

Contents

Certificate	ii
Declaration by the Candidate	iii
Copyright Transfer Certificate	iv
Acknowledgements	v
Contents	vi
List of Figures	xi
List of Tables	xiii
Preface	xvii
1 Introduction	1
1.1 Motivation	1
1.2 Feature Selection	3
1.2.1 Benefits and Application of Feature Selection	8
1.3 Thesis Structure	9
2 Background	13
2.1 Rough Set Theory	13
2.2 Fuzzy Set Theory	15
2.3 Fuzzy Rough Set Theory	16
2.4 Fuzzy Rough Set based Feature Selection	17
2.4.1 Related Work	19
2.4.2 Limitation of Fuzzy Set	20

2.5	Intuitionistic Fuzzy Set	20
2.5.1	Intuitionistic Fuzzy Rough Set Theory	21
2.5.2	Related Work	22
2.6	Summary	23
3	Feature Selection Models and its Application	25
3.1	Divergence based Intuitionistic Fuzzy Rough Set Model	26
3.1.1	Feature selection using IF rough set model based on divergence measure	35
3.1.2	Experimentation	38
3.1.3	Application to tuberculosis treatment	39
3.1.3.1	Result	42
3.2	k-mean based Intuitionistic Fuzzy Rough Set Model	49
3.2.1	Feature Selection based on Intuitionistic Fuzzy Rough Set Model based on k-means	50
3.2.2	Application for Enhancing Prediction of Aptamer-protein Interacting Pairs	51
3.2.2.1	Result	52
3.3	Summary	55
4	A Fitting Model for Feature Selection	57
4.1	Fitting Model based on Intuitionistic Fuzzy Rough Set	58
4.2	Feature Selection based on Fitting Model	61
4.3	Experimentation	64
4.4	Summary	68
5	Feature Selection Model for Incomplete Data	69
5.1	Fuzzy Rough Model for Feature Selection and Missing Value Imputation	70
5.1.1	Feature Grouping	71
5.1.2	Missing Value Imputation	71
5.1.3	Search Heuristic for Finding Reduct	75
5.2	Experimentation	80
5.2.1	Results	81
5.2.1.1	By employing Parameter variation	82
	By varying the level of induced missing Values	82
	By varying the value of k (number of nearest neighbour for missing value imputation)	84
	By varying the percentage of correlated features employed for obtaining reduced dataset using proposed approach	86
	By varying the percentage of missing entries required in an instance to ignore the instance	88

5.2.1.2 Comparison with Existing Missing Value Imputation method	89
5.2.1.3 Comparison with Other Feature Selection Algorithms	92
5.3 Summary	93
6 Bireduct Model and its Application	95
6.0.1 Bireduct formulation	96
6.1 Intuitionistic Fuzzy Bireducts for Data Reduction	97
6.1.1 Intuitionistic Fuzzy Feature Selection	98
6.1.2 Intuitionistic Fuzzy Instance Selection	99
6.1.2.1 Method I	99
6.1.2.2 Method II	100
6.1.3 Simultaneous Intuitionistic Fuzzy Instance and Feature Selection	102
6.1.4 Heuristic Search Strategy for IF Bireducts	105
6.2 Experimentation	109
6.2.1 Results	110
6.2.1.1 Using Parameter Variation	111
6.2.1.2 Using Variants of Instance Selection	116
6.2.1.3 Comparisons with Other FS Algorithms	118
6.2.1.4 Comparison with Instance Selection and Feature Selection + Instance Selection Approaches	121
6.2.1.5 Comparison with existing Bireduct approach	124
6.3 Application to Cancer Treatment	125
6.3.0.1 Results	129
6.3.0.2 Comparison with Unreduced Dataset	131
6.3.0.3 Comparison with Existing Approaches	131
6.4 Summary	132
7 Unsupervised Feature Selection	135
7.1 Feature Selection based on Fuzzy Rough Set in Unsupervised Domain	137
7.1.1 Feature subset quality evaluation	138
7.1.1.1 Dependency measure	138
7.1.2 Search strategy	141
7.1.2.1 Reproduction 1	141
7.1.2.2 Reproduction 2	142
7.2 Experimentation	144
7.2.1 Results	145
7.2.1.1 Using variants of proposed approach	146
7.2.1.2 Comparison with state of art dependency based approach	147
7.2.1.3 Comparison with state of art non dependency based approach	150

7.2.1.4	Comparison with supervised approach	152
7.3	Summary	153
8	Conclusion	159
8.1	Feature Selection	160
8.2	Future Work	161
A	Data Validation Techniques	163
B	Performance Evaluation Metrics	165
C	Statistical Testing	167
	Bibliography	169