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What is pattern? What one different approches in pattern recognition? How dato is classified using pattern classification? Explain

Pattern -

01

Pottern is everything around in this digital world. A pottern can be either seen physically of offerthere be observed mathematically by applying offerthms.

Different approaches in pattern recognition

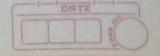
- 1) Statistical Pattern Recognition.

 This approach involves modeling potterns using statistical techniques such as probability distributions.
- 2) Newson Networks
 Prilizing ANNS to secognize potterns by learning
- 3) Machine learning
 Employing various machine learning algorithm

 to identify pattern and make predictions

 based on training data.
- comparing input data with predefined templates or prototypes.

s) clustering -



Grouping input similar data points tegether based en certain features ar characteristics.

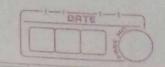
Process of data classification using pattern
i) Feature ExtractionIdentifying relevant features in the input
data that distinguish patterns

in Training Using a labeled dataset to teach the classifier
how to recognize different patterns.

Evaluating the classifier's performance on new unseen data to assess it's ability to generalize

In) classification -

Assigning input data to one or more predefined classes based on the learned patterns.



5:3 What is reason terration of Explain the reason signal function with suitable example.

Medicines one the basic building blocks of the revious system function of neurons is the troops to signals in the form of electrical impulses A heaven receives signals through its dendrites processes this infarmation in the cell body and the transmits the signal along its area to communicate with other heavens or effector cells.

- i) beceive intarmotion
- ii) Integrate incoming signals
- iii) communicate signals to target cells

The signal transmission in a neuron con be explained through the following step 1) Pereption-

bendaites receive from other neurons or sensory receptors. These signals one typically in the form of neurotransmitters

2) Integration-

The cell body integrates the received signals. It the combined signals reach a centarn threshold an action potential is generated. This is a rapid. electrical impulse that travels along the oxon of the neuron.

3) Propagation The action potential travels down the axon



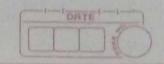
across the cell membrane

1) Axen Terminal
The action potential reaches the amon terminal prompting the release of neurotransmitter into the synapse

S) Synaptic TransmissionNeurotransmitters cross the synapse and bind to receptors are the demonsters of the nightening neuron, transmitting the signal to continue the process.

e.9.

consider a sensory neuron responsible for conveying the sensative of hood. When you touch a hot surface, specifized receptors in your skin generate electrical signals. Twise signals are then transmitted as action potential the sensory neuron. The nearons wiltimately leading to the perception of heat in your brain



as what one linear and non-linearly seperable problems? How it is classified using various algorithms using ANNs.

A) Linear seperable
In a linearly seperable problems a stronght

line can complexitly seperable the closes.

c.g. Imagine a 2D space where prints from two classes can be perfectly suppressed by a straight line

B) MON-linear seperability-

In a non-linearly seperable problems, a simple straight line connot effectively divide the classes and a more complex boundary is required.

erg. Points from two closses may be intent winded in a way that connot be orderetely seperated by a stroight line

classification using Artificial Neural Networks
i) Linear separability in ANN-

For linearly separable problems, a sangle layer perceptron (SLP) con be safficient. SLP's have one layer ilp nodes and a single layer of olp nodes with a linear activation function. They can be learn and classify linearly separable patterns.

ii) Non-linearly separatele problems multi-



layer perceptions (MLPs) with hidden laters and non-linear action and other and non-linear and non-linear and character and contrar function allows Anns models and learn complex non-linear relationships in the data,

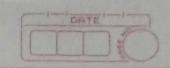
in) Activation tunction -

common non-linear activation functions includes

- sigmoid sequasher of p between opind !
- Hyperbolic Tongent (tont) sequensho ofp between -1 and 1.
- Rectified lines unit (Relu) Allows positive values to pass through while negative values are set to semo.

- enshol vappin (ni

the introduction of hidden layers in ANNs
provides the copacity to least intricate
potterns making them suitable for nonlinearly seperatele problems. The back propagate
algorithm is common used to train ANNs
by adjusting weights based on the error
in prediction.



of what is linear separable problem? How it is solved using logic gates? Give the example of few gates with sample data

Linearly seperable problem is one when the closers are contegories can be separated by a stronght line Essentially. It means that there exists a linear decision boundary that can accurately distinguish between different closers in the dotases.

solving linearly separate problems using logic gates-

Logic gates non be used to represent simple decision boundries. Each logic gate correspond to a specific operation, and nombinations of these gates can areate more complex decision rules. Here one a few examples of logic gates.

1) AND Gote -

inputs one true (1)

e.g. a b output

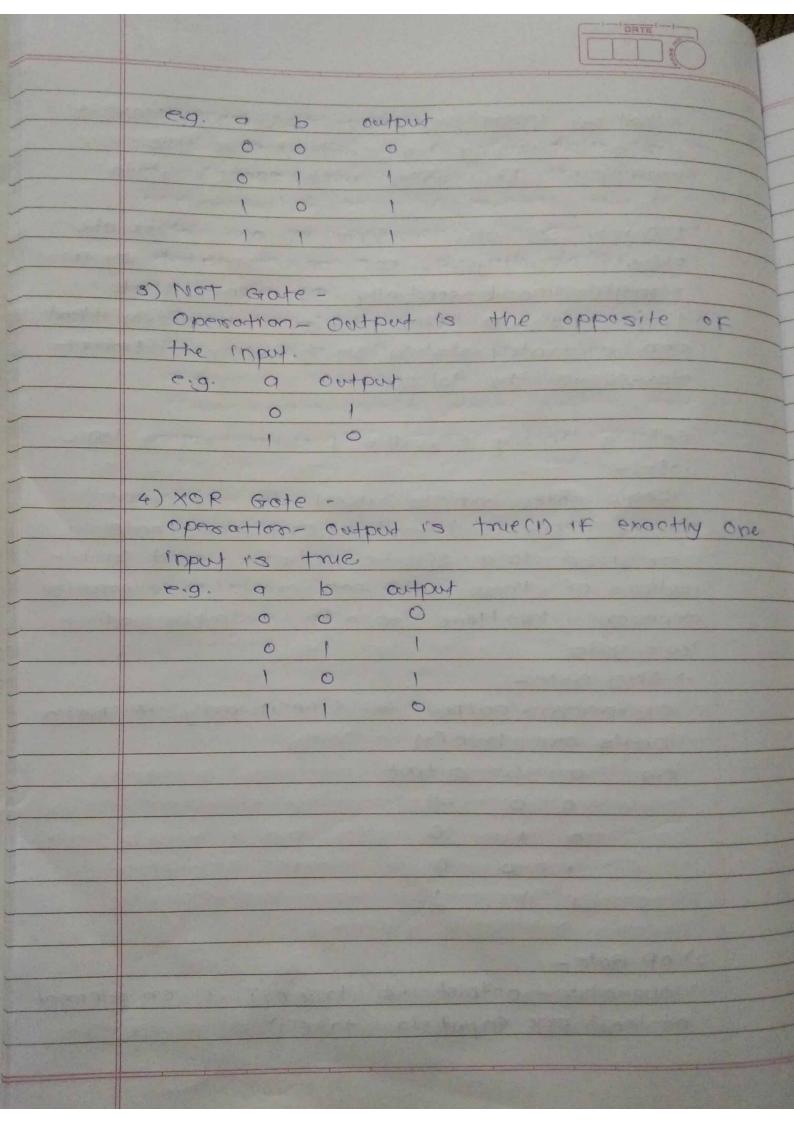
0 1 0

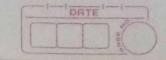
100

1 1

2) OP Gate -

operation - output is true(1) if on element of least one apput is true(1)





as what non-linearly separable problem? Explain

A non-linearly separatele problem is and where classes ar notegaries connot be separated by decision boundary involving chaves or non-linear shapes is required to anarately distinguish between different classes in the data set.

xob beoplew -

The xor problem is a classic example of a binary operation that returns true only if the number of true inputs are add.

The xor problem arises when trying to find a linear decision boundary to seperate the two classes of xor data points.

NOR Touth table

a b output

o o o

o 1

1 o 1

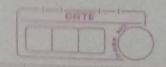
In the xor truth table the olp is true
if the inputs one different and talse if
the inputs one the same. Attempting to
use a single stronght line to separate the
points with olp. I from those with olp



Is not possible.

If you plot the nor doto points in a so share with jubril ou the x-axis and input 2 on the x-axis, you will trad that no single stroight line can accomplety divide the data into two classes. TO X MINIO IN INC. 01-3-3

Here a represents data paints and you can sent that a strongh line connot seperate the point with output I from those with output o.



a. 6 state and explain preception learning algorithm

The perception learning algorithm is a supervised learning algorithm used for binary
classification tasks. It was developed by
fromk Rosenblotian in 1957, and is toundation
for building neural networks. The perception
is a simple model of biological neuron, and
it's learning algorithm involves adjusting
weights to learn a decision boundary that
seperates different alosses steps of perception
learning algorithm.

1) Initialize weight and Bios.

Initialize the overght (w) and bios (b)

with small rondom value.

2) Input and Activation -

the weighted sum of the input teatures and add the bias. This is the input to the activation function.

The activation function traditionally a step function determines the output (0-1) based on whether the weighted sum is above or below a threshold.

31 Update neights -

It the perceptron macrossifier an example update the weight and bios to reduce the error.



the weight apporte formula for the i-th weight (wi) is

wi = wi + 10000 ing - rate * (desired - output
actual of) * input i;

The pias is abouted similarly;

a) Repeat
pepeat step 2 and 3 for each learning

example in the dataset

Iterate through the dataset multiple times

achieves satisfactory performance

The goal of perceptorn learning algorithm is to find weights and a bias that allo the perceptorn to correctly classify all training examples. It's important to note that the perceptorn is limited to solving linearly separable problems. It can't learn non-linear decision boundaries