

Table of Contents

- 1 Introduction 1**
 - 1.1 Motivation 1
 - 1.2 Industry problem 3
 - 1.3 Research question 4
 - 1.4 Objective..... 5
 - 1.5 Research hypotheses 5
 - 1.5.1 Product-related hypotheses..... 6
 - 1.5.2 Process-related hypotheses 7
 - 1.6 Research method 7
 - 1.7 Assumptions and limitations..... 9
 - 1.8 Contributions 10
 - 1.9 Thesis structure..... 11

- 2 Background 13**
 - 2.1 Context-aware systems..... 13
 - 2.2 Requirements elicitation for context-aware systems..... 15
 - 2.3 Context modeling 17
 - 2.3.1 The four context modeling activities..... 17
 - 2.3.2 Context models 19
 - 2.4 Data-driven requirements elicitation 21
 - 2.5 Our definitions..... 22
 - 2.6 Summary 23

- 3 A survey on the practical role of context modeling in the elicitation of context-aware functionalities 25**
 - 3.1 Survey design 25
 - 3.1.1 Planning 26
 - 3.1.2 Execution phase 28
 - 3.1.3 Analyzing the data..... 31
 - 3.2 Results 31
 - 3.2.1 Demographics 31
 - 3.2.2 Main findings..... 33
 - 3.2.3 Usage of context models in practice..... 34

3.2.4	Context-modeling activities in practice	35
3.2.5	Further remarks	40
3.3	Discussion	41
3.3.1	Survey results	41
3.3.2	Threats to validity	42
3.4	Summary	43
4	Data-driven context modeling: review of the state of the art	45
4.1	Review question.....	45
4.2	Review method.....	46
4.2.1	Search strategy.....	46
4.2.2	Selection criteria	47
4.2.3	Selection procedure	47
4.2.4	Data extraction strategy	48
4.2.5	Synthesis	48
4.3	Results.....	49
4.3.1	Search results.....	49
4.3.2	Analysis of the results.....	49
4.4	Discussion	55
4.5	Summary	58
5	The data-driven context modeling framework	61
5.1	Overview.....	61
5.2	Task decomposition	62
5.2.1	Conceptual model	63
5.2.2	Sub-process	64
5.3	Data collection.....	66
5.3.1	Conceptual model	66
5.3.2	Sub-process	68
5.4	Data processing	71
5.4.1	Conceptual model	71
5.4.2	Sub-process	74
5.5	Summary	77
6	Implementation of the framework	81
6.1	Solution overview.....	81
6.2	The metadata file	81

6.3	xPACE.....	85
6.3.1	Statistical methods.....	86
6.3.2	Graph analysis.....	89
6.4	TASC4RE.....	91
6.5	TASC Modeler	93
6.6	Summary	95
7	Application in a software development project.....	97
7.1	The project setting	97
7.2	Preliminary activities	97
7.2.1	Identification of contextual elements	97
7.2.2	Analysis of accessibility.....	99
7.3	Task decomposition	100
7.4	Data collection process	100
7.5	Metadata configuration	105
7.6	Processing contextual data	106
7.7	Commentary on effort.....	109
7.8	Summary	110
8	Empirical validation	113
8.1	Experiment planning	113
8.1.1	Goals, design, and participants.....	113
8.1.2	Hypotheses and variables.....	115
8.1.3	Experimental materials	116
8.1.4	Procedure	117
8.2	Execution	118
8.2.1	Preparation	118
8.2.2	Deviations.....	118
8.3	Analysis	119
8.3.1	Descriptive statistics	121
8.3.2	Data set preparation	122
8.3.3	Hypothesis testing	125
8.4	Discussion	130
8.4.1	Evaluation of results and implications.....	130
8.4.2	Threats to validity	132
8.5	Summary	133
9	Conclusions and Outlook.....	135
9.1	Problem and objective	135

9.2	Results and contributions	136
9.3	Limitations	137
9.4	Open questions and future work	138
9.4.1	Foundations and methods	138
9.4.2	Tools	139
9.4.3	Empiricism	140
References		141
A	Appendix A	151
B	Appendix B.....	159
C	Appendix C.....	189
C.1	Informed consent.....	190
C.2	Briefing questionnaire.....	191
C.3	Instructions about the data-driven context model	192
C.4	Introductory presentation given to the control group.....	196
C.5	Introductory presentation given to the treatment group ...	203
C.6	Data-driven context model	214
C.7	List of contextual elements.....	215
C.8	Debriefing questionnaires	217
C.9	Data collection forms (excerpts)	221
C.10	Requirements validation checklist.....	224
C.11	Raw data extraction and validation	225