Contents

Part I Understanding and Defining Situations

1 Introduction 3
1.1 The Emerging Eco-system and a Motivating Application 4
1.1.1 Motivating Application: Asthma Risk-Based Recommendations 5
1.2 Difficulties in Handling Situations 5
1.2.1 Concept of Situation Is Ill Defined 6
1.2.2 Conceptual Situation Modeling: Abstractions Required 6
1.2.3 Data Representation, Unification, and Processing 6
1.2.4 Situation Evaluation at Scale 7
1.2.5 From Situations to Personalized Alerts 7
1.2.6 Rapid Implementation, Validation, Refinement, and Deployment 7
1.3 Contributions 7
1.4 Outline of the Book 9
References 9

2 Understanding and Using Situations 11
2.1 Defining *Situations* 11
2.1.1 Previous Definitions 11
2.1.2 Proposed Definition 13
2.2 Problem of Situation Recognition 13
2.2.1 Data 15
2.2.2 Features 15
2.2.3 Situations 15
2.3 Situation-Aware Applications 16
2.4 Design Goals for Framework to Build Situation-Aware Applications 18
2.4.1 Expressive Power 20
2.4.2 Lower the Floor 20
2.4.3 Raise the Ceiling 20

2.5 Components Required for the Framework 21
2.5.1 The Building Blocks 21
2.5.2 Modeling Approach 21
2.5.3 Rapid Prototyping Toolkit 22
References 22

3 Related Work on Situation Recognition 25
3.1 Situation Awareness Across Research Areas 25
3.1.1 GIS (Geographical Information Systems) 25
3.1.2 Active Databases and Stream Processing 26
3.1.3 Aviation and Military Applications 27
3.1.4 Robotics and AI 27
3.1.5 Linguistics 28
3.1.6 Context-Based Systems 28
3.1.7 Computational Social Science 28
3.1.8 Media Processing and Applications 29
3.2 Progress in the Field of "Concept Recognition" from Multimedia Data 29
3.3 Toolkit Support for Situations, Context, and Data Analytic Applications 31
References 32

Part II A Framework for Recognizing Situations

4 Overall Framework for Situation Recognition: Overview 39
4.1 Design Features of the Framework 39
4.1.1 Using Humans as Sensors 39
4.1.2 Consider Space and Time as Fundamental Axes 40
4.1.3 Support Real-Time Situation Evaluation 40
4.1.4 Generate Personalized Actionable Situations 41
4.2 Situation Modeling 41
4.3 Situation Recognition 42
4.3.1 Data Stream Selection 42
4.3.2 Data Ingestion 43
4.3.3 Data Unification 43
4.3.4 Spatiotemporal Aggregation 43
4.3.5 Situation Evaluation 44
4.4 Situation Visualization, Personalization, and Alerts 45
References 46

5 Situation Modeling 47
5.1 Operators and Operands 48
5.1.1 Operands 48
5.1.2 Operators 49
5.2 The Wizard for Modeling Situations 50

5.3 Enhancing and Instantiating the Model 52
5.3.1 Refining the Model 52
5.3.2 Instantiating the Model 52
5.4 Example: Modeling Epidemic Outbreaks 52
References 55

6 Data Representation and Situation Recognition Operators 57
6.1 Data Representation 57
6.1.1 Data Unification 57
6.1.2 Spatiotemporal Aggregation 59
6.2 Analysis (Situation Recognition Operators) 59
6.2.1 Filter (Π) 60
6.2.2 Aggregation ($\oplus$) 63
6.2.3 Classification (γ) 64
6.2.4 Characterization (@) 66
6.2.5 Pattern Matching (ψ) 68
6.2.6 Combining Operators to Create Composite Queries 71
6.3 Personalization and Alerts 72
6.4 Validating the Data Representation and Analysis Operators 73
6.4.1 Application Scenario: Business Analytics 73
References 75

Part III EventShop: An Open-Source Toolkit for Situation Recognition

7 EventShop: System Architecture 79
7.1 System Design: Overview 80
7.2 Data Ingestor 82
7.2.1 Data Sources 83
7.2.2 Iterators 84
7.2.3 Handling Different Types of Data 85
7.3 Stream Query Processor 87
7.3.1 Query 88
7.3.2 Operators 89
7.4 Personalization and Alerts 95
7.5 Discussion 96
References 96

8 Using EventShop 97
8.1 Getting Started 97
8.1.1 System Requirements 97
8.1.2 Launching EventShop Web Application 98
8.1.3 Log In and Sign Up 98
8.1.4 Application Layout 99

8.2 Register Data Sources Panel 99
8.2.1 Controlling and Searching Data Sources 100
8.2.2 Adding New Data Source 102
8.2.3 Sample of Data Sources 105
8.3 E-mage Panel 106
8.3.1 Visualizing Data Source E-mage 106
8.4 Create and Execute Query Panel 107
8.4.1 Forming Queries Using Operators 107
8.4.2 Registering Query 113
8.5 Query Graph Panel 114
8.5.1 Visualizing Query Graph 115
8.6 Registered Queries Panel 115
8.6.1 Executing Registered Queries 116
8.6.2 Searching Registered Query 117
8.6.3 Visualizing Output E-mage 117
8.7 Taking Actions 119

9 Case Studies: Using EventShop for Creating Multiple Situation Recognition Applications 121
9.1 Wildfire Recognition in California 121
9.1.1 Created Models 121
9.1.2 Satellite Data-Based Detector: Comparison with Ground Truth 122
9.1.3 Final Performance: Comparison with Ground Truth 124
9.2 Flood Evacuation in Thailand 125
9.2.1 Created Situation Models 125
9.3 Asthma/Allergy Recommendation System 128
9.3.1 Created Model 129
9.3.2 Results 130
9.4 Discussion and Looking Back at the Design Goals 132
References 134

10 Research Directions: Challenges and Opportunities 137
References 139

http://www.springer.com/978-3-319-30535-6

Situation Recognition Using EventShop

Singh, V.K.; Jain, R.

2016, XVII, 140 p. 79 illus., 75 illus. in color., Hardcover
ISBN: 978-3-319-30535-6