

Deep Learning - intro

Terms

➤ **Neural Network**

A computational model inspired by the human brain consists of interconnected nodes, known as neurons

➤ **Layer**

- *Input* → receives initial data
- *Hidden* → process the input and give it to the output
- *Output* → final layer that produces the output

➤ **Neuron**

Basic units for neural networks that process the input and produce an output

➤ **Weights**

Parameters in neural networks that adjust during the training.

➤ **Activation Functions**

Introducing the non-linearity into the network enables us to learn the complex patterns.

➤ **Loss function**

Measures the difference between the predicted value of a model and the actual value.

➤ **Backpropagation**

The network learns from its mistakes by adjusting the weights of connections based on the difference between its predicted output and the actual output.

➤ **Batch size**

Instead of showing the entire dataset to the model at once, we break it into smaller groups (batches).

➤ **Epoch**

It's like going through the entire set of examples once

➤ **Overfitting**

Overfitting happens when a machine learning model learns the training data too well, including its noise and outliers

➤ **Underfitting**

It's like trying to fit a straight line into a very complex curve.

➤ **Optimization**

Optimization in machine learning involves finding the best set of parameters for a model that minimizes or maximizes a certain metric (like minimizing error)

Process

- *Setup layers and neurons*
- *Randomly activate weights*
- *Set a loss function and optimization algorithm*
- *Get data and split*
- *Start training*
- *Loss calculation*
- *Backpropagation*
- *Predicting*

Types

- *Feedforward Neural Network (FNN)*
- *Multi-Layer Perceptron (MLP)*
- *Convolutional Neural Network (CNN)*
- *Recurrent Neural Network (RNN)*
- *Long Short Term Memory (LSTM)*
- *Gradient Recurrent Unit (GRU)*
- *Auto Encoders*
- *Self-organizing map (SOM)*
- *Generative Adversarial Network (GAN)*
- *Transformer Based Networks*

Types of propagation

- *Forward*
- *Backward*

Application of Deep Learning

- *Image and speech recognition*
- *Self-driving cars*
- *NLP tasks*
- *Game playing*

Advantages of Deep Learning

- *Effective future learning*
- *Excellent performance in future learning*
- *Adaptability*
- *Performance in complex data*

Limitations of Deep Learning

- *Black box nature → can't interpret*
- *Data-intensive → needs a lot of data*
- *Computational intensive*

Loss Functions

- *MSE → for regression*
- *Binary cross-entropy → for binary classify*
- *Categorical cross-entropy → for multiclass classify*

Optimizations

- *Batch gradient descent*
- *SGD*
- *Momentum*
- *RMSProp*
- *Adam*

Activation functions

- *Linear*
- *step*
- *Sigmoid*
- *Tanh*
- *Relu*
- *LeakyRelu*
- *PRelu*
- *Elu*

Regularization

- *Dropout*
- *Early stopping*
- *Batch normalization*
- *Data Augmentation*