## **Table of Contents**

Pretace	<b>v</b>
Chapter 1: First Steps	1
Introducing data science and Python	2
Installing Python	3
Python 2 or Python 3?	3
Step-by-step installation	4
A glance at the essential Python packages	5
NumPy	5
SciPy )	6
pandas )	6 6 6
Scikit-learn	
IPython <mark>Matplotlib</mark>	7 <mark>7</mark> 8
Statsmodels	7 8
Beautiful Soup	8
NetworkX	8
NLTK	9
Gensim	9
PyPy	9
The installation of packages	( <mark>10</mark> )
Package upgrades	<mark>11</mark>
Scientific distributions	<b>12</b>
Anaconda	12
Enthought Canopy	13
PythonXY	13
WinPython	13
Introducing IPython	13
The IPython Notebook	15

Datasets and code used in the book	22
Scikit-learn toy datasets	22
The MLdata.org public repository	26
LIBSVM data examples  Loading data directly from CSV or text files	26 <mark>27</mark>
Scikit-learn sample generators	30
Summary	31
Chapter 2: Data Munging	33
The data science process	34
Data loading and preprocessing with pandas	35
Fast and easy data loading	35
Dealing with problematic data	38
Dealing with big datasets	41
Accessing other data formats	45
Data preprocessing	47 47
Data selection	49
Working with categorical and textual data	52
A special type of data text	54
Data processing with NumPy	60
NumPy's n-dimensional array	61
The basics of NumPy ndarray objects	62
Creating NumPy arrays	63
From lists to unidimensional arrays	63
Controlling the memory size	64
Heterogeneous lists	65
From lists to multidimensional arrays	66
Resizing arrays	68
Arrays derived from NumPy functions	69
Getting an array directly from a file	71
Extracting data from pandas	71
NumPy fast operation and computations	72
Matrix operations	75
Slicing and indexing with NumPy arrays	76
Stacking NumPy arrays	79
Summary	81
Chapter 3: The Data Science Pipeline	83
Introducing EDA	83
Feature creation	87
	90
Dimensionality reduction The covariance matrix	90
	90
Principal Component Analysis (PCA)	91

	Table of Contents
A variation of PCA for big data-randomized PCA	95
Latent Factor Analysis (LFA)	96
Linear Discriminant Analysis (LDA)	97
Latent Semantical Analysis (LSA)	97
Independent Component Analysis (ICA)	98
Kernel PCA	99
Restricted Boltzmann Machine (RBM)	100
The detection and treatment of outliers	102
Univariate outlier detection	103
EllipticEnvelope	105
OneClassSVM	110
Scoring functions	114
Multilabel classification	114
Binary classification	116 117
Regression	117
Testing and validating  Cross-validation	123
Using cross-validation iterators	125
Sampling and bootstrapping	127
Hyper-parameters' optimization	129
Building custom scoring functions	123 132
Reducing the grid search runtime	135
Feature selection	136
Univariate selection	137
Recursive elimination	139
Stability and L1-based selection	140
Summary	142
Chapter 4: Machine Learning	143
Linear and logistic regression	143
Naive Bayes	147
The k-Nearest Neighbors	<b>150</b>
Advanced nonlinear algorithms	<b>152</b>
SVM for classification	<mark>152</mark>
SVM for regression	( <mark>155</mark> )
Tuning SVM	156
Ensemble strategies	158
Pasting by random samples	158
Bagging with weak ensembles	(159)
Random Subspaces and Random Patches	160
Sequences of models – AdaBoost	<mark>162</mark>

Gradient tree boosting (GTB)	<mark>162</mark>
Dealing with big data	163
Creating some big datasets as examples	164
Scalability with volume	165
Keeping up with velocity Dealing with variety	167 169
A quick overview of Stochastic Gradient Descent (SGD)	171
A peek into Natural Language Processing (NLP)	172
Word tokenization	173
Stemming	174
Word Tagging	174
Named Entity Recognition (NER)	175
Stopwords	176
A complete data science example – text classification	177
An overview of unsupervised learning	179
Summary	184
Chapter 5: Social Network Analysis	187
Introduction to graph theory	187
Graph algorithms	192
Graph loading, dumping, and sampling	199
Summary	203
Chapter 6: Visualization	205
Introducing the basics of matplotlib	205
Curve plotting	206
Using panels	208
Scatterplots	209
Histograms	210
Bar graphs	212
Image visualization	213
Selected graphical examples with pandas	215
Boxplots and histograms	216
Scatterplots	218
Parallel coordinates	221
Advanced data learning representation	221
Learning curves	222
Validation curves	224
Feature importance	225
GBT partial dependence plot	227
Summary	228
Index	231