Introduction Chapter 1

- Neural Networks 1.1
 - Artificial Neural Network: Definition 1.1.1
 - Advantages of Neural Networks
- Application Scope of Neural Networks 1.2
- **Fuzzy Logic** 1.3
- Genetic Algorithm 1.4
- Hybrid Systems 1.5
 - 1.5.1 Neuro Fuzzy Hybrid Systems
 - Neuro Genetic Hybrid Systems 1.5.2
 - 1.5.3 Fuzzy Genetic Hybrid Systems
- **Soft Computing** 1.6
- Summary 1.7

Artificial Neural Network: An Introduction Chapter 2

- Fundamental Concept 2.1
 - Artificial Neural Network 2.1.1
 - Biological Neural Network 2.1.2
 - Brain vs. Computer Comparison Between Biological Neuron and Artificial Neuron 2.1.3
- **Evolution of Neural Networks** 2.2
- Basic Models of Artificial Neural Network 2.3
 - Connections 2.3.1
 - Learning 2.3.2
 - Supervised Learning 2.3.2.1
 - Unsupervised Learning 2.3.2.2
 - Reinforcement Learning 2.3.2.3
 - **Activation Functions** 2.3.3
- Important Terminologies of ANNs 2.4
 - Weights 2.4.1
 - Bias 2.4.2
 - Threshold 2.4.3
 - Learning Rate 2.4.4
 - Momentum Factor 2.4.5
 - Vigilance Parameter 2.4.6
 - 247 **Notations**

2.5	McCullo	ch-Pitts Neuron				
		Theory				
	2.0.2	Architecture				
2.6		eparability				
2.7	Hebb Ne	twork				
	2.7.1	Theory				
		Flowchart of Training Algorithm				
	2.7.3	Training Algorithm				
2.8	Summar	y				
2.9	Solved P	roblems				
2.10	Review	Questions				
2.11	20 BB					
2.12	Projects					
Cha	apter 3	Supervised Learning Network	nonsub-			
-						
3.1	Introduc					
3.2		ron Networks				
	3.2.1	Theory Puls				
	3.2.2	Perceptron Learning Rule				
		Architecture Floweboot for Training Process				
	3.2.4	Flowchart for Training Process Persontran Training Algorithm for Single Output Class	Ses			
	3.2.5	Perceptron Training Algorithm for Single Output Class Perceptron Training Algorithm for Multiple Output Cl				
	3.2.6		103503			
3.3		Perceptron Network Testing Algorithm ve Linear Neuron (Adaline)				
3.3						
	3.3.1	Theory Delta Rule for Single Output Unit				
	3.3.3	Architecture				
	3.3.4					
	3.3.5	Training Algorithm				
	3.3.6	Testing Algorithm				
3.4		ple Adaptive Linear Neurons				
	3.4.1	Theory				
	3.4.2	Architecture				
	3.4.3	Flowchart of Training Process				
	3.4.4					
3.	5 Back	-Propagation Network				
	3.5.1	Theory				
	3.5.2	Architecture				
	3.5.3	Flowchart for Training Process				
	3.5.4					
	3.5.5	Learning Factors of Back-Propagation Network				
		3.5.5.1 Initial Weights				
		3.5.5.2 Learning Rate α				
		3.5.5.3 Momentum Factor				
		3.5.5.4 Generalization				
		3.5.5.5 Number of Training Data				
		3.5.5.6 Number of Hidden Layer Nodes				
	3.5.6	Testing Algorithm of Back-Propagation Network				

3,6 Radial Basis Function Network	
3.6.1 Theory	
3.6.2 Architecture	
3.6.3 Flowchart for Training Process	
3.6.4 Training Algorithm	
3.7 Time Delay Neural Network	
3.8 Functional Link Networks	
3.9 Tree Neural Networks	
3.10 Wavelet Neural Networks	
3.11 Summary	
3.12 Solved Problems	
3.13 Review Questions	
3.14 Exercise Problems	
3.15 Projects	
3,13 110,000	
Chapter 4 Associative Memory Networks	The second section is a second section of the second section of the second section is a second section of the section of
Chapter 4 Associative Memory Networks	The second secon
4.1 Introduction	
4.2 Training Algorithms for Pattern Association	
4.2.1 Hebb Rule	
4.2.2 Outer Products Rule	
4.3 Autoassociative Memory Network	
4.3.1 Theory	
4.3.2 Architecture	
4.3.3 Flowchart for Training Process	
4.3.4 Training Algorithm	
4.3.5 Testing Algorithm	
and the state of	
4.4.1 Theory	
4.4.2 Architecture	
4.4.3 Testing Algorithm	
4.5 Bidirectional Associative Memory (BAM)	
4.5.1 Theory	
4.5.2 Architecture	
4.5.3 Discrete Bidirectional Associative Memory	
4.5.3.1 Determination of Weights	
4.5.3.2 Activation Functions for BAM	
4.5.3.3 Testing Algorithm for Discrete BAM	
4.5.4 Continuous BAM	
4.5.5 Analysis of Hamming Distance, Energy Functio	on and Storage Capacity
6 Hopfield Networks	
4.6.1 Discrete Hopfield Network	
4.6.1.1 Architecture of Discrete Hopfield Net	
4.6.1.2 Training Algorithm of Discrete Hopfie	
4.6.1.3 Testing Algorithm of Discrete Hopfield	
4.6.1.4 Analysis of Energy Function and Stora	age Capacity on Discrete Hopfield Net
4.6.2 Continuous Hopfield Network	
4.6.2.1 Hardware Model of Continuous Hopfie	eld Network
4.6.2.2 Analysis of Energy Function of Contin	
4.0.2.2 Milarysis of Energy Pulicular of Contin	luous riophelu Network

4.

4.7	Iterative	e Autoassociative Memory Networks			
7./	4.7.1	Linear Autoassociative Memory (LAM)			
	4.7.2	Brain-in-the-Box Network			
		4.7.2.1 Training Algorithm for Brain-in-the-Box Mode	de l'access le		
	4.7.3	Autoassociator with Threshold Unit			
		4.7.3.1 Testing Algorithm			
4.8	Temporal Associative Memory Network				
4.9	Summary				
4.10	Solved Problems				
4.11	Review Questions				
4.12		se Problems			
4.13	Project	ts			
C)		5 II Networks			
Ch	apter	5 Unsupervised Learning Networks	A STATE OF THE PARTY OF THE PAR		
5.1	Introd	uction			
5.2	Fixed	Weight Competitive Nets			
3.2		Maxnet			
	5.2.1	5.2.1.1 Architecture of Maxnet			
		5.2.1.2 Testing/Application Algorithm of Maxnet			
	5.2.2	Mexican Hat Net			
		5.2.2.1 Architecture			
		5.2.2.2 Flowchart			
		5.2.2.3 Algorithm			
	5.2.3	Hamming Network			
		5.2.3.1 Architecture			
		5.2.3.2 Testing Algorithm			
5.3	Kohon	nen Self-Organizing Feature Maps			
	5.3.1	Theory			
	5.3.2	Architecture			
	5.3.3	Flowchart			
	5.3.4	Training Algorithm			
	5.3.5	Kohonen Self-Organizing Motor Map			
5.4	Learni	ing Vector Quantization			
	5.4.1				
	5.4.2	Architecture			
	5.4.3	Flowchart			
	5.4.4				
	5.4.5	Variants			
	5	5.4.5.1 LVQ 2			
		5.4.5.2 LVQ 2.1			
		5.4.5.3 LVQ 3			
E E	Count	1			
5.5					
	5.5.1				
	5.5.2				
		5.5.2.1 Architecture			
		5.5.2.2 Flowchart			
		5.5.2.4 Testing (Application) Algorithm			

	5,5,3	Forward-Only Counterpress	
		Forward-Only Counterpropagation Net 5.5.3.1 Architecture	
		5.5.3.2 Flowchart	
		5.5.3.3 Training Algorithm	
	Adam		
	5.6 Adapt 5.6.1	Theory Network	
	5.0.1	Incory	
		5.6.1.1 Fundamental Architecture 5.6.1.2 Fundamental O	
		Tundamental Operation D	
	5.6.2	5.6.1.3 Fundamental Algorithm	
	51012	Theory 1	
		Architecture	
		- Towellart Of Training Drope	V1/2 15 months
	5.6.3	II dillillo A locavitle	
		Adaptive Resonance Theory 2 5.6.3.1 Architecture	
		5.6.3.2 Algorithm	
		5.6.3.3 Flowchart	
		5.6.3.4 Training Algorithm	
		5.6.3.5 Sample Values of Parameter	
5.7	Summa	values of Parameter	
5.8	Solved	Problems	
5.9		Questions	
5.1		e Problems	
5.1			
1	rojeca		
C	apter 6	Charlet M.	
	iapter o	Special Networks	
6.1	Introduc	ction	and a second second
6.2	Simulate	ed Annealing Network	
6.3		unn Machine	
		Architecture	
		Algorithm	
			and Trauming Algorithm
		B the Weights of the Netwo	
6.4		6. 3.2.2 Testing Algorithm Machine	
6.5			
	Cauchy I		
6.6		stic Neural Net	
6.7	Cascade	Correlation Network	
6.8	Cognitro	n Network	
6.9	Neocogn	itron Network	
6.10	The last section of the second	Neural Network	
6.11		TOURAL TICKHOIR	
	Logicon	Projection Natural Model	
6 10		Projection Network Model	
6.12	Spatio-Te	emporal Connectionist Neural Network	
6.12	Spatio-Te		
	Spatio-Te Optical N	emporal Connectionist Neural Network Jeural Networks	
	Spatio-Te Optical N 6.13.1 E	emporal Connectionist Neural Network leural Networks lectro-Optical Multipliers	
	Spatio-Te Optical N 6.13.1 E 6.13.2 H	emporal Connectionist Neural Network Jeural Networks	

Ensemble Neural Network Models 6.15.1 Model of an Ensemble Neural Network Architecture 6.15.2 Ensemble Neural Network Training Algorithm 6.16 Summary 6.17 Review Questions **Third-Generation Neural Networks** Chapter 7 Introduction 7.1 7.2 Spiking Neural Networks 7.2.1 Architecture of SNN Model 7.2.2 Izhikevich Neuron Model 7.2.3 **Encoding of Neurons in SNN** 7.2.4 Learning with Spiking Neurons Spike Prop Learning Algorithm 7.2.5 Spike Time-Dependent Plasticity (STDP) Learning 7.2.6 Convolutional Neural Networks 7.3 Layers in Convolutional Neural Networks 7.3.1 Architecture of a Convolutional Neural Network 7.3.2 Designing the Layers in CNN Model 7.3.3 Design of Convolutional Layer 7.3.3.1 Design of Pooling Layer 7.3.3.2 Layer Modelling in CNN and Common CNN Nets 7.3.4 Conversion of Fully Connected Layer to Convolutional Layer 7.3.4.1 **CNN Layer Sizing** 7.3.4.2 Common CNN Nets 7.3.4.3 Limitations of CNN Model 7.3.5 Deep Learning Neural Networks 7.4 Network Model and Process Flow of Deep Learning Neural Network 7.4.1 Training Algorithm of Deep Learning Neural Network 7.4.2 **Encoder Configurations** 7.4.3 Extreme Learning Machine Model 7.5 ELM Architecture and Training Algorithm 7.5.1 Other ELM Models 7.5.2 Online Extreme Learning Machine 7.5.2.1 Pruned Extreme Learning Machine 7.5.2.2 Improved Extreme Learning Machine Models 7.5.2.3 Applications of ELM 7.5.3 7.6 Summary

Chapter 8 Clustering of Self-Organizing Feature Maps

8.1 Introduction

7.7

- 8.2 Concept of Clustering8.2.1 Basic Clustering Algorithm
- 8.3 Training of SOMs
- 8.4 Clustering of SOM: Method I

Review Questions

8.4.1 Automated Procedure to Determine Partitioning from the Clustering Tree