Contents

Illustrations vii
Tables viii
Preface ix

Chapter 1: Introduction 1

Chapter 2: The emergence of the spatial sciences as a new and integrative field 7
2.1 The formation and elaboration of the spatial sciences 7
2.2 The fusion of theory, practice, and technology 15
2.3 The rapid growth and elaboration of the spatial sciences community 29
2.4 Syncing science and the technology platforms 33

Chapter 3: Cloud computing, big data, data science, and open science in the digital era 39
3.1 Cloud computing 40
3.2 Big data 42
3.3 Data science 44
3.4 Open science 46
3.5 Implications for the spatial sciences 50

Chapter 4: Geospatial big data 53
4.1 Location-based devices and services 54
4.2 Volunteered and ambient geographic information 56
4.3 Remote sensing 61
4.3.1 In situ sensing 61
4.3.2 Traditional satellite and high-altitude airborne remote sensing systems 62
4.3.3 Nanosatellites 69
4.3.4 Street-level imagery 70
4.3.5 Unoccupied aerial systems 71
4.4 Sensor networks and the Internet of Things 73
4.5 3D modeling, video, and augmented and virtual reality systems 76
4.5.1 Digital twins and building information models 78
4.5.2 3D city models 80
4.5.3 Spatial video 82
4.5.4 Virtual and augmented reality 85
4.6 Syncing science and geospatial big data 88

Copyright © 2024 Esri. All rights reserved.

Chapter 5: The Esri geospatial cloud 91
5.1 Geospatial knowledge discovery 91
5.2 ArcGIS as an open platform 95
5.3 ArcGIS and interoperability 97
5.4 Scenarios and patterns 99
5.4.1 Enabling location intelligence across an organization 100
5.4.2 Operationalizing spatial data science 101
5.4.2.1 Working with real-time data 101
5.4.2.2 Working with big vector and tabular data 103
5.4.2.3 Working with big image and raster data 106
5.4.2.4 Working with artificial intelligence, machine learning, and deep learning methods 113
5.4.3 Supporting national data standards using industry and open standards 127
5.5 Enabling 3D across ArcGIS 129
5.6 Moving ArcGIS indoors 131
5.7 Using knowledge graphs in ArcGIS 132
5.8 Deploying ArcGIS on Kubernetes 134
5.9 Syncing science and the enabling technologies 134

Chapter 6: Conclusions and future prospects 139
6.1 Adopting and using the latest advances in computing 141
6.2 Adopting and using new data streams 141
6.3 Adopting and using the latest spatial methods 143
6.4 The role of geodesign and spatial methods in analysis, modeling, prediction, and decision-making 150

Abbreviations 153
References 161
Index 199

Copyright © 2024 Esri. All rights reserved.