

PART-A

a) inspired by Evolution biology and perform selection, crossover and mutation

- Survival of the fittest
- Charles & Darwin theory
- Selection, crossover & mutation

b)

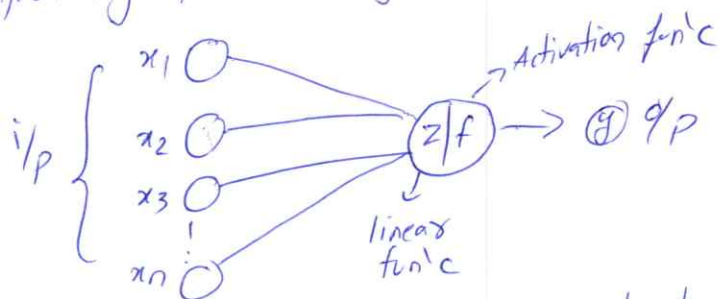
Hill climbing

- Heuristic search
- stuck in local maxima
- premature convergence

Simulated Annealing

- meta heuristic search
- move to global maxima
- convergence

c) Input layer, Hidden layer, output layer



d) Supervised learning :-

- 1) stochastic gradient descent
- 2) Batch gradient descent
- 3) Mini-Batch gradient descent

Unsupervised learning :-

- 1) clustering

Reinforcement learning :-

- 1) Q-learning

e) Swarm intelligence, swarm space, particles
Ex: ant colony optimization

f) Ant colony, pheromone, shortest path

g) inspired by biological immune system (antibodies, sensors)

h) → self space

→ mutation

→ Negative selection (self, non-self)

→ Hyper mutation

(i) Gene sequence, protein structure, drug discovery, Disease analysis.

(j) visualization, piechart, bar graph, virtual reality, augmented reality.

PART - B

(2) problem solving in AI is viewed search process, space of possible state to reach goal state.

=> AI system explore different path, evaluate them, and choose the best one.

=> problem solving = search for a sequence of actions from initial state - goal state

=> Search space

=> Search strategies, each node = state, each edge = action

Components : initial state, Goal state, operators, state space, pathcost

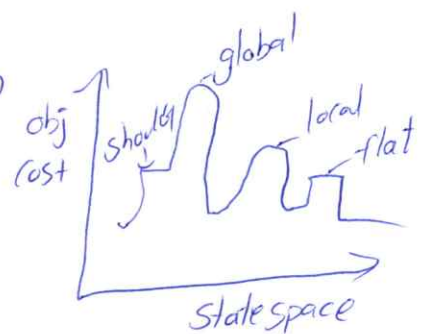
Ex: puzzle problem

Hill climbing algorithm :- Heuristic search algorithm

-> increasing value

-> Best possible solution.

-> Does not back track



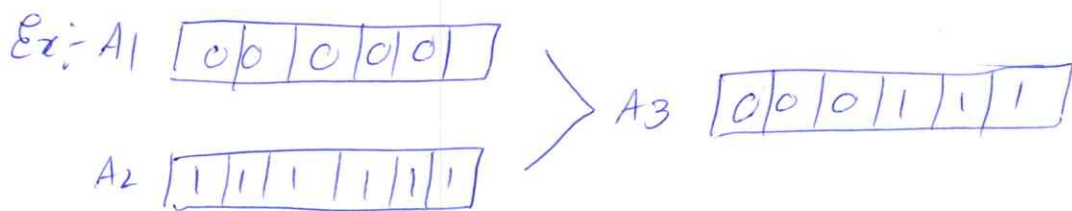
Ex: ① maximize the function

② maintain climbing

(3) Evolutionary Biology optimization technique inspired by nature evolution Darwin Theory, survival of the fittest, works through selection, crossover, mutation.

Working :-

- > Initialization (population)
- > Fitness evaluation
- > Selection
- > Crossover
- > mutation
- > Termination



Computing methods

Selection, crossover, mutation, offspring

(4) Neural network Architecture $\rightarrow$ neurons $\rightarrow$ layers $\rightarrow$ connected.
architectures $\rightarrow$ classification, prediction, pattern recognition, image processing

Architectures: (i) Feed forward neural network (FNN)

$\rightarrow$ input $\rightarrow$ hidden $\rightarrow$ output

$\rightarrow$ No cycles or loops

(ii) Convolutional Neural Network (CNN)

$\rightarrow$ Uses convolutional images

$\rightarrow$ image classification

$\rightarrow$ convolutional, pooling, Activation, fully connected

(iii) Recurrent neural network (RNN)

$\rightarrow$ feedback connection

$\rightarrow$ Maintain memory of previous input

(iv) LSTM (Long short Term memory)

$\rightarrow$ Special RNN that solve vanishing gradient

$\rightarrow$ memory cell, input, forget, output

(v) Generative Adversarial Network (GAN)

$\rightarrow$ Generator + Discriminator.

$\rightarrow$ completes and learns to generate new synthetic data.

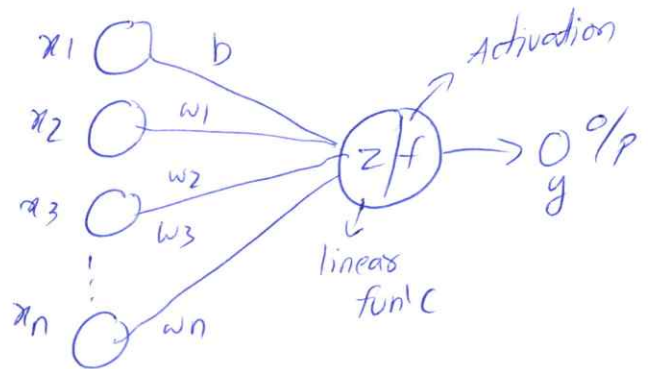
⑤ Artificial neural network is computational model inspired by Biological neural network

→ neurons → layers

→ Solve complex problems, pattern recognition, prediction & classification

Architecture :-

- ① Input layer
- ② Hidden layer
- ③ output layer

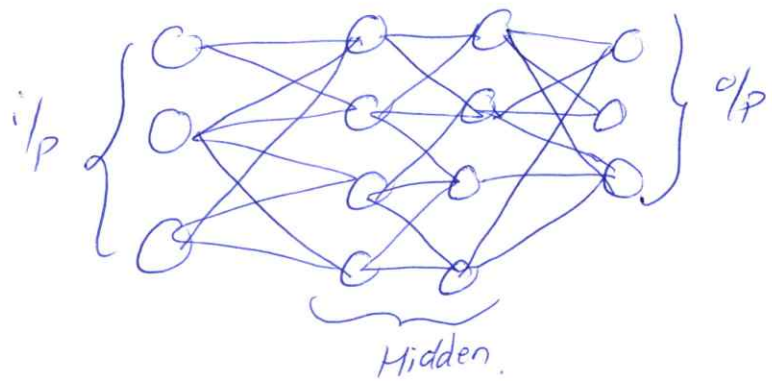


Working :-

- input layer
- weighted sum
- activation func
- update.

Types :-

RNN	perception
LSTM	MLP
CNN	
FFN	



⑥ Learning Algorithms

- (i) Supervised learning
- (ii) Unsupervised learning
- (iii) Reinforcement learning

⑥ Swarm robotics → Swarm intelligence
ant colony, bees, fish, birds

⇒ Features :-
Decentralization
Self-organization
Scalability
Adaptability.
Robustness
Cooperation

⇒ Actuators, Detectors and Result.

Diagram

Robot 1

Robot 2

Robot 3

Target/goal.



Applications :-

- AIML
- Healthcare
- Construction
- optimization
- routing & scheduling
- Robotics

⑦ Social Adaptation of Knowledge in Swarm intelligence

- collective learning
- Local interaction → Global Behaviour
- Knowledge sharing
- Self-organizing
- positive feedback
- Robustness
- Flexibility
- Adaption.

⑧ Clonal selection → B cells

- ⇒ antigens → antibodies
- ⇒ inspired by Biological immune system
- ⇒ To solve complex pathogens.

Working :- Initialization.

Affinity evaluation

Selection

Clonal expansion / cloning

Hyper mutation

memory storage

Update / Replace

Termination.

Affinity maturation :- improving antibodies to fit with antigens
High Affinity → High selection

⑨ Bone marrow :- Immuno computing

→ B-cells, maturation, filtering

→ Used in AIS

→ To generate detectors, activators, optimize, eliminate

Key points :- Generation B-cells

Self-NonSelf

Survival of cells

Clonal selection & maturation

Steps :

Candidate Generation



Self / Non-Self



Negative selection



Clonal expansion



Hyper mutation

Affinity maturation



memory Formation



output

⑩ Bioinformatics Combination of Biology, computer science, information technique, mathematics to store, analyze & manage.

⇒ It develops tools and algorithms

⇒ Biological process

⇒ Gene Sequence

⇒ protein prediction

⇒ drug design

⇒ Disease analysis

⇒ It uses DNA and RNA

⑪ Information Display

⇒ visualization

⇒ pie chart, bar graph, Heatmaps, Histogram

⇒ visualize tools

⇒ ~~types~~ ⇒ ① Virtual reality ② Augmented reality

⇒ Representation

⇒ 3D-graph

⇒ graphical & pictorial

⇒ pixel orientation

⇒ Tools (Power BI, Tableau, Qlik)

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CSM

Volume
~~Vociety~~
Value
Vessity

Subject: NIC (AI702PC)

CSM

Key Answers and valuation criteria

PART A

- ① a) Definition ($\frac{1}{2}$) and significance ($\frac{1}{2}$) marks
- b) Atleast 3 differentiation (1) marks
- c) Structure (1) mark,
- d) Atleast 3 list of ANN (1) mark
- e) Defination of S.I ($\frac{1}{2}$) & example ($\frac{1}{2}$) mark
- f) Role of ANO (1) mark
- g) Defination (1) mark
- h) Atleast 4 importance of NSA (2) mark
- i) 2 applications (1) mark
- j) case study atleast 2 (1) mark

Past B

- 2) problem solving (5) marks and Hill climbing alg with example (5) marks
- 3) Evolutionary Biology (5) and methods (5) marks
- 4) Types of NN architecture and diagram & example (5) marks
- 5) ANN description(s) and learning algorithm (5) marks.
- 6) Concept of Swarm Robotics(s) in Swarm intelligence (5) marks application
- 7) Concept of social Adaptation and Swarm Intelligence (10) marks
- 8) Working of clonal selection (5) and Affinity maturation (5) marks.
- 9) Description of Bone marrow model (5) and computational relevance (5) marks
- 10) Bioinformatics use in Nature inspired computing - analysis (10) marks
- 11) Explanation of I.D (5) and relevance of NIC (5) marks

