If not mentioned , Learning rate = 0.1, epochs = 3 , Batch size = 1 for SGD or full dataset for batch GD, Step activation function for perceptron

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Q1 Task 1

Implement the OR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Task 2

- Use the iris dataset Encode the input and show the new representation
- Decode the lossy representation for the output
- Map the input to reconstruction and visualize

---

Task 1

Implement the OR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Q2 Task 2

- Use the heart disease Dataset
- Create an Auto Encoder and fit it with our data using 3 neurons in the dense layer
- Display new reduced dimension values
- Plot loss for different Auto encoders

---

Q3 Task 1

Implement the OR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Task 2

- Load the Intel Image dataset
- Train and test the dataset
- Create a model using CNN
- Evaluate the model using confusion matrix.

---

Q4 Task 1

Implement the OR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Task 2

- Implement autoencoder
- Use the Iris Dataset
- Create an autoencoder and fit it with our data using 2 neurons in the dense layer
- Plot loss w.r.t. epoch
- Calculate reconstruction error using Mean Squared Error (MSE).

---

Q5 Task 1

Implement the NOT Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Task 2

1. Use the Iris Dataset
2. Create an Auto Encoder and fit it with our data using 3 neurons in the dense layer
3. Display new reduced dimension values
4. Plot loss for different encoders

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Task 1

Implement the OR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Task 2

Use the heart disease dataset and do the following

- Use the Dataset
- Create an autoencoder and fit it with our data using 2 neurons in the dense layer
- Plot loss w.r.t. epochs
- Calculate reconstruction error using Mean Squared Error (MSE).

-----------------------------------------------------------------------------------------------------------

Q6

- Load California Housing dataset and select 2 features (e.g., Median Income, House Age) and 1 target (Median House Value).
- Normalize inputs and initialize a single-layer NN with random weights and bias.
- Perform forward propagation, calculate prediction error, Squared Error, and MSE.
- Update weights and bias using gradient descent.
- Plot Loss vs Weight, Loss vs Bias, and Error Surface.

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Take the dataset of Life expectancy

Initialize a neural network with random weights.

a) Calculate output of Neural Network
b) Calculate squared error loss
c) Plot the mean squared error for each iteration in stochastic Gradient Descent.

-----------------------------------------------------------------------------------------------------------

Task 1

Implement the OR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Task 2

Implement autoencoder

- Use the Wine Dataset
- Create an autoencoder and fit it with our data using 3 neurons in the dense layer
- Calculate loss w.r.t to different epochs and plot using line graph.

-----------------------------------------------------------------------------------------------------------

Q7 Implement Self Organizing Map for anomaly Detection

- Use Credit Card Applications Dataset:

- Detect fraud customers in the dataset using SOM and perform hyperparameter tuning
- Show map and use markers to distinguish frauds.

---

Q8 Train a small neural network (dataset - MNIST classification)
Compare the optimizers:

1. SGD
2. SGD + Momentum
3. Adam

Plot:

1. Training loss vs epochs
2. Accuracy vs epochs

---

Q9

1. Use MNIST or IRIS/ Cifar-10 Dataset
2. Train a model with and without data augmentation (horizontal flip, rotation, noise).
3. Compare generalization performance on the validation set. (Accuracy & Error)
4. Evaluate the model using confusion matrix, precision, recall

---

Q10

1. Implement a tiny SimCLR framework using a small dataset (e.g., CIFAR-10 subset).
2. Use data augmentations.
3. Implement the NT-Xent loss function to compute similarity between pairs.
4. Compare Data with and without Augmentation.

---

Q11

1. Use a pretrained model (e.g., ResNet-50 or MobileNet).
2. Freeze its encoder.
3. Train a classifier head on a different dataset (e.g., Flowers dataset).
4. Compare accuracy with fine tuning

---

Q12

Choose two datasets with different distributions (dogs &cats , cars).

1. Resize images to the required input size of the chosen pre-trained model.
2. Load Pre-trained Model (LeNet-5 or VGG-16)
3. Compare the performances of all the models and visualize
4. Write down your observations and conclusions

---

Choose two datasets with different distributions (dogs &cats , cars).

1. Resize images to the required input size of the chosen pre-trained model.
2. Load Pre-trained Model ( AlexNet or ResNet-50)
3. Compare the performances of all the models and visualize
4. Write down your observations and conclusions

---

1. Choose two datasets with different distributions (dogs &cats , cars).
2. Resize images to the required input size of the chosen pre-trained model.
3. Load Pre-trained Model ( ResNet-50)
4. Compare the performances of all the models and visualize
5. Write down your observations and conclusions

---

- Take the dataset of Breast cancer
- Initialize a neural network with random weights.
- Calculate output of Neural Network:
- Calculate MSE
- Plot error surface using loss function verses weight, bias

- Perform this cycle in step c for every input output pair
- Perform 5 epochs of step d.
- Update weights accordingly using stochastic gradient descend.
- Plot the mean squared error for each iteration in stochastic Gradient Descent.
- Similarly plot accuracy for iteration and note the results

-----------------------------------------------------------------------------------------------------------

Q13

- Take the dataset of Iris.
- Initialize a neural network with random weights.
- Calculate output of Neural Network:
- Calculate MSE
- Plot error surface using loss function verses weight, bias
- Perform this cycle in step c for every input output pair
- Perform 10 epochs of step d.
- Update weights accordingly using stochastic gradient descend.
- Plot the mean squared error for each iteration in stochastic Gradient Descent.
- Similarly plot accuracy for iteration and note the results

-----------------------------------------------------------------------------------------------------------

Q14

- Implement batch gradient descent optimizer function
  Take the dataset of Titanic
- Initialize a neural network with random weights.
- Calculate output of Neural Network:
- Calculate squared error loss
- Update network parameter using batch gradient descent optimizer function Implementation.
- Display updated weight and bias values
- Plot loss w.r.t. Iterations

-----------------------------------------------------------------------------------------------------------

1. Implement the NOR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.
2. Take the dataset of Diabetes 2
   b) Initialize a neural network with random weights.
   c)Calculate output of Neural Network:
      i. Calculate squared error loss
      ii. Update network parameter using batch Mini Batch gradient descent optimizer function Implementation.
      Iii. Display updated weight and bias values
      iv. Plot loss w.r.t. bias values

Q15

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- Take the dataset of Diabetes
- Initialize a neural network with random weights.
  - c)Calculate output of Neural Network:
  - Calculate Mean squared error loss
  - Update network parameter using batch momentum based gradient descent optimizer function Implementation.
  - Display updated weight and bias values
  - Plot loss w.r.t. iterations

-----------------------------------------------------------------------------------------------------------

1. Implement the XOR Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.

Q16

2. Take the dataset of Penguin
3. b) Initialize a neural network with random weights.

   c)Calculate output of Neural Network:

   i. Calculate squared error loss

   ii. Update network parameter using batch Adaptive delta gradient descent optimizer function Implementation.

   iii. Display updated weight and bias values

   iv. Plot accuracy w.r.t. epoch values

---

Q17

1. Implement backpropagation algorithm from scratch.

a) Take Iris Dataset

b) Initialize a neural network with random weights.

c) Calculate Squared Error (SE)

d) Perform multiple iterations.

e) Update weights accordingly.

f) Plot accuracy for iterations and note the results.

---

Q18

Build a multiclass image categorization CNN network which correctly classifies different categories of images in the dataset.(handwritten digits from Mnist digit dataset

- Split original dataset to train and test set
- Build CNN Model
- Generate the accuracy of the built model using Adam Optimizer and Adagrad Optimizer.
- Compare performance of different optimizer on Digit categorization.
- Plot training vs validation accuracy
- Evaluate the model using confusion matrix, precision, recall.

---

Build a multiclass image categorization CNN network which correctly classifies different categories of images in the dataset.( Fashion Mnist dataset.)

- Split original dataset to train and test set
- Build CNN Model
- Generate the accuracy of the built model using RMSProp and SGDOptimizer.
- Perform hyperparameter tuning to increase the accuracy of the CNN.
- Compare performance of different optimizer on Cloth categorization.
- Plot training vs validation loss
- Evaluate the model using confusion matrix, precision.

---

1. Implement CNN and compare its performance using different optimizers

   Take the MNIST dataset

   b) Initialize a neural network basic layers with random weights.

   c) Perform practical analysis of optimizers on MNIST dataset keeping batch size, and epochs same but with different optimizers.

   d) Compare the results by choosing 5 different optimizers [ SGD, Adadelta, Adagrad, Adam, RMSprop] on a simple neural network

---

- Load the CIFAR-10 image dataset.
- Split the dataset into training and testing sets.

Q19

- Design a CNN model for object classification.
- Train and evaluate the model.
- Plot accuracy and loss curves.

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- Use alpaca dataset
- CNN must include : Convolution layer, Pooling layer, Flatten layer,Dense layer
  Plot:
- Accuracy vs Epochs
- Loss (Error) vs Epochs

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Q20

1. Load the Corn 3-Classes image dataset.
2. Preprocess the images:
   a. Resize images to a fixed size (e.g., 224×224)
   b. Normalize pixel values.
3. Split the dataset into training and testing sets.
4. Create a CNN model using:
   a. Convolution layer
   b. Max Pooling layer
   c. Flatten layer
   d. Dense layer
5. Train the CNN model for multi-class classification.
6. Test the model on unseen images.
7. Plot graphs:
   a. Training vs Validation Accuracy
   b. Training vs Validation Loss (Error)

-----------------------------------------------------------------------------------------------------------------

Q7

Implement Self Organizing Map for anomaly Detection

1. Use Credit Card Applications Dataset:
2. Detect fraud customers in the dataset using SOM and perform hyperparameter tuning
3. Show map and use markers to distinguish frauds.

-----------------------------------------------------------------------------------------------------------------

Q21

### Task 1

Implement the NAND Boolean Logic Gate using a Perceptron Neural Network.

- Inputs: x1, x2, bias
- Train using perceptron learning rule
- Output: y
- Display final weights and bias
- Verify truth table results

### Task 2

Use the Iris Dataset

- Normalize the input features
- Perform Min–Max scaling
- Visualize original vs normalized features

---

Task 1

Implement Multi-output Perceptron for

Q22

- AND gate
- OR gate
- Display weight matrix and bias vector

Task 2

Load Flowers Dataset

- Train CNN model with 3 kernals.
- Plot training and validation accuracy using graph.

---

~~Implement perceptron~~

- ~~Train on AND,OR gate~~
- ~~Compare convergence with normal perceptron~~

~~Task 2~~

~~Use Iris Dataset~~

- ~~Encode using Autoencoder (3 neurons)~~
- ~~Decode and reconstruct~~
- ~~Plot original vs reconstructed data~~

---

Use dataset with initial values X = [1.0, 2.0], Y = [0.5, 1.5]

- Initialize neural network with random weights
- Compute output using linear activation
- Calculate MAE and MSE
- Plot loss surface (weight vs loss)

---

~~Use CIFAR-10 Dataset~~

Q23

- ~~Train CNN with and without data augmentation~~
- ~~Augmentations: rotate, zoom, distort images~~
- ~~Compare validation accuracy and loss and plot using Graph~~

---

Implement XOR gate using 2-layer Neural Network

- Use Adadelta optimizer
- Plot accuracy vs epoch

Fashion-MNIST Classification

- CNN with RMSProp & Adam
- Compare confusion matrices

---

Implement the backpropagation algorithm.

1. Take Iris Dataset
2. Initialize a neural network with random weights.
3. Calculate error
4. Perform multiple iterations of NN
5. Update weights accordingly.
6. Plot accuracy for iterations and note the results.

Q24

---

~~Build a multiclass image categorization of CNN network which correctly classifies different categories of images in the dataset.~~

~~1. Take Flower dataset~~
~~2. Split original dataset to train and test set~~

~~3. Build CNN Model~~
~~4. Generate the accuracy of the built model using any optimizer.~~
~~5. Compare performance of different optimizers on Flower categorization.~~

---

~~Train a small neural network (dataset – Cifar- 100 Classification)~~
~~Compare the optimizers:~~

- ~~Adagrad~~
- ~~SGD~~
- ~~Adam~~

~~Plot:~~

- ~~Training loss vs epochs~~
- ~~Accuracy vs epochs~~

---

- ~~Use IRIS Dataset~~
- ~~Train a model with and without data augmentation (horizontal flip, rotation, noise).~~
- ~~Compare generalization performance on the validation set. (Accuracy & Error)~~
- ~~Plot accuracy vs epochs~~
- ~~Plot loss vs epochs~~

---

~~Task 1: Build a small CNN for MNIST digits dataset~~

- ~~Split dataset into train/test~~
- ~~Use 2 convolution layers + pooling + dense~~
- ~~Metrics / Plots: Accuracy, Confusion Matrix, Precision & Recall, plot training vs validation accuracy and loss~~

~~Task 2: Compare Adam vs SGD optimizer~~

- ~~Metrics / Plots: Plot training loss & accuracy for each optimizer~~

---

Q25

- Calculate and plot all activation functions (Sigmoid and tanh) for input ranging in (-10, +10)
- Calculate and plot Derivative of given Activation function and plot also observe the behaviour of curves.
- Consider a target vector Y and prediction vector $\hat{Y}$. Calculate MSE and MAE.

---

- Calculate and plot all activation functions ( Tanh and Relu) for input ranging in (-5, +5)
- Calculate and plot Derivative of given Activation function and plot also observe the behaviour of curves.
- Consider a target vector Y and prediction vector $\hat{Y}$. Calculate MSE and MAE.

---

1. Calculate and plot all activation functions (Sigmoid, Relu and softmax) for input ranging in (-10 to +10)
2. Calculate and plot Derivative of given Activation function and plot also observe the behaviour of curves.
3. Consider a target vector Y and prediction vector $\hat{Y}$. Calculate MSE and MAE.

---

~~Task 1~~
~~Implement the AND Boolean logic gate using perceptron Neural Network. Inputs = x1, x2 and bias, weights should be fed into the perceptron with single Output = y. Display final weights and bias of each perceptron.~~

Task 2

1. Use the titanic Dataset

Q26

2.Create an Auto Encoder and fit it with our data using 3 neurons in the dense layer
3. Display new reduced dimension values
4.Plot loss for different encoders [ Sparse Autoencoder, Noise Autoencoder]

---

~~Use dataset – MNIST digit classification~~
~~Create a neural network and apply following optimizers~~

- ~~SGD~~
- ~~SGD + Momentum~~
- ~~Adam~~

Plot the comparison using ROC curve

---

1. ~~Use MNIST or IRIS/ Cifar-10 Dataset~~
2. ~~Train a model with and without data augmentation (horizontal flip, rotation, noise).~~
3. ~~Compare generalization performance on the validation set. (Accuracy & Error)~~
4. ~~Observe improvements and plot the graph.~~

---

- ~~Load California Housing dataset, select 2 features (e.g., Median Income, House Age) and 1 target (Median House Value).~~
- ~~Normalize inputs and initialize a single-layer neural network with random weights and bias.~~
- ~~Perform forward propagation and calculate prediction error, Squared Error, and MSE.~~
- ~~Update weights and bias using gradient descent.~~
- ~~Visualize or analyze how loss changes with weight and bias and observe the error surface.~~

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- ~~Load Iris dataset~~
- ~~Normalize inputs and create an autoencoder with 2–3 neurons in the dense layer.~~
- ~~Encode and decode the inputs.~~
- ~~Calculate reconstruction error (MSE) and analyze the results.~~
- ~~Observe loss progression over epochs and compare with different encoder configurations.~~

---

- ~~Load a small image dataset (Intel Image or CIFAR-10 subset).~~
- ~~Preprocess images and split into training and testing sets.~~
- ~~Build and train a CNN model.~~
- ~~Evaluate the model using confusion matrix, precision, recall, and accuracy.~~
- ~~Analyze training vs validation metrics over epochs to check generalization.~~

---

- ~~Load MNIST or Fashion-MNIST dataset.~~
- ~~Train a small neural network with different optimizers: SGD, SGD+Momentum, Adam.~~
- ~~Evaluate accuracy and ROC curve for each optimizer.~~
- ~~Compare training loss, validation loss, and overall performance across optimizers.~~

---

- ~~Load California Housing dataset and select 2 features (e.g., Median Income, House Age) and 1 target (Median House Value).~~
- ~~Normalize inputs and initialize a single-layer neural network with random weights and bias.~~
- ~~Perform forward propagation and calculate prediction error, Squared Error, and MSE.~~

- ~~Update weights and bias using gradient descent.~~
- ~~Visualize or analyze how loss changes with weight and bias and observe the error surface.~~

----------------------------------------------------------------------------------------------------------------

~~Task 1: Implement a small CNN for CIFAR-10 subset~~

- ~~Preprocess & normalize images~~
- ~~Convolution + Pooling + Flatten + Dense layers~~
- ~~Metrics / Plots: Accuracy, Confusion Matrix, Precision & Recall, plot training vs validation accuracy/loss~~

~~Task 2: Apply data augmentation (flip, rotate, noise)~~

- ~~Compare performance with original data~~
- ~~Metrics / Plots: Plot accuracy vs epochs and loss vs epochs~~

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