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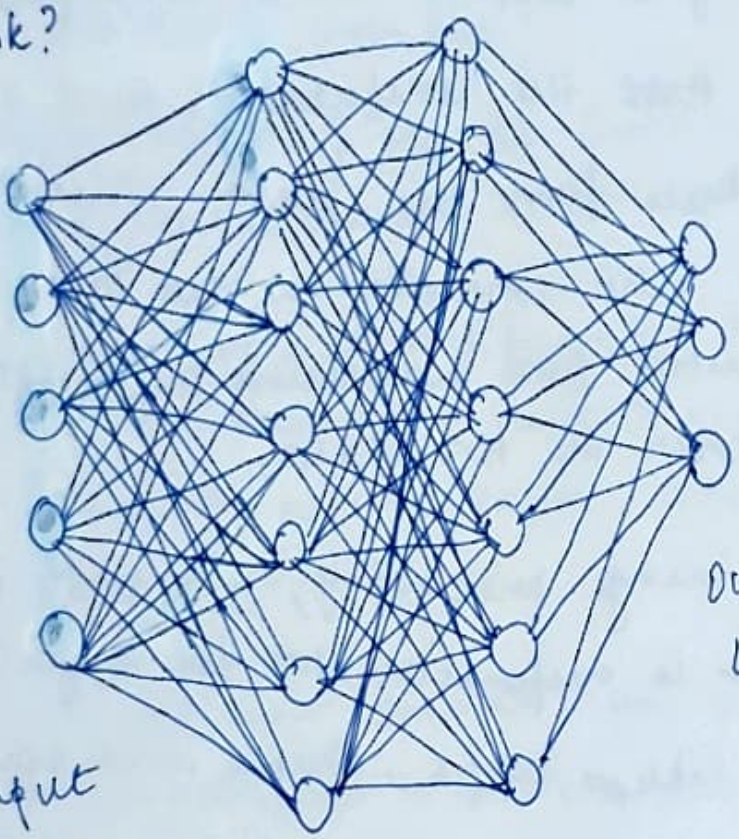
Deep Learning and Artificial Intelligence

Assignment - 4.2

Q 1) Explain the different layers in Neural Network?

Ans)



Input Layer :- The data we feed into the model is loaded into the input layer from the external sources like a .csv file or a web service. It is the only visible layer in the complete Neural Network Architecture that ~~~~ passes ~~~~ passes complete info. from the outside

words without any computation.

Hidden layer :- The hidden layer are ~~what~~ what makes deep learning what ~~it~~ it is today. They are intermediate layers that do all the computation and extract the features from the data. There can be multiple inter-connected hidden layer that are accounted for scanning different hidden ~~feat~~ features in the data.

Eg :- In image processing, the first hidden layer is responsible for higher level features like edges, shapes and boundaries.

→ later hidden layer performs most complicated tasks like identify complete objects / a car a building a person etc.

Output layer :- takes input from the preceding hidden layers and comes to a final prediction based on the model's learnings. It is the most important layer where we get the final result.

a case of classification or regression models, the output layer generally has a singer node. However, it is completely modality specific and ~~depend~~ depend on the way in which the nodes was built.

Q3) What will happen if the ~~to~~ learning ~~rate in~~ rate in of a Neural Network is too high?

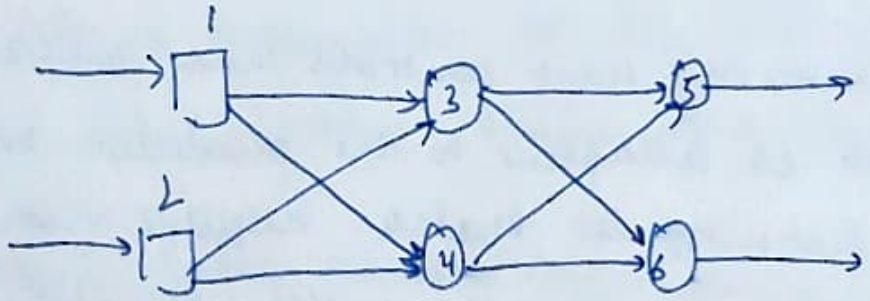
Ans) Learning rate is configurable hyperparameter used in the training of neural networks that has a small positive value, often in the range between 0.0 and 1.0.

The learning rate controls how quickly the model is adapting to the problem. smaller ~~learn~~ learning ~~to~~ rates require more training epochs given the smaller changes made to the weights each update, whereas large learning rates result in rapid changes and fewer training epochs. A ~~too~~ learning rate that is too large can cause the model to converge too quickly to a suboptimal solution ~~s~~. Consider the case where one ~~wants~~ came

near an optimum, but all of a sudden, due to higher learning rate, you ended up just up another, so that you are extremely close to the second and worse local optimum, which makes your next gradient much close to zero and hinders your ability to move out. In a nutshell, high learning rate make your soln more unstable.

Q2) The following ------ pattern:

Ans)



$w_{13} = -2$ $w_{14} = 4$ $w_{35} = 1$

$w_{23} = 3$ $w_{24} = 1$ $w_{45} = -1$

$w_{36} = 1$

$w_{46} = 1$

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

Pattern	P_1	P_2	P_3	P_4
Node 1	0	1	0	1
Node 2	0	0	1	1

(a) Pattern P_1, $X_1 = 0$ and $X_2 = 0$

Input to hidden layer,

$H_1 = w_{13} X_1 + w_{23} X_2 = 0$

$H_2 = w_{14} X_1 + w_{24} X_2 = 0$

$h_1 = \psi(H_1) = 1$

$h_2 = \psi(H_2) = 1$

Hidden to Output Layer,

$H_3 = w_{35} \times h_1 + w_{25} \times h_2 = 0$

$H_4 = w_{36} \times h_1 + w_{46} \times h_2 = 0$

$y_5 = \psi(H_3) = 1$

$y_6 = \psi(H_4) = 1$

(b) Pattern P_2, $X_1 = 1$ and $X_2 = 0$

Input to hidden layer,

$H_1 = w_{13} X_1 + w_{23} X_2 = -2$ $\quad h_1 = \psi(H_1) = 0$

$H_2 = w_{14} X_1 + w_{24} X_2 = 4$ $\quad h_2 = \psi(H_2) = 1$

hidden layer to Output layer,

$H_3 = w_{35} h_1 + w_{45} h_2 = -1$

$H_4 = w_{36} h_1 + w_{46} h_2 = 1$

$y_5 = \psi(H_3) = 0$

$y_6 = \psi(H_4) = 1$

(c) Pattern P_3, $x_1 = 0$ and $x_2 = 1$

Input to hidden layer,

$H_1 = w_{13} x_1 + w_{23} x_2 = 3$

$H_2 = w_{14} x_1 + w_{24} x_2 = -1$

$h_1 = \psi(H_1) = 1$

$h_2 = \psi(H_2) = 0$

hidden layer to Output layer,

$H_3 = w_{35} h_1 + w_{45} h_2 = 1$

$H_4 = w_{36} h_1 + w_{46} h_2 = -1$

$y_5 = \psi(H_3) = 1$

$y_6 = \psi(H_4) = 0$

Pattern P_4, $X_1 = 1$ and $X_2 = 1$

Input to Hidden Layer,

$$H_1 = w_{13} X_1 + w_{23} X_2 = 1$$
$$H_2 = w_{14} X_1 + w_{24} X_2 = 2$$

$$h_1 = \psi(H_1) = 1$$
$$h_2 = \psi(H_2) = 1$$

Hidden to Output Layer,

$$H_3 = w_{35} X_1 + w_{45} X_2 = 0$$
$$H_4 = w_{36} X_1 + w_{46} X_2 = 0$$

$$y_5 = \psi(H_3) = 1$$
$$y_6 = \psi(H_4) = 1$$

Pattern	P_1	P_2	P_3	P_4
Model	0	1	0	1
Model	0	0	1	1
(Output) y_5	1	0	1	1
y_6	1	1	0	1