

Contents

Introduction

1	Introduction	3
1.1	Structure of This Book	5
1.2	History of This Book	7

Fundamentals of Cloud Labor Services

2	Cloud Labor Services	11
2.1	Overview	11
2.1.1	History	11
2.1.2	Concept	12
2.2	Related Concepts	16
2.2.1	Crowdsourcing	16
2.2.2	Paid Crowdsourcing	18
2.2.3	Human Computation	18
2.2.4	Social Computing	20
2.2.5	Open Source	20
2.2.6	Collective Intelligence	21
2.2.7	Human Tasks in Business Process Management and SOA	21
2.2.8	Cloud Computing	22
2.3	Challenges	23
2.3.1	Application Challenges	23
2.3.2	Platform Challenges	25
2.3.3	Workforce Challenges	28
2.4	Application Perspective	29
2.4.1	Existing Applications	29
2.4.2	Identification of Relevant Tasks	31
2.4.3	Workflows and Task Granularity	33
2.4.4	Privacy, Copyright and Compliance	35
2.5	Platform Perspective	37
2.5.1	Existing Platforms	37
2.5.2	Technical Infrastructure	40
2.5.3	Worker-to-Task Matching and Allocation	42
2.5.4	Quality Management	44
2.6	Workforce Perspective	44
2.6.1	Worker Demographics	44
2.6.2	Motivation and Incentives	45
2.6.3	Education and Feedback	47

2.6.4	Task Design	48
2.6.5	Work Model.	49
3	Quality Management for Cloud Labor Services	51
3.1	Quality of Cloud Labor Services	51
3.1.1	Quality.	51
3.1.2	Relevant Quality Dimensions	52
3.1.3	Influencing Factors	55
3.2	Quality Management Approaches.	57
3.2.1	Qualification Tests.	57
3.2.2	Output-Based Quality Management	58
3.2.3	Execution Process Monitoring.	58
3.2.4	Response Time Management	59
3.3	Patterns for Output-Based Quality Management.	60
3.3.1	Relevant Task Characteristics	60
3.3.2	Gold Pattern	62
3.3.3	Voting Pattern.	64
3.3.4	Validation Pattern	66
3.3.5	Iteration Pattern.	68
3.3.6	Comparison Pattern	70
3.4	Comparison of Output-Based Approaches	71
3.4.1	Decision Matrix	72
3.4.2	Gap Analysis	74
 Dynamic Quality Management for Cloud Labor Services		
4	Statistical Quality Control	79
4.1	Overview	79
4.1.1	Quality Management	79
4.1.2	Statistical Quality Control.	81
4.2	Areas of Statistical Quality Control	82
4.2.1	Acceptance Sampling.	82
4.2.2	Statistical Process Control	82
4.2.3	Design of Experiments.	83
4.3	Acceptance Sampling	83
4.3.1	Introduction	83
4.3.2	Single-Sampling Plans for Attributes	84
4.4	Continuous Sampling Plans.	90
4.4.1	The Continuous Sampling Plan 1 (CSP-1)	90
4.4.2	Determination of Clearance Number and Sampling Fraction	91
5	Core Model	93
5.1	Motivation	93
5.1.1	Application of Statistical Quality Control	94
5.1.2	Quality Management Patterns for Sample Inspection	95

5.2	Model	96
5.2.1	Assumptions	97
5.2.2	Process Flow	98
5.2.3	Rationale for Using the CSP-1	100
5.3	Dynamic Voting Mechanism (DVM)	101
5.3.1	Definitions	101
5.3.2	Statistical Considerations	102
5.3.3	Calculation of the Conditional Probabilities	103
5.4	Completion Time Management	105
5.4.1	Motivation	106
5.4.2	Maximum Throughput	106
5.4.3	Fixed Deadline	107
5.5	Model Application	107
5.5.1	Configuration of the CSP-1 and the DVM	107
5.5.2	Initialization of Worker Failure Rates	108
5.5.3	Detailed Process Flow	109
5.5.4	Selection of Completion Time Management Option	110
5.6	Small Worker Pools	110
5.6.1	Motivation	110
5.6.2	Prevention of Delayed Task Inspection	111
6	Model Variations	113
6.1	Multi-labeling Scenarios	113
6.1.1	Types of Classification Scenarios	114
6.1.2	Assumptions and Definitions	114
6.1.3	Application of the DVM	116
6.1.4	Process Flow	117
6.1.5	Posterior Probability per Label	118
6.1.6	Identification of Best Suitable Labeling Decision	119
6.1.7	Updating the Worker's Sensitivity and Specificity	122
6.2	Non-deterministic Tasks	122
6.2.1	Introduction	123
6.2.2	Fundamentals	123
6.2.3	Process Flow	125
6.2.4	Sampling Process	128
6.2.5	Inspection Process	128
6.2.6	Number of Reviewers to Be Used	131
 Evaluation and Case Studies		
7	Toolkit Development	135
7.1	Architecture	135
7.2	Live Mode	137
7.3	Simulation Mode	139

8	Evaluation of Core Model	141
8.1	Model Scenario: Optical Character Recognition	141
8.1.1	Experimental Setup	142
8.1.2	Simulations	143
8.1.3	Live Experiments	147
8.1.4	Comparison of Simulation and Live Experiments	150
8.1.5	Discussion	152
8.2	Case Study: Address Research	154
8.2.1	Scenario	154
8.2.2	Experimental Setup	156
8.2.3	Simulation Experiments	156
8.2.4	Live Experiment	160
8.2.5	Discussion	161
9	Evaluation of Model Variations	165
9.1	Case Study: Medical Coding	165
9.1.1	Experimental Setup	166
9.1.2	ICD-10 Coding as a Multi-labeling Task	168
9.1.3	Task Execution	169
9.1.4	Results	169
9.1.5	Discussion	170
9.1.6	IBM Insurance Service Hub	172
9.2	Case Study: Product Research	173
9.2.1	Experimental Setup	173
9.2.2	Task Execution	175
9.2.3	Full Inspection	176
9.2.4	Sample-Based Inspection	179
9.2.5	Discussion	181
Conclusion		
10	Conclusion	187
10.1	Summary	187
10.2	Contribution	188
10.3	Recommended Further Research	191
Appendix A: Complementary Figures		193
Appendix B: Complementary Research		197
References		203
Index		213

<http://www.springer.com/978-3-319-09775-6>

Dynamic Quality Management for Cloud Labor Services
Methods and Applications for Gaining Reliable Work
Results with an On-Demand Workforce

Kern, R.

2014, XVI, 215 p. 49 illus., Softcover

ISBN: 978-3-319-09775-6