- **Activation Functions:** Introduce non-linearity (ReLU often preferred for hidden layers).
- **Learning Rate:** Controls weight update ↓ ıring training.
- **Optimizer:** Adjusts weights to minimize loss (Adam is popular for its adaptability and

Message ChatGPT

ChatGPT can make mistakes. Check important info.

MacBook Air

1- Data Collection:-

Machines collect data using various sensors such as cameras, microphones, LIDAR and other specialized instruments.

The collected data can be in various forms such as images, audio, text or numerical data.

2- Data Processing:-

This involves cleaning and preparing the data for analysis. Steps may include normalization, noise reduction, and feature extraction.

3- Pattern Recognition:-

Machine learning algorithms are used for supervised, unsupervised or reinforcement learning-based.

4- Inference Interpretation:-

The trained Model is used to make predictions or decisions based on new input data.

5 Feedback and Learning:-

The system can continuously improve its performance by learning from new data and feedback.

Perception in machines and Biology refers to how system(either artifical or natural) interpret and understand their environment.

While both aim to process sensory information to generate a meaningful understanding of the surroundings.

Machine Perception:-

1) Sensors.
2) Data Processing.
3) Pattern Recognition.
4) Interpretation.
5) Adaptability.
6) Computational.

Biological Perception:-

1) Senses.
2) Data Processing.
3) Pattern Recognition.
4) Adaptability.
5) Biological.

Machine Perception:-

1- Sensors:- Machines use sensors like camera, microphones and other to collect data from the enviornment.

Example:- A camera for capturing images or a microphone for capturing sound.

2- Data processing:-

Algorithms:- Machine perception relies on algorithms and mathematical models to process sensory data.

Example:- Convolutional Neural Networks (CNN) for image recognition.

3- Pattern Recognition:-

Machine Learning models are trained on large datasets to recognize patterns and make predictions

Example:-

Training a model on a dataset of labeled images to recognize objects.

4- Interpretation:-

Intepretation and decision-making are based on programming rules or learned models.

5- Adaptability:-

Machines can adapt based on new data, but this requires re-training or updating models.

6- Computational:-

Relies on computational power to yaform complex calculations quickly.

GPUs used for training deep learning models.

Biological Perception:-

Living organisms use biological senses such as sight, hearing, touch, taste, and smell to gather information.

Example:- Eyes for vision, ears for hearing.

Senses

2- Data processing:-

Sensory data is processed by the nervous system, primarily the brain, which integrates and interprets the information.

3- Pattern Recognition:-

Biological perception relies on complex neural networks in the brain, which have evolved over time.

4) Interpretation:-

Interpretation is influenced by past experiences, emotions and learning.

5) Adaptability:-

Biological systems are highly adaptable, capable of learning and adjusting to new environments and situations.

6) Biological:-

The brain is highly energy efficient compared to artificial systems. The human brain operates on roughly 20 watts of power, much less than most advanced computational systems.

Neuron:- A neuron is a fundamental unit of brain and nervous system responsible for processing and transmitting information through electrical and chemical signals.

Neural:-
The term pertains to anything related to the nervous system or neurons. It is often used in contexts involving neuroscience, brain function, and neural pathways.

Neural Networking:-
A neural networking is a computational model inspired by the way biological neural networks in the brain process information.
It is used in artificial intelligence (AI) and machine Learning to recognize patterns, classify data and make predictions.

Layers:-
1) Input Layer
2) Hidden Layer.
3) Output Layer.

1) **Input Layer:-** The Layer of neurons that receives the input data.

2) **Hidden Layers:-** one or more layers between the input and output layers where the main processing and feature extraction occurs. These layers transform the input data into a more abstract representation.

3) **Output Layer:-** The Layer of neurons that produces the final output or prediction.

b) **Weights:-** Each connection between neurons has an associated weight that adjusts during training to minimize error and improve the accuracy of network.

c) **Activation function:-** A function applied to the output of each neuron to introduce non-linearity, allowing the network to learn and represent complex patterns.

How neural Networks Work:-

The output of the network is compared to the true values using a loss function to measure the error.

Forward Propagation:-

The input data is passed through the network, layer by layers with each neuron performing a weighted sum of its inputs and applying an activation function to produce an output.

Backward propagation:- (Back propagation).

The error is propagated backward through the network, and the weights are adjusted using optimization algorithms (like gradient descent) to minimize the error.

Min Pooling and Max Pooling:-

Max Pooling:-

Max Pooling is a down-sampling technique used in convolutional neural networks (CNNs).
It reduces the dimensionality of feature maps while retaining the most important information.

Min Pooling:-

Min Pooling is similar to max pooling but instead of selecting the maximum value from each sub-region, it select the minimum value.

Padding:-

Padding is the process of adding extra pixels (usually) zero around the border of an input feature map.

Types:-

) valid padding:- No padding. The output feature map is similar than the input.

Same padding:- Padding added so that the output feature map has the same spatial dimension as the input.

Margin:-

In the context of machine Learning, especially support vector machine (SVM) The margin refers to the distance between the separating hyperplane (decision bundary) and the closet data points (support vectors).

Activation function:-

Activation function introduce non-linearity into the neural network, allowing it to Learn and represent complex patterns.

An activation function in a neural network determines whether a neuron should be activated (i-e its output should be passed on the next level) based on the weighted sum of its inputs.

Why we need Activation functions:-

Without activation functions, neural networks would just be linear model, no matter how many layers they have. Linear models can only solve problems where the relationship between input and output is a straight line. Activation functions introduce non-linearity, allowing networks to solve more complex problems.

Common Activation functions:-

1) Sigmoid 2) Tanh 3) ReLU.

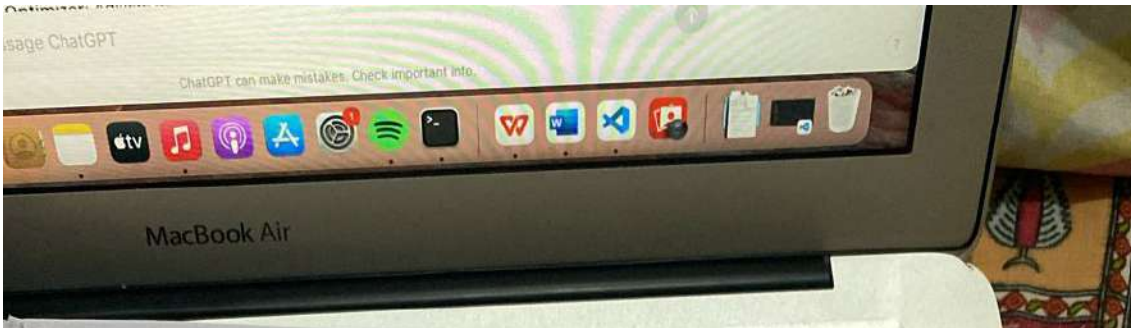
4) Leaky ReLU 5) Softmax.

1) Sigmoid:- Output value between 0 and 1.
It is good for binary classification.
can suffer from vanishing gradient problem.

2) Tanh:- output values between -1 and 1.
Zero-centered, better than ~~sigmoid~~ sigmoid.
can also suffer from vanishing gradient.

3) ReLU (Rectified Linear Unit):-
Outputs the input if possible, otherwise.
Simple, efficient, reduces likelihood of vanishing gradients.

4) Leaky ReLU:-
A variation of ReLU that allows a small gradient when the unit is inactive.
Fixes dying ReLU problem.



5) Softmax:- converts logits to probabilities, used in the output layer for multi-class classification.

Best Activation functions

ReLU and Softmax.
ReLU is generally preferred for hidden layers due to its simplicity and effectiveness.
Softmax:- ~~converts logits~~ is best for the output layer in multi-class classification tasks.

Learning Rate:-

The Learning Rate is a hyperparameter that controls how much the model's weights are adjusted during each iteration of training.

Optimizer:-

Optimizer are algorithms that adjust the weights of the neural network to minimize the loss function.

Types of optimizers:-

→ Gradient Descent.
1) Batch Gradient Descent.
2) Stochastic Gradient Descent.
3) Mini- Batch Gradient Descent.

→ Momentum:-
Accelerates gradient descent by considering the previous gradient direction.

→ RMSprop:- Adapts the learning rate for each parameter by dividing the learning rate by a moving average of the magnitudes of recent gradients.

→ Adam (Adaptive Moment Estimation):-
Combines the benefits of both momentum and RMSprop. It maintains per-parameter learning rates that are adapted based on first and second moments of gradients.

Perceptron in Machine Learning :-

Perception in machine learning refers to the process by which a machine or system interprets and make sense of data from around the world.

This involves a series of steps including :
- > data collection.
- > data processing.
- > pattern recognition.

(to derive meaningful insights or actions.)

Here are some key aspects of perception in machine learning.

1) Data Collection.
2) Data Processing
3) Pattern recognition.
4) ~~Keteep~~ Inference and Interpretation.
5) Feedback and Learning.