

Contents

Abstract	VI
1 Introduction	1
1.1 Recommender Systems	1
1.2 Preview of this Thesis	4
1.2.1 Scalability	4
1.2.2 New Users, Sparsity and Cold Start	4
1.2.3 Efficiency and Accuracy of Prediction	5
1.2.4 Multi-criteria Recommender Systems	6
1.2.5 Group Recommender Systems	6
1.2.6 Medical Recommender Systems	7
1.2.7 Telemedical ICT System	7
1.3 Structure of this Thesis	8
2 A Closer Look on Decision Making and Recommendation Algorithms	9
2.1 Computerised Decision Support	9
2.2 Multi-criteria Recommender Systems	10
2.3 Model-based Recommender Systems	12
3 Knowledge-based Distances	14
3.1 Standard Distance Measures	14
3.2 Feasibility of Distance Measures	15
3.3 Knowledge-based Distance Measures	19
4 Recommender Systems based on Behavioural Models	23
4.1 Literature Review	23
4.2 The InCF algorithm	24
4.2.1 Definitions and Concepts	24
4.2.2 Structure of Algorithm InCF	25
4.2.3 Learning Algorithm in InCF	27
4.2.4 Prediction Algorithm in InCF	31
4.3 Experimental Analysis	33
4.3.1 Experimental Set-up	33
4.3.2 Evaluation Matrices	33
4.3.3 Collaborative Filtering based on K-Means	34
4.3.4 Collaborative Filtering based on K-NN	34
4.3.5 Collaborative Filtering with InCF	37
4.4 Recommending Movies to Interested Users with InCF	39
4.5 Conclusion	39
5 Knowledge-based Recommender Systems	41
5.1 Work Related to Medical Recommender Systems	41
5.2 A Knowledge-based Incremental Collaborative Filtering Algorithm	42
5.2.1 Definitions and Concepts	42
5.2.2 Structure of Algorithm K-InCF	43
5.2.3 Learning Algorithm in K-InCF	44
5.2.4 Prediction Algorithm in K-InCF	48
5.3 Medical Recommender System based on K-InCF	50

5.3.1	Risk Factors Identified by Experts	50
5.3.2	Employing Expert Rules	51
5.4	Validation	51
5.4.1	Experimental Set-up	51
5.4.2	Evaluation Matrices	52
5.4.3	Test Data and Data Preparation	53
5.4.4	Comparative Experimental Results	53
5.4.5	Comparison of Utilising Prediction Techniques in a Medical RS	56
5.5	Discussion	57
5.6	Conclusion	57
6	Group Recommender Systems	59
6.1	Related Work	59
6.2	A Group Recommender System based on InCF	60
6.2.1	Individual Recommendations with InCF	61
6.2.2	A Group Recommender System	61
6.3	Experimental Analysis	63
6.3.1	Effect of G-InCF on Recommendation Quality	63
6.4	Conclusion	63
7	Consensual Recommender Systems	65
7.1	Social Connections	65
7.2	Forming Consensus	66
7.3	Consensual Recommender Systems	67
7.3.1	Structure of the Method	67
7.3.2	Learning Algorithm	67
7.3.3	Recommendation Algorithm	70
7.4	Experimental Analysis	71
7.4.1	Example of Employing C-InCF	71
7.4.2	Evaluation Criteria	73
7.5	Experimental Results	73
7.5.1	C-InCF with Average Consensus Protocol	74
7.5.2	C-InCF with Leader-following Consensus Protocol	75
7.6	Conclusion	80
8	Utilisation	81
8.1	Extending InCF with a Feedback Option	81
8.1.1	General Considerations	82
8.1.2	Learning Mode	82
8.1.3	Recommendation Mode	83
8.1.4	Feedback Mode	83
8.2	Deployment as an ICT System	83
8.3	Conclusion	85
9	Conclusion and Outlook	86
9.1	Contributions and Results	86
9.2	Outlook and Future Work	89
	Bibliography	91