Weekly Assessment

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ACTIVITY 1

AIM :

Using a deep learning framework of your choice (TensorFlow, PyTorch, etc.), implement a CNN to classify images from the CIFAR-10 dataset. Ensure your network includes convolutional layers, pooling layers, and fully connected layers. Evaluate the performance of your model and discuss any improvements you could make

LIST OF HARDWARE/SOFTWARE USED:

- Windows OS
- VS Code
- PyTorch

PROCEDURE:

Step 1: Open VS code

Step 2: Create a new Python file

Step 3: Rename the file and type the code to execute the program.

Step 4: Save and run the code

CODE :-

1. Import libraries

```
import tensorflow as tf
from tensorflow.keras import datasets, layers, models
import matplotlib.pyplot as plt

```

2. Load and Preprocess the CIFAR-10 Dataset

```
(train_images, train_labels), (test_images, test_labels) = datasets.cifar10.load_data()

train_images, test_images = train_images / 255.0, test_images / 255.0
```

3. Define the CNN Model

```
model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3), activation='relu', input_shape=(32, 32, 3)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
```

4. Define Loss Function and Optimizer

```
model.add(layers.Flatten())
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(10))
model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=True),
              metrics=['accuracy'])

# Train the model
history = model.fit(
                    validation_data=(test_images, test_labels))
```

(function) validation_data: Any

5. Train the Network

```
history = model.fit(train_images, train_labels, epochs=10,
                    validation_data=(test_images, test_labels))
```

6. Evaluate the Network

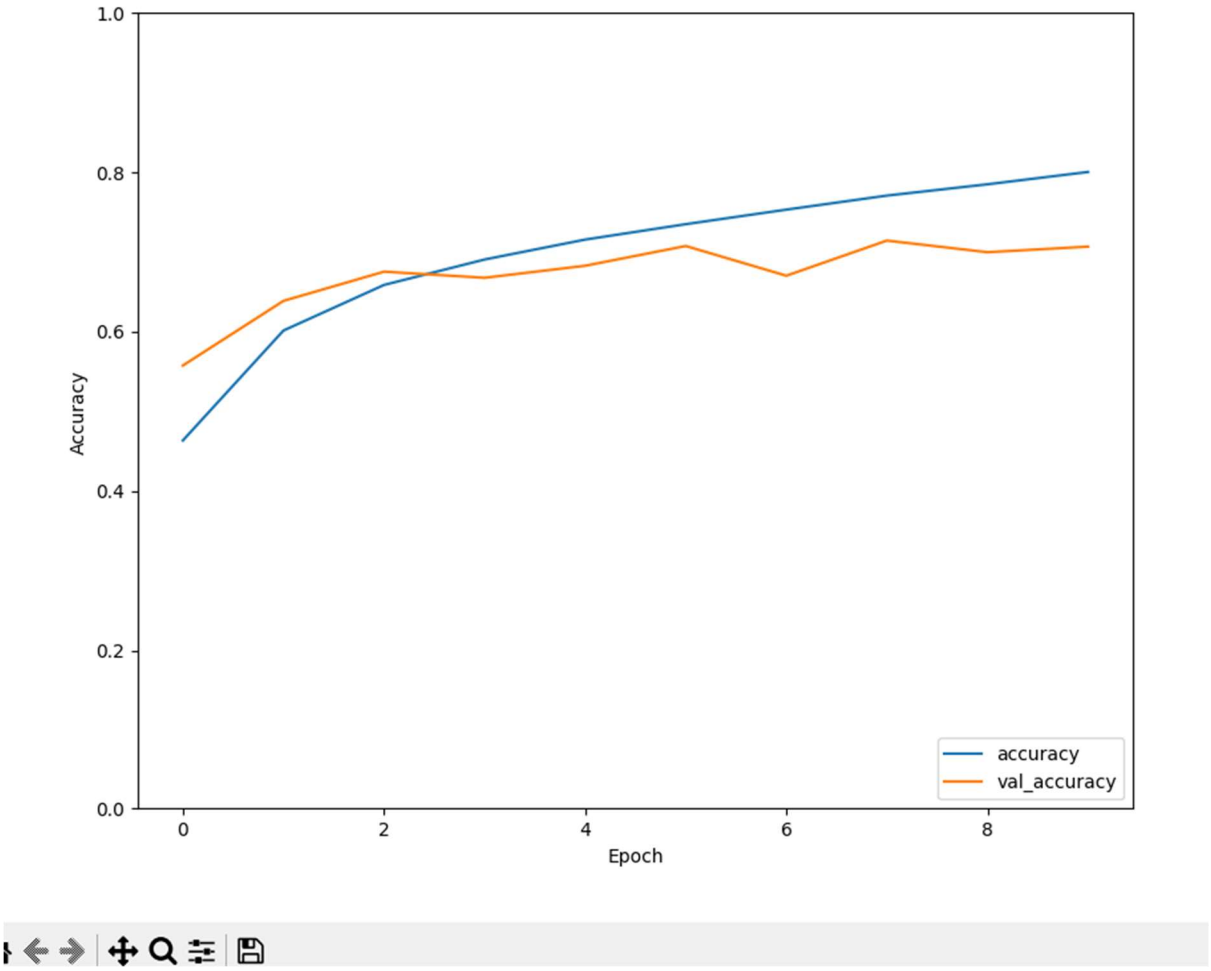
```
test_loss, test_acc = model.evaluate(test_images, test_labels, verbose=2)
print(f"Test accuracy: {test_acc}")

# Plot training history
plt.plot(history.history['accuracy'], label='accuracy')
plt.plot(history.history['val_accuracy'], label = 'val_accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.ylim([0, 1])
plt.legend(loc='lower right')
plt.show()
```

CODE:

```
import tensorflow as tf
from tensorflow.keras import datasets, layers, models
import matplotlib.pyplot as plt

# Load and preprocess the CIFAR-10 dataset
(train_images, train_labels), (test_images, test_labels) =
datasets.cifar10.load_data()

train_images, test_images = train_images / 255.0, test_images / 255.0

# Define the CNN model
model = models.Sequential()
model.add(layers.Conv2D(32, (3, 3), activation='relu', input_shape=(32, 32,
3)))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))
model.add(layers.MaxPooling2D((2, 2)))
model.add(layers.Conv2D(64, (3, 3), activation='relu'))

model.add(layers.Flatten())
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(10))
model.compile(optimizer='adam',
              loss=tf.keras.losses.SparseCategoricalCrossentropy(from_logits=T
rue),
              metrics=['accuracy'])

# Train the model
history = model.fit(train_images, train_labels, epochs=10,
                    validation_data=(test_images, test_labels))

# Evaluate the model
test_loss, test_acc = model.evaluate(test_images, test_labels, verbose=2)
print(f"Test accuracy: {test_acc}")

# Plot training history
plt.plot(history.history['accuracy'], label='accuracy')
plt.plot(history.history['val_accuracy'], label = 'val_accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.ylim([0, 1])
plt.legend(loc='lower right')
plt.show()
```

Output:

```
313/313 - 1s - loss: 0.8506 - accuracy: 0.7158 - 873ms/epoch - 3ms/step
Test accuracy: 0.7157999873161316
```



RESULT:

The program is successfully completed

ACTIVITY 2

AIM: Construct a feedforward neural network to predict housing prices based on the provided dataset. Include input normalization, hidden layers with appropriate activation functions, and an output layer. Train the network using backpropagation and evaluate its performance using Mean Squared Error (MSE)

LIST OF HARDWARE/SOFTWARE USED:

- Windows OS
- VS code

PROCEDURE:

1: Open Visual Studio Code

2: Create a new Python file and name it housing_prices_prediction.py

3: Install required Python libraries

```
import pandas as pd
import numpy as np
from sklearn.preprocessing import StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error
import tensorflow as tf
from tensorflow.keras import layers, models
```

4: Load the Dataset

```
Bedrooms,Bathrooms,SquareFootage,Location,Age,Price
3,2,1500,Urban,10,300000
4,3,2000,Suburban,5,400000
2,1,800,Rural,20,150000
3,2,1600,Urban,12,310000
4,3,2200,Suburban,8,420000
2,1,900,Rural,25,160000
5,4,3000,Urban,3,600000
3,2,1400,Suburban,15,290000
3,2,1300,Rural,30,180000
4,3,2500,Urban,7,500000
```

Use pandas to load the dataset from a CSV file.

```
data = pd.read_csv('housing_prices.csv')

# Preprocess the data
X = data.drop('Price', axis=1)
y = data['Price']
```

5: Encode Categorical Variables.Convert categorical variables into numerical values using one-hot encoding.

```
data = pd.read_csv('housing_prices.csv')

# Preprocess the data
X = data.drop('Price', axis=1)
y = data['Price']

# One-hot encode the 'Location' feature
preprocessor = ColumnTransformer(
    transformers=[
        ('num', StandardScaler(), ['Bedrooms', 'Bathrooms', 'SquareFootage', 'Age']),
        ('cat', OneHotEncoder(), ['Location'])
    ])

X = preprocessor.fit_transform(X)
```

6: Apply standardization to features using StandardScaler

```
preprocessor = ColumnTransformer(
    transformers=[
        ('num', StandardScaler(), ['Bedrooms', 'Bathrooms', 'SquareFootage', 'Age']),
        ('cat', OneHotEncoder(), ['Location'])
    ])

X = preprocessor.fit_transform(X)
```

7: Define the Neural Network Model.Build the neural network using PyTorch.

```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Build the feedforward neural network model
model = models.Sequential()
model.add(layers.Dense(64, activation='relu', input_shape=(X_train.shape[1],)))
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(1))  # Output layer
```

8: Train the Model Train the model using backpropagation.

```
history = model.fit(X_train, y_train, epochs=100, validation_split=0.2)
```

9: Evaluate the Model

Mean Squared Error (MSE): The MSE of the model on the test dataset will be printed after training. This metric helps to understand the model's performance.

```
y_pred = model.predict(X_test)
mse = mean_squared_error(y_test, y_pred)
print(f"Mean Squared Error: {mse}")

# Plot the training history
import matplotlib.pyplot as plt

plt.plot(history.history['loss'], label='train_loss')
plt.plot(history.history['val_loss'], label='val_loss')
plt.xlabel('Epoch')
plt.ylabel('Mean Squared Error')
plt.legend()
plt.show()
```

Code:

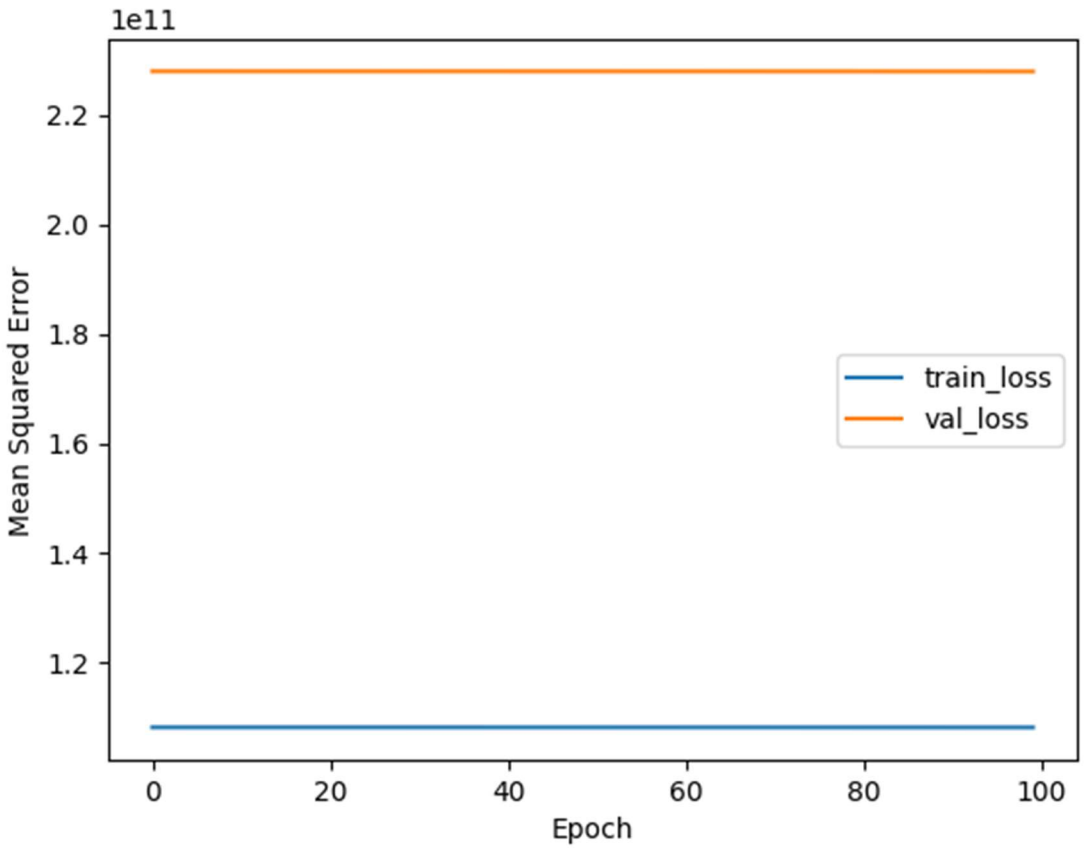
```
import pandas as pd
import numpy as np
```

```
from sklearn.preprocessing import StandardScaler, OneHotEncoder
from sklearn.compose import ColumnTransformer
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_squared_error
import tensorflow as tf
from tensorflow.keras import layers, models

# Load the dataset
data = pd.read_csv('housing_prices.csv')

# Preprocess the data
X = data.drop('Price', axis=1)
y = data['Price']

# One-hot encode the 'Location' feature
preprocessor = ColumnTransformer(
    transformers=[
        ('num', StandardScaler(), ['Bedrooms', 'Bathrooms', 'SquareFootage',
'Age']),
        ('cat', OneHotEncoder(), ['Location'])
    ])

X = preprocessor.fit_transform(X)

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,
random_state=42)

# Build the feedforward neural network model
model = models.Sequential()
model.add(layers.Dense(64, activation='relu',
input_shape=(X_train.shape[1],)))
model.add(layers.Dense(64, activation='relu'))
model.add(layers.Dense(1))  # Output layer

# Compile the model
model.compile(optimizer='adam', loss='mse')

# Train the model
history = model.fit(X_train, y_train, epochs=100, validation_split=0.2)

# Evaluate the model
y_pred = model.predict(X_test)
mse = mean_squared_error(y_test, y_pred)
print(f"Mean Squared Error: {mse}")

# Plot the training history
import matplotlib.pyplot as plt
```

```
plt.plot(history.history['loss'], label='train_loss')
plt.plot(history.history['val_loss'], label='val_loss')
plt.xlabel('Epoch')
plt.ylabel('Mean Squared Error')
plt.legend()
plt.show()
```

OUTPUT:

```
Mean Squared Error: 96185529454.4999
```



RESULT:

The program is successfully completed