

Contents

- 1 Introduction** 1
 - 1.1 Pervasive Computing—Past, Present, and Future 2
 - 1.2 Pervasive Computing Systems 6
 - 1.3 About This Book 9
 - 1.4 Exercises 13
 - References. 13
- 2 Signals** 15
 - 2.1 Signals in the Wild. 15
 - 2.1.1 One-Dimensional Continuous Time Signals 15
 - 2.1.2 Two-Dimensional Continuous Signals. 19
 - 2.2 Signals in the Cage. 20
 - 2.2.1 One-Dimensional Digital Signals 20
 - 2.2.2 Two-Dimensional Digital Signals 25
 - 2.3 Conclusions 28
 - 2.4 Exercises 29
 - References. 30
- 3 Control Systems.** 31
 - 3.1 A Case Study: Computer-Based Navigation Systems 32
 - 3.2 A Case Study: Smart Homes 36
 - 3.2.1 Let us Build Some Smart Curtains 36
 - 3.2.2 Efficient House Heating 43
 - 3.3 A Case Study: Autonomous Vehicles. 45
 - 3.3.1 Obstacle Detection 45
 - 3.3.2 Let us Follow a Line. 48
 - 3.3.3 Follow that Wall! 50
 - 3.4 Conclusions 51
 - 3.5 Exercises 52
 - References. 53

4	Image Processing	55
4.1	Point Processing	56
4.2	Neighborhood Processing	60
4.2.1	Filtering	60
4.2.2	Correlation	63
4.3	Morphological Operations	65
4.4	Let us Count Objects!	70
4.5	Conclusions	72
4.6	Exercises	73
	References	73
5	Sound Processing	75
5.1	Frequency Spectrum Analysis	76
5.2	The Frequency Spectrum of a Periodic Signal	77
5.3	The Frequency Spectrum of a Non-periodic Signal	83
5.4	Dealing with Noise	85
5.4.1	Digital Filters	85
5.4.2	Filtering in Time Domain	86
5.4.3	Filtering in Frequency Domain	87
5.5	Conclusions	90
5.6	Exercises	90
	References	91
6	Classification	93
6.1	The Classification Problem	94
6.2	Typical Features for Image Classification	98
6.2.1	Single-Parameter Shape Descriptors	98
6.2.2	Statistical Image Moments	100
6.2.3	Zoning	101
6.3	Typical Features for Sound Classification	102
6.3.1	The Frequency Spectrum	104
6.3.2	Spectrograms	104
6.3.3	Mel-Frequency Cepstral Coefficients (MFCC)	105
6.4	Classification Algorithms	107
6.4.1	Rule-Based and Decision Tree Classifiers	107
6.4.2	Template Matching	109
6.4.3	Neural Network (NN) Classifiers	111
6.4.4	Probabilistic Classifiers	115
6.4.5	Classification Performance Measurement	122
6.5	Conclusions	126
6.6	Exercises	126
	References	127

7 Systems Engineering	129
7.1 Systems and Software Development Models	130
7.2 Getting Started	133
7.3 Requirements Engineering	138
7.3.1 Discovering What the User Wants	138
7.3.2 Specifying the Requirements.	140
7.4 System Design	150
7.5 Testing	151
7.5.1 Why Do We Need Testing?	151
7.5.2 Does the System Do What It Is Expected to Do?	153
7.5.3 Is the System Safe?	160
7.5.4 Does the Product Behave Ethically?	162
7.6 Project Management	164
7.7 Putting Things Together	166
7.8 Conclusions	169
7.9 Exercises	170
References.	171
Appendix A: Getting Started with Signals Using MATLAB	173
Appendix B: Simple Traffic Light Recognition Using MATLAB.	197
Index	207

Pervasive Computing

Engineering Smart Systems

Silvis-Cividjian, N.

2017, XVIII, 210 p. 183 illus., 99 illus. in color., Softcover

ISBN: 978-3-319-51654-7