TABLE OF CONTENTS

	Page No.
Certificate	ii
Declaration	iii
Acknowledgements	iv-v
Preface	vi-viii
List of Figures	ix-x
List of Tables	xi
List of Abbreviation	xii
List of Symbols	xiii
CHAPTER 1: INTRODUCTION	**1-6**
1.1 OVERVIEW	1
1.2 BACKGROUND	2-4
1.3 PROBLEM STATEMENT AND RESEARCH OBJECTIVES	4-5
1.4 THESIS ORGANIZATION	5-6
CHAPTER 2: LITRATURE REVIEW	**7-42**
2.1 FUZZY LOGIC	8-20
2.1.1 Linguistic Variables	9-10
2.1.2 Arithmetic Fuzzy Logic .	10

2.1.3 Proposition Fuzzy Logics 11-12

2.1.4 Signify Fuzzy Logics 12

2.1.5 Higher-Order Fuzzy Logics 12

2.1.5.1 The Fuzzy Hypercube 13-14

2.1.6 Time Line of Fuzzy Logic Publication 14-18

2.1.7 Fuzzy Logic Article in Pubmed 18-19

2.1.8 Applications of Fuzzy Logic in Bioinformatics 19-20

2.2. ARTIFICIAL NEURAL NETWORK 20-35

2.2.1 The Biological Model 22-24

2.2.2 The Mathematical Model 25-27

2.2.2.1 Activation Functions 27-29

2.2.3. Handling Units 29-30

2.2.4 Neural Network Topologies 30

2.2.5 Training of Artificial Neural Network 31-32

2.2.6 Modifying Patterns of Connectivity of Neural Networks 32-33

2.2.7 Historical Sketch of Neural Networks 33-35

2.3. ARTIFICIAL NEURO FUZZY INFERENCE SYSTEM 35-42

2.3.1 Application of ANFIS in Diverse Area 37-39

2.3.2 ANFIS Article in Pubmed 40

2.3.3 Architecture of Neuro-Fuzzy System 40-42

CHAPTER 3: RISK BASED PRIORITIZATION FOR RESPIRATOTRY DISORDER SYSTEM USING SOFT COMPUTING **43-57**

3.1 INTRODUCTION 43-46

3.2. RESPIRATORY 46-48

3.2.1 Mechanism of Respiratory 48

3.2.1.1. Airway Combustion in respiratory 48-49

3.2.1.2. Inflammatory Mediators 49

3.2.1.3. Mechanism of Airway Hyper Responsiveness 49-50

3.2.2 Cause of Respiratory. 50

3.2.2.1. Environmental 50-51

3.2.2.2. Genetic 51-52

3.2.3 Diagnosis of respiratory 52-53

3.2.3.1. Differential Diagnosis 54-55

3.2.3.2. Signs and Symptoms of Respiratory 55-56

3.2.3.3. Respiratory Severity 57

CHAPTER 4: DEVELOPING CLINICAL DECESION SUPPORT SYSTEM USING FUZZY LOGIC AND ARTIFICIAL NURAL NETWORK **58-81**

4.1 SCOPE OF WORK AND STUDY AREA 58

4.2 BACKGROUND 59

4.3 COLLECTION OF DATA 60

4.4 SOFTWARE PAKAGE 60-61

4.4.1 Features 61

4.4.2 Algorithm Involved 62

4.5 PLANNING OF FUZZY INFERENCE SYSTEM FOR FINDING OF RESPIRATORY 62-75

4.5.1 The FIS Editor 63-64

4.5.2 The Membership Function Editor 64-65

4.5.3 The Rule Editor 65

4.6 COMPREHENSIVE SOFTWARE ARCHITACTURE OF FUZZY INFERENCE SYSTEM 66

4.6.1 Model Development 67-73

4.6.2 Calculation 74

4.6.3 Defuzzification of the Output 75

4.7 DESIGNING OF ARTIFICIAL NEURAL NETWORK INFERNCE SYSTEM FOR THE DIAGNOSIS OF RESPIRATORY 76-81

4.7.1 Input and Target Data 76

4.7.2 Creating the Neural Network 76

4.7.3 Training the Neural Network 77-80

4.7.4 Testing the Respiratory Neural Network 81

CHAPTER 5: IMPROVING THE DESIGN OF CLINICAL DECESION SUPPORT SYSTEM USING ANFIS **82-90**

5.1 INTRODUCTION 82-83

5.1.1 Methodology 83

5.1.2 Proposed Method 83-85

5.1.3 Data Modeling. 85-86

5.2 SYSTEM DEVELOPMENT 87-90

5.2.1 Data Management system and Preparation 87

5.2.2 Data Mining 87-88

5.2.3 Input Phase 88

5.2.4 FIS Phase 89

5.2.5 ANFIS Modeling 89-90

5.2.6 Field Output Phase 90

91-113

CHAPTER 6: EXPERIMENTAL RESULTS AND COMPARATIVE ANALYSIS

6.1. FUZZY INFERENCE SYSTEM RESULTS 91

6.1.1 Performance Evaluation of Fuzzy Inference System 91-96

6.2. RESULTS OF ARTIFICIAL NEURAL NETWORK INFERENCE SYSTEM MODEL 96-98

6.2.1 Performance Evaluation of ANN Inference System 98-101

6.3 RESULT OF ARTIFICIAL NEURO FUZZY INFERNCE MODEL 101-102

6.3.1 Performance Evaluation of Artificial Neuro Fuzzy Inference System 102-109

6.4. COMPERATIVE ANALYSIS OF VARIOUS SOFT COMPUTING TECHNIQUE USED IN THE DIAGNOSIS OF RESPIRATORY DISORDER 110-112

6.5. RESPIRATORY MANAGEMENT PLAN 112-113

CHAPTER 7: CONCLUSION **114-116**

7.1. CONCLUSION 114-115

7.2. RECOMMENDATIONS 116

APPENDICE **117**

APPENDIX I 117-138

APPENDIX II 139

REFERENCES **140-155**

LIST OF FIGURE

		Page No.
Figure 2.1:	2 dimensional hypercube I2 with the 4 non fuzzy subsets (0, 0), (0, 1), (1, 1), and the fuzzy set (0.5, 0.5).	13
Figure 2.2:	The picture of Neural Computation (www.rajalakshmi.org/dept/BME/BM2401-NOL.doc)	21
Figure 2.3:	Biological Neuron (www.rajalakshmi.org/dept/BME/BM2401-NOL.doc).	23
Figure 2.4:	Logistic Activation Function.	26
Figure 2.5:	Gaussian Activation Function.	26
Figure 2.6:	Mathematical Model of Neural Network (www.rajalakshmi.org/dept/BME/BM2401-NOL.doc)	27
Figure 2.7:	Supervised Learning	31
Figure 2.8:	Number of papers distributed by PubMed utilizing ANFIS	40
Figure 2.9:	Neuro-Fuzzy equivalent system	41
Figure 3.1:	Graphical dispersion of Respiratory and COPD load in India. (Picture is taken from http://arachnoserver.org)	44
Figure 3.2:	(A) picture showing airways & lungs (B) normal airway(C) airway during respiratory (Picture is taken from http://nhlbi.nih.gov).	47
Figure 4.1:	Fuzzy Inference System (www.rohan.sdsu.edu)	63
Figure 4.2:	Four information variable (FVC, PEFR, FEV1 and FEF 25-75%) and one Output variable Respiratory Severity.	64
Figure 4.3:	Triangular participation capacity	65

Figure 4.4:	Trapezoidal Membership Function	65
Figure 4.5:	Comprehensive software architecture of fuzzy inference system for diagnosis of Respiratory disorder system	66
Figure 4.6:	The number of events under each classification of fuzzy inference system	67
Figure 4.7:	Membership Function Plot for Input Variable PEFR	68
Figure 4.8:	Membership Function Plot for Input Variable FEV1	69
Figure 4.9:	Membership Function Plot for Input Variable FVC	70
Figure 4.10:	Membership Function Plot for Input Variable FEF2575	70
Figure 4.11:	Membership Function Plot for Output Variable Respiratory Severity	71
Figure 4.12:	Rule Viewer for Respiratory Inference System	73
Figure 4.13:	AND operation over a persistently differing scope of truth values A and B	74
Figure 4.14:	Defuzzification of the aggregate output	75
Figure 5.1:	The proposed ANFIS	85
Figure 5.2:	Information of the ANFIS model	90
Figure 6.1:	Output Classification of Respiratory Severity	91
Figure 6.2:	Plot between PEFR, FEV1 and Output	95
Figure 6.3:	Plot between FEF2575, FEV1 and Output	95
Figure 6.4:	Plot between FEF2575, FVC and Output	95
Figure 6.5:	Plot between FEV1, FVC and Output	95
Figure 6.6:	Plot between PEFR, FVC and Output	95
Figure 6.7:	Plot between PEFR, FEF2575 and Output	95
Figure 6.8:	ANN Performance Plot	96

Figure 6.9: ANN Regression Plot Figure 97

Figure 6.10: Comparative examination of fuzzy, ANN and ANFIS inference framework 112

LIST OF TABLES

		Page No.
Table 2.1:	Number of papers distributed by PubMed utilizing fuzzy logic	18-19
Table 3.1:	Characterization of Respiratory seriousness with various parameters (according to GINA Report, 2009)	57
Table 4.1:	Membership Function esteem for Input Variable PEFR	69
Table 4.2:	Membership Function esteem for Input Variable FEV1	69
Table 4.3:	Membership Function esteem for Input Variable FVC	70
Table 4.4:	Membership Function esteem for Input Variable FEF2575	71
Table 4.5:	Membership Function esteem for output Variable Respiratory Severity	71
Table 4.6:	Shows the Rule base for Respiratory disorder Inference System	72
Table 4.7:	Logical operation performed by AND Connection in Fuzzy Logic	74
Table 6.1:	Results of the Fuzzy inference system framework output and field information output	92-94
Table 6.2:	Results of the ANN deduction framework output and field information output	99-101
Table 6.3:	Testing and preparing mistake of various frameworks for module No. - 1	103
Table 6.4:	Testing and training error of different systems for module	104

	No.-2	
Table 6.5:	Results of the ANF derivation framework output and field information output for System Number 2 of Module 1	105-107
Table 6.6:	Results of the ANF inference system output and field data output for System Number 4 of Module 1	107-109
Table 6.6:	Comparative Result with the same Parameters	110
Table 6.7:	Comparison of error and its Accuracy	111
Table No.-I.:	Training Data Set	117-132
Table No.-II.:	Testing Data Set	132-138

LIST OF ABBREVIATIONS

AFLC	Adaptive Fuzzy Leader Clustering
ANFIS	Adaptive Neuro Fuzzy Inference System
ANN	Artificial Neural Network
CAT	Computed Axial Tomography
COG	Centre of Gravity
COS	Centre of Singleton
CT	Computed Tomography
FCM	Fuzzy C-Means
FIS	Fuzzy Inference System
FLC	Fuzzy Logic Controller
GUI	Graphical User Interface
IS	Inference System
MF	Membership Function
MLP	Multi Layer Perceptron
MR	Magnetic Resonance
MRI	Magnetic Resonance Image
NMR	Nuclear Magnetic Resonance
NN	Neural Network
PCA	Principal Component Analysis
PET	Positron Emission Tomography
PNN	Probabilistic Neural Network
RF	Radio Frequency
RGB	Red Green Blue

LIST OF SYMBOL

θ	Threshold
i	Input signals
w	Weight the neurons
b	Bias signal
O	Output signals
Σ	Summation of all incoming signals
Π	Product of all the incoming signals
x	Universal sets
e	Error
E	Total error
∈	Subset
μA(x)	Membership functions of A
Ç	Intersection @ AND logic operation
È	Complement @ OR logic operation
f	Activation function
M x N	Rows x columns
i	Training image of image i
Φ	Pixel vector
ωi	feature vectors