

Contents

1	Introduction	1
1.1	Introduction	1
1.2	Data Acquisition	3
1.3	Methodologies for Classification	4
1.4	Layout of the Thesis	8
2	Preliminaries	10
2.1	Linear Algebra	10
2.2	Optimization	13
2.3	Functional Analysis	16
2.4	Machine Learning	18
3	Artificial Neural Network(ANN) for Classification	22
3.1	Introduction	23
3.2	Learning using ANN	25
3.2.1	Learning Methodology	25
3.2.2	The Levenberg-Marquard algorithm	27
3.3	Experimental set up and results	28
3.4	Summary	31

4	Support Vector Machine with Positive Definite Kernels	32
4.1	Introduction	33
4.2	Mathematical Formulation of SVM	34
4.2.1	Linearly Separable Data	34
4.2.2	Nonlinearly Separable Data (Kernel Trick)	38
4.2.3	Soft Margin - for Noisy Data	40
4.2.4	Sequential Minimal Algorithm (SMO)	41
4.3	SVM to diagnose Skin Disorders	44
4.4	Summary	47
5	Support Vector Machine with Novel Indefinite Kernel	48
5.1	Introduction	49
5.2	Kreĭn Space: A pseudo-Euclidean(pE) Space	51
5.3	Classification with Indefinite Kernel	54
5.3.1	Optimal Separation for separable data in pE space	55
5.3.2	Optimal Separation for Non-Separable data in pE space	56
5.3.3	SVM with Indefinite Kernel	58
5.4	Classification using Various Kernels	60
5.4.1	Distance Based Kernels	60
5.4.2	A Novel Modified Gaussian Kernel	62
5.5	Summary	64
6	Probabilistic Approach in Feature Selection	65
6.1	Introduction	66
6.2	Techniques of Feature Selection	67
6.3	A Novel Approach for Feature Selection	69

6.4	Experiments and Results	71
6.5	Summary	81
7	Kernel Based Extreme Learning Machine for Classification	82
7.1	Introduction	83
7.2	Algorithm of ELM and its Comparative Study	85
7.2.1	Algorithm of ELM	85
7.2.2	Comparative Study	88
7.3	Experimentations and Result Analysis	89
7.4	Summary	91
	Future Scope	92
	Publications	93
	Appendix-A	94
	Appendix-B	112
	Bibliography	142