict concept of “solely” automated decisions; explicitly recognizing the need for enhanced protection of vulnerable adults and children; linking the much discussed data subject’s right to an explanation to the right to challenge automated decisions; and interpreting Article 22(1) as a “general prohibition”. This development represents, according to Sancho, an important step towards the development of a more mature and sophisticated regime for automated decision-making that is committed to helping individuals retain adequate levels of autonomy and control in decision-making, whilst meeting the technology and innovation demands of the data-driven society.

Chapters 5 and 6 deal with one of the most important questions raised by autonomous systems: whether and how traditional concepts and the provisions of current legal regimes (e.g., regarding negligence or strict liability) can apply in the context of emerging autonomous systems, or whether we need new rules. *Susana Navas* (Chapter 5) and *Ruth Janal* (Chapter 6) expose the key issues, dealing with (extra-)contractual liability of users, keepers, and operators for wrongs committed by autonomous systems. Both authors explore how the concept of “wrong” can be defined with respect to autonomous systems and what standard of care can reasonably be expected of them. Further, the contributions look at existing accountability rules for things and people in various legal orders and explain how these rules can be applied to autonomous systems.

In addition, *Gerald Spindler* analyses in Chapter 7 the control of algorithms in financial markets, especially in the case of high-frequency trading. High-frequency trading has become an important factor in financial markets and is one of the first areas in algorithmic trading to be intensely regulated. Against this background, the author gives an overview of the EU approach to regulating algorithmic trading and considers whether this regime (with its pre- and post-trade controls, and real-time monitoring) could be taken as a blueprint for other regulations on algorithms.

In Chapter 8, *Susana Navas* deals with the creativity of algorithms and copyright law. The author discusses the possible emulation of human creativity by various models of artificial intelligence systems. As the degree of originality of creations using algorithms may surprise even human beings themselves, the author makes the case for copyright protection of the “works” created by autonomous systems, especially taking into account the fundamental contributions of computer science researchers on the one hand and, on the other, the investment in human and economic resources that is required to obtain these “works”. The author does not only question traditional categories in the field of IP rights but also suggests how the law could approach “computational creativity”.

In Chapter 9, *Brian Subirana*, *Renwick Bivings* and *Sanjay Sarma* focus on voice-recognition systems and smart speakers in the context of conversational commerce, and especially on the regulatory options for standardizing the initial steps of the human-to-machine interaction. According to the authors, voice is complicated to

regulate because it is ambiguous; it is neither race nor gender neutral because it reveals significant amounts of information about the person through its tone, choice of words and semantic constructs. Given the design choices for these new powerful AI technologies, the chapter examines how to algorithmically enforce neutrality in the behavior of such technologies. It concludes with a discussion of possible standards to establish an “emotional firewall”.

In the book’s final Chapter 10, *Björn Steinrötter* analyses the legal framework of (training) data. The chapter highlights that the European Union is facing considerable challenges in this regard, because it wants to promote both a high level of data protection (GDPR) and at the same time a free flow of data (data economic law). In light of these considerations, the author assesses the status quo of legislation (initiatives) and legal discussions at the European level.

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