



Table of Contents

PART I - Introduction to Analytics and AI	1
1 Introduction to Business Analytics and AI	6
1.1 Business Analytics	6
1.1.1 Types of Business Analytics	7
1.1.2 Challenges to Business Analytics	8
1.1.3 How Business Analytics Work	9
1.1.4 Applications of Business Analytics	10
1.1.5 Business Analytics vs Data Science	10
1.2 Decision Support Systems (DSS)	11
1.2.1 Development Framework	13
1.2.2 Applications of Decision Support Systems	15
1.3 Business Intelligence	15

1.3.1	Business Intelligence vs Competitive Intelligence	17
1.3.2	Data	17
1.3.3	Applications of Business Intelligence	18
1.4	Data Science	19
1.4.1	Data Science vs Business Intelligence	22
1.4.2	Lifecycle of Data Science	23
1.5	Artificial Intelligence	24
1.5.1	Applications of AI	27
1.6	References	28
2	Artificial Intelligence: Concepts, Drivers, Major Technologies and Business Applications	34
2.1	Introduction	34
2.2	Concept behind Artificial Intelligence	35
2.3	Drivers to the Development of Artificial Intelligence	38
2.4	Major Technologies which are prevalent in Artificial Intelligence	41
2.4.1	Decision Management	41
2.4.2	Generation of Natural Language	41
2.4.3	Optimized Hardware	42
2.4.4	Biometrics	42
2.4.5	Analysis of Text	43
2.4.6	Automation by Robotic Processes	43
2.4.7	Virtual Agents	44
2.5	Major Business Applications of Artificial Intelligence	45
2.5.1	Fraud Detection in Banking and Finance	45
2.5.2	Customer Support	45
2.5.3	Security	46
2.5.4	Human Resource Management	47
2.5.5	Forecasting Market Behaviour	47
2.5.6	Improved System Processes	48
2.5.7	Hazardous Business Operations	48
2.6	References	48
3	Nature of Data, Statistical Modeling, and Visualization	50
3.1	Nature of Data	50
3.1.1	Introduction	50
3.2	Statistical Modeling	54

3.2.1	Introduction	54
3.2.2	Statistical Model Specification	55
3.2.3	Formal Definition and Dimensions of the Model	56
3.2.4	Statistical Inference	57
3.2.5	Statistical Hypothesis Testing	57
3.2.6	Statistical Model Validation	58
3.3	Visualization	59
3.3.1	Introduction	59
3.3.2	Uses of Data Visualization	59
3.3.3	Tools and Common Types of Data Visualization	60
3.4	References	62
PART II-Predictive Analytics and Machine Learning		64
4	Data Mining Process, Methods, and Applications	67
4.1	Introduction	67
4.1.1	Data from Databases	68
4.1.2	Data Warehouse	69
4.1.3	Transactional Data	69
4.1.4	Others	69
4.2	Data Mining Models and Tasks	69
4.2.1	Data Mining Tasks	69
4.2.2	Data Mining Models	70
4.2.3	Data Mining Techniques	71
4.3	Data Mining Process	76
4.3.1	Business Understanding	76
4.3.2	Data Understanding	77
4.3.3	Data Preparation	78
4.3.4	Modeling	78
4.3.5	Evaluation of the Model	79
4.3.6	Plan Deployment	80
4.4	Issues in Data Mining	80
4.4.1	Mining Various Kinds of Knowledge	81
4.4.2	User Interaction	82
4.4.3	Efficiency and Scalability	83
4.5	Applications of Data Mining	83
4.6	References	85

5	Machine Learning Techniques for Predictive Analytics	88
5.1	Machine Learning	88
5.2	Predictive Analytics	89
5.3	Working Pattern of Machine Learning	90
5.4	Machine Learning in Daily Life	91
5.5	Some Machine Learning Methods	92
5.5.1	Supervised Machine Learning Algorithms	92
5.5.2	Unsupervised Machine Learning Algorithms	92
5.5.3	Semi-supervised Machine Learning Algorithms	92
5.5.4	Reinforcement Machine Learning Algorithms	93
5.6	Requirements for Creating Good Machine Learning Systems	93
5.7	Tools used in Machine Learning	94
5.7.1	Scikit-learn	94
5.7.2	PyTorch	95
5.7.3	TensorFlow	95
5.7.4	Weka	95
5.7.5	KNIME	96
5.7.6	Colab	96
5.7.7	Apache Mahout	96
5.7.8	Accord.Net	96
5.7.9	Shogun	97
5.7.10	Keras.io	97
5.8	Branches of Machine Learning	98
5.8.1	Computational Learning Theory	98
5.8.2	Adversarial Machine Learning	98
5.8.3	Quantum Machine Learning	98
5.8.4	Predictive Analysis	98
5.8.5	Robot Learning	98
5.8.6	Grammar Induction	99
5.8.7	Meta-learning	99
5.9	Comparison	99
5.9.1	Machine Learning vs AI	99
5.9.2	Machine Learning vs Deep Learning	100
5.10	Predictive Analytics Tools	101
5.11	Predictive Analytics Models	101
5.12	Machine Learning and Predictive Analytics	102
5.13	Relation between Machine Learning and Predictive Analytics	102

5.14	5Application of Machine Learning	103
5.14.1	Genomics	103
5.14.2	Proteomics	103
5.14.3	Microarrays	103
5.14.4	System Biology	103
5.14.5	Text Mining	103
5.14.6	Web Search Engine	104
5.14.7	Photo Tagging Applications	104
5.14.8	Spam Detector	104
5.15	Application of Predictive Analytics	104
5.15.1	Price Prediction	104
5.15.2	Dosage Prediction	104
5.15.3	Document Classification	105
5.15.4	Diagnosis	105
5.16	Application of Machine Learning and Predictive Analytics	105
5.16.1	Banking and Financial Services	105
5.16.2	Security	105
5.16.3	Retail	105
5.17	References	106
6	Brief about Deep Learning and Cognitive Computing	108
6.1	Deep Learning	108
6.2	History of Deep Learning	109
6.3	Importance of Deep Learning	110
6.4	Models of Deep Learning	110
6.4.1	DBN (Deep Belief Network)	111
6.4.2	BM (Boltzmann Machine)	112
6.4.3	RBM (Restricted Boltzmann machine)	112
6.4.4	DNN(Deep Neural Network)	113
6.5	Algorithm	113
6.6	Classes of Deep Learning	113
6.6.1	Deep Networks for Unsupervised or Generative Learning	114
6.6.2	Deep Networks for Supervised Learning	114
6.6.3	Hybrid Deep Networks	114
6.7	Neural Network	115
6.7.1	ANN (Artificial Neural Networks) and Deep Learning	115
6.7.2	Feed-forward Neural Network	115

6.8	Applications of Deep Learning	117
6.9	Introduction to Cognitive Computing	119
6.10	Cognitive Computing	120
6.10.1	Computer Vision	120
6.11	Cognitive Analytics	121
6.12	Cognitive Models	122
6.13	Features of Cognitive Computing	123
6.14	Tools for Cognitive Systems Design	124
6.15	Cognitive Computing and AI	125
6.16	Advantages of Cognitive Computing	125
6.17	Application of Cognitive Computing	126
6.18	References	127
7	Everything about Text Mining, Sentiment Analysis, and Social Analytics	130
7.1	Introduction to Text mining	130
7.2	Text Mining Process	131
7.3	Text Mining Applications	134
7.3.1	Domains of Text Mining	135
7.4	Introduction to Sentiment Analysis	136
7.4.1	Types of Sentiment Analysis	137
7.4.2	Sentiment Analysis Approaches	139
7.4.3	Sentiment Analysis Metrics and Evaluation	140
7.4.4	Sentiment Analysis Challenges	141
7.4.5	Sentiment Analysis Applications	142
7.5	Social Media Analytics	143
7.5.1	Types of Social Media Analytics	144
7.6	Role in Business Intelligence	145
7.7	References	145
	PART III - Prescriptive Analytics and Big Data	149
8	Prescriptive Analysis with Optimization and Simulation	153
8.1	Introduction	153
8.2	Introduction to Prescriptive Analysis	155
8.3	Using Prescriptive Analysis with Optimization Techniques	158
8.4	Enhancing the Effect of Prescriptive Analysis using Simulation	161
8.5	References	163

9	Brief about Big Data, Location Analytics, and Cloud Computing	165
9.1	Big Data	165
9.1.1	Volume	169
9.1.2	Variety	169
9.1.3	Veracity	170
9.1.4	Velocity	170
9.1.5	Value	170
9.2	Location Analytics	171
9.2.1	Ground Truth	173
9.2.2	Placer.ai	173
9.2.3	ShopperTrak	173
9.2.4	RetailNext	174
9.2.5	CountBOX	174
9.2.6	RetailFlux	174
9.2.7	Dor	174
9.3	Cloud Computing	175
9.3.1	Three Models of Cloud Computing	177
9.4	References	181
PART IV - Everything about Robotics, Social Networks, AI, & IoT		183
10	Robotics: Industrial and Consumer Applications	188
10.1	Introduction	188
10.2	Industrial Applications of Robotics	190
10.2.1	Material Handling Applications	192
10.2.2	Processing Operations	193
10.2.3	Assembly Applications	197
10.2.4	Inspection Operations	198
10.3	Consumer Application of Robotics	199
10.3.1	Healthcare Assisting Robotics Applications	199
10.3.2	Education Applications of Robotics	200
10.3.3	Personal Task Assistance Applications	201
10.3.4	Consumer Goods Applications of Robotics	203
10.3.5	Tax Automation Application	206
10.4	References	207

11 Brief about Group Decision Making, Collaborative Systems, and AI Support	210
11.1 Group Decision Making	210
11.2 Group vs Individual Decision Making	211
11.3 Techniques of the Effective Group Decision-making Process	212
11.4 Important Tools for a Successful Decision Process	217
11.5 Collaboration System	218
11.5.1 History of Collaborative System	218
11.5.2 What is the Collaboration System?	219
11.5.3 Circumstances of Collaborative System	221
11.6 Different Collaborations for Different Corporate Cultures	222
11.6.1 Positive Phases to Structured Collaboration	222
11.6.2 Weaknesses to Structured Collaboration	223
11.7 How to Maintain a Collaborative System?	223
11.7.1 Power Distribution	223
11.7.2 Relationships	223
11.7.3 Value	224
11.7.4 Preparing a Collaborative System	224
11.8 Artificial Intelligence History	224
11.9 Importance of Artificial Intelligence	225
11.10 Use of Artificial Intelligence	226
11.10.1 In Health Care	227
11.10.2 In Retail	227
11.10.3 In Manufacturing	227
11.10.4 In Banking	227
11.11 How to Work with Artificial Intelligence?	228
11.11.1 Which way Artificial Intelligence works	228
11.12 Various Technologies that Allow and Help AI	229
11.13 In Today's World, What is AI?	230
11.14 References	230
12 Everything about Knowledge Systems: Expert Systems, Recommenders, Chatbots, Virtual Personal Assistants, and Robo Advisors	232
12.1 What is Knowledge Systems?	232
12.1.1 Knowledgebase	234
12.1.2 Inference Engine	234

12.1.3	The Advantages of Knowledge Systems	235
12.2	Expert System (Skilled Systems)	238
12.2.1	Definition	238
12.2.2	Characteristics of Expert Systems	240
12.2.3	Capabilities of an Expert System	240
12.2.4	Necessities of Economical Einsteinium User Interface	241
12.2.5	Applications of Expert Systems	242
12.2.6	Advantages of Expert Systems	242
12.2.7	Disadvantages of Expert Systems	243
12.2.8	Few Example Cases wherever a Skilled System is often Designed	243
12.2.9	Benefits of Skilled Systems	244
12.3	Recommenders	244
12.3.1	What are Recommenders?	244
12.3.2	Hybrid Systems	245
12.3.3	Evaluation of Recommenders	245
12.3.4	Domains	245
12.3.5	Conversable Recommendation	245
12.4	Chatbots	246
12.4.1	ELIZA	246
12.4.2	Development of Chatbots	246
12.4.3	Limitations of Chatbots	247
12.5	Virtual Personal Assistants	247
12.5.1	Presence of Virtual Personal Assistants	249
12.5.2	Services	249
12.5.3	Security Concerns	250
12.6	Robo Advisors	250
12.6.1	Working of Robo Advisors	250
12.6.2	Benefits of using a Robo Advisor	251
12.7	References	252
13	Using IoT as a Platform for Intelligent Applications	255
13.1	Introduction	255
13.2	Internet of Things (IoT)	256
13.2.1	Need for IoT	257
13.2.2	Applications of IoT	257
13.2.3	Future Scope of IoT	258

13.3	Intelligent Applications	258
13.3.1	Categories	259
13.4	Use of IoT in Intelligent Applications	262
13.4.1	IoT in Everyday Life	262
13.4.2	IoT in Healthcare	263
13.4.3	IoT in Smart cities	265
13.4.4	IoT in Agriculture	267
13.4.5	IoT in Industrial Automation	268
13.4.6	Role of IoT in Disaster Management	269
13.4.7	IoT in Security	270
13.5	Challenges in Building IoT Applications	270
13.6	References	271

PART V - Caveats of Analytics and AI 274

14 Implementation Issues: From Ethics and Privacy to Organizational and Societal Impact 276

14.1	Ethical Issues	276
14.1.1	Reinforcing Biases	277
14.1.2	Evil Slaves	278
14.1.3	Accountability	278
14.1.4	Currency	279
14.1.5	Robotics in Warfare	279
14.1.6	Robotics in Healthcare	279
14.1.7	Digital Divide	279
14.2	Privacy Issues	279
14.2.1	Randomization Methods	281
14.2.2	The k-anonymity and l-diversity Methods	281
14.2.3	Distributed Privacy Preservation	282
14.2.4	Downgrading the Effectiveness of Data Mining Results	282
14.3	Differential Privacy	282
14.3.1	Ownership of Data	282
14.3.2	Transaction of Data	283
14.3.3	Consent	283
14.4	Organizational Impact	285
14.5	Societal Impacts	288
14.5.1	Singularity	289

Table of Contents	xvii
14.5.2 Impact on Humanity	289
14.5.3 Political Impact	290
14.5.4 Robot Rights	290
14.5.5 Environmental Concerns	291
14.6 Summary	291
14.7 References	291
Appendix A: Abbreviations	294
Appendix B: Figures	298
Appendix C: Graphs & Tables	303
Graphs	303
Tables	303
Index	304