Lecture # 25 Artificial Neural Networks - concepts & Training

Linear regressor ⇒ linear model
easy to understand

.. review

---Neural network is non-linear model.

(solve the short-coming of linear model)

↓ able to handle complex relations.

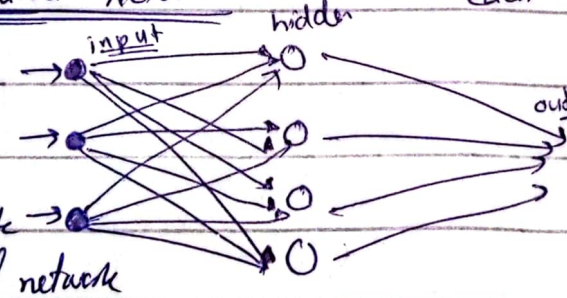
limitation

⇒ can't make hard decision (uncertainty).

-- neurons (simple mathematical functn)

✓ Simple Neural Network

(fully connected) / Standard Neural Network / feed forward neural network / dense neural network / ANN (Artificial Neural Network)



each neuron (linear + non-linearity)

more neurons more non-linearity → so more complex problem can solve

example of different Neural Network

1) CNN (Convolutional Neural Network) ⇒ when image/video as input
2) RNN (recurrent neural network) ⇒ when time series data exaple (company shares)
3) Auto Encoders (import for understanding Bert, GPT)
4) Attention Model (Transformer) ⇒ mainly for NLP like chatGPT

when you want to use neural network → Predictions / Training
all calculations

→ forward propagation (forward pass) (All predictions/inference)

→ backward propagation (backward pass) (Training phase)
(forward + backward)

Hyper-parameters

- وہ چیز جو ڈیٹا سے نہیں سیکھ سکتا بلکہ (Neural Network) بنانے والا اپنے تجربے سے لکھتا ہے (hyper parameter)
- جب کہ دوسری طرف اگر وہ ڈیٹا سے سیکھ رہا ہے تو کہلائے (Parameters)

example of hyper-parameters

- no. of layers
- learning rate
- batch size
- epochs

Practical

(i) input (dataset)
(ii) output

example fashion mnist

① import libraries (tensorflow / PyTorch)
and all other required libraries

② load the dataset (understand & load the data)

③ Data splitting

original data — Training Data / Test Data

3) display data

4) flattening images
(To make into 2D so that it can pass to neurons)
2D matrix ⇒ 1D

example
previous :- (60000, 28, 28) 28×28
after flatting (60000, 784)

and this 784 pass through 784 neurons.

gray-scale ⇒ image 1 channel (Black/white)
coloured image ⇒ RGB 3 channel
each image is matrix.
gray-scale ⇒ 1 matrix
colored-image ⇒ 3 matrix

5) Normalize the data (for better predictions)
(min-max Scaling)

6) one-hot encoding (processing the target variable)

input — one-hot encod (10 classes) → 10 neurons as output on final layer
784 neurons (input neurons) (neurons) لیئر (output) جتنی کلاسز اتنی

7) Setting up hyper-parameters
input_size
batch_size
hidden-
hidden
class
epochs

(Softmax) neuron at last layer of multi-class classification

8) Building FCN Model - Sequential

9) Training model

Goal - less minimize

10) Testing the model