



# Contents

<b>1</b>	<b>Introduction</b>	<b>19</b>
1.1	Motivation and Setting	20
1.1.1	Stakeholders	21
1.1.2	Trust Relationships	23
1.1.3	Example Service	25
1.2	Challenges, Contributions and Evaluation Methods	28
1.2.1	Trust in Digital Certificate Infrastructures	29
1.2.2	Inter-Component Rating and Performance Functions	31
1.2.3	Distributive Fairness	34
1.2.4	Decomposing Customer Feedback	35
1.2.5	Multicriterial Trust Visualization	37
1.3	Publications	39
1.4	Structure	40
<b>2</b>	<b>Background</b>	<b>43</b>
2.1	Computational Trust and Trust Management	44
2.1.1	Classifications and Definitions	44
2.1.2	Computational Trust	47
2.1.3	Trust Management	50
2.2	Digital Identifiers	50
2.2.1	Authenticity of Digital Identifiers	50



2.2.2	Validating Digital Certificates	51
2.2.3	Trust in Digital Certificates	52
2.3	Composition and Decomposition	54
2.3.1	Influence of the Composite Structure	55
2.3.2	Drawbacks of Service Level Agreements	56
2.4	Feedback and Quality Prediction	57
2.4.1	Difficulties with Reviews and Ratings	57
2.4.2	From Feedback to Quality Prediction	59
2.5	Fairness Models	60
2.5.1	Classification and Definition	60
2.6	Trust Visualizations	61
<b>3</b>	<b>Trust in Digital Certificate Infrastructures</b>	<b>63</b>
3.1	Related Work	68
3.2	Local Trust Views	70
3.2.1	Evaluation	73
3.3	Reputation Systems	74
3.3.1	Centralized Reputation System	75
3.3.2	Decentralized Reputation System	75
3.3.3	Evaluation	76
3.4	Conclusion	78
<b>4</b>	<b>Inter-Component Rating and Performance Functions</b>	<b>81</b>
4.1	Related Work	83
4.1.1	Reputation Propagation Mechanisms	84
4.1.2	Fraud Detection Mechanisms	89
4.2	Inter-Component Rating	91
4.3	Performance Functions	92
4.3.1	Illustrative Example	93
4.3.2	Design of Performance Functions	94



4.4	Implementing Inter-Component Rating with Performance Functions	97
4.4.1	Challenges in Evaluating Performance Functions	98
4.4.2	Drawbacks of Function Interpolation	99
4.4.3	Application of Computational Trust	102
4.5	Evaluation	103
4.5.1	Scenario and Setup	104
4.5.2	Comparison with Standard Performance Evaluation	108
4.5.3	Adaption to Changed Performance	117
4.5.4	Influence of Fraudulent Component Services	122
4.6	Conclusion	123
<b>5</b>	<b>Distributive Fairness</b>	<b>125</b>
5.1	Related Work	126
5.1.1	Mathematics	128
5.1.2	Economics	128
5.1.3	Computer Science	129
5.2	System Model	132
5.3	Fairness Classes	133
5.3.1	Requirements	134
5.3.2	Definitions	134
5.4	Evaluation	143
5.4.1	Class Relations	144
5.4.2	Reasoning on Fairness	147
5.4.3	Semantics of Degrees of Fairness	149
5.4.4	Optimizing Distributions	152
5.5	Conclusion	154
<b>6</b>	<b>Decomposing Customer Feedback</b>	<b>157</b>
6.1	Related Work	158
6.1.1	Customer Reviewing Motivation	160



- 6.1.2 Decomposition-Supporting Review Systems 161
- 6.1.3 Automated Decomposition 161
- 6.2 Customer Reviewing Behavior 164
  - 6.2.1 Reasons for Writing Reviews 166
  - 6.2.2 Tendency toward Negative or Positive Reviews 167
  - 6.2.3 Incentives 168
  - 6.2.4 Capability to Write Decomposed Reviews 169
  - 6.2.5 The Influence of Warranty 170
  - 6.2.6 Conclusion 170
- 6.3 Decomposition-Supporting Review System 171
  - 6.3.1 Description 171
  - 6.3.2 Evaluation 173
  - 6.3.3 Findings 173
- 6.4 Decomposition with Conjoint Analysis & Machine Learning 175
  - 6.4.1 Approach 176
  - 6.4.2 Data Sets 178
  - 6.4.3 Evaluation 179
- 6.5 Conclusion 185
- 7 Multicriterial Trust Visualization 189**
  - 7.1 Related Work 191
  - 7.2 T-Viz 196
    - 7.2.1 Desired Properties 197
    - 7.2.2 Design Process 198
    - 7.2.3 Design Iterations 200
  - 7.3 Evaluation 201
    - 7.3.1 Hypotheses 202
    - 7.3.2 Study Design 202
    - 7.3.3 Results 204
  - 7.4 Conclusion 209



## **8 Conclusion and Outlook 211**

8.1 Conclusion 211

8.2 Outlook 214

**List of Tables 217**

**List of Figures 219**

**Bibliography 225**

### **A Proofs 251**

A.1  $n+1$  Supporting Points Suffice to Interpolate a Polynomial Performance Function without Error 251

A.2 The Area of a Radar Plot Depends on the Order of Categories 252

### **B Algorithms 255**

B.1 Trust Validation Algorithm used by Trust Views 255

B.2 Update Algorithm used by Trust Views 257

### **C Selected CertainLogic Operators 259**

C.1 CertainLogic AND-Operator 259

C.2 CertainLogic cFUSION-Operator 260

### **D ICR Plots 263**

D.1 Composite Quality 263

D.2 Class Selection Count 266