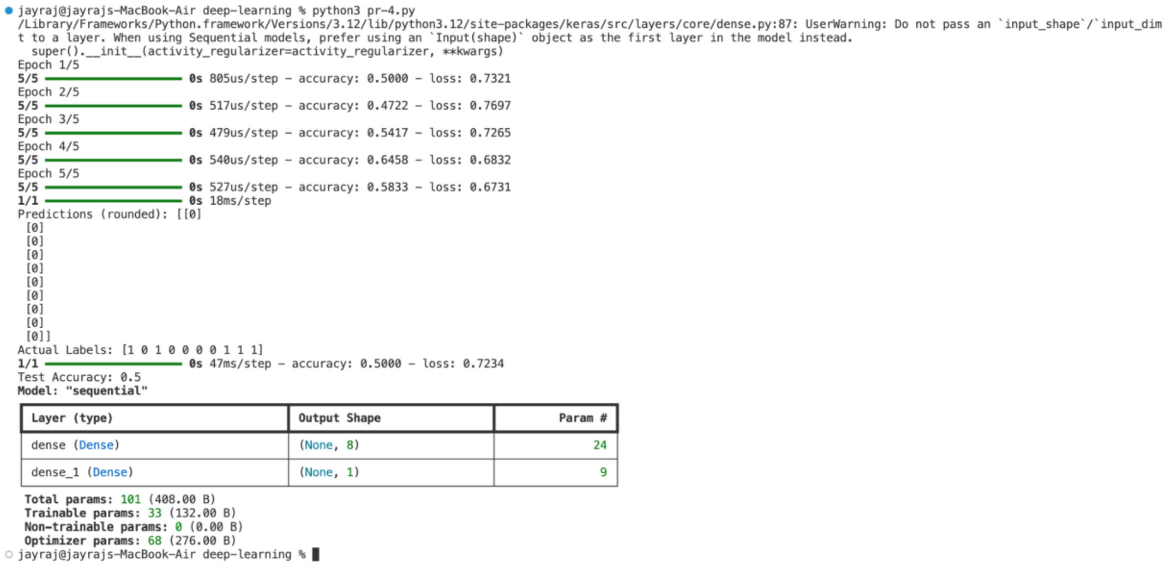
Practical 4

Aim : Basics of Tensorflow for Nueral network

Code:

```
import numpy as np import
tensorflow as tf
from tensorflow.keras import layers, models

# Step 1: Create a small dataset
x_train = np.array([[0.1, 0.2], [0.4, 0.3], [0.5, 0.6], [0.9,
0.8], [0.7, 0.3],
                    [0.2, 0.1], [0.8, 0.5], [0.4, 0.6], [0.3,
0.7], [0.6, 0.9]]) y_train = (x_train[:, 1] > x_train[:,

0]).astype(int)

# Step 2: Define the Model model =
models.Sequential([
    layers.Dense(8, activation='relu', input_shape=(2,)),
    layers.Dense(1, activation='sigmoid')
])

# Step 3: Compile the Model model.compile(optimizer='adam',
loss='binary_crossentropy',               metrics=['accuracy'])

# Step 4: Train the Model
model.fit(x_train, y_train, epochs=5, batch_size=2)

# Step 5: Make Predictions predictions =
model.predict(x_train) print("Predictions
(rounded):",
np.round(predictions).astype(int))
print("Actual Labels:", y_train)

# Step 6: Evaluate the Model
test_loss, test_acc = model.evaluate(x_train, y_train) print(f'Test
Accuracy: {test_acc}')

# To visualize the model structure model.summary()
```

Output



```
● jayraj@jayrajs-MacBook-Air deep-learning % python3 pr-4.py
/Library/Frameworks/Python.framework/Versions/3.12/lib/python3.12/site-packages/keras/src/layers/core/dense.py:87: UserWarning: Do not pass an `input_shape`/`input_dim
t to a layer. When using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/5
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 805us/step - accuracy: 0.5000 - loss: 0.7321
Epoch 2/5
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 517us/step - accuracy: 0.4722 - loss: 0.7697
Epoch 3/5
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 479us/step - accuracy: 0.5417 - loss: 0.7265
Epoch 4/5
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 540us/step - accuracy: 0.6458 - loss: 0.6832
Epoch 5/5
5/5 ━━━━━━━━━━━━━━━━━━━━ 0s 527us/step - accuracy: 0.5833 - loss: 0.6731
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 18ms/step
Predictions (rounded): [[0]
 [0]
 [0]
 [0]
 [0]
 [0]
 [0]
 [0]
 [0]
 [0]]
Actual Labels: [1 0 1 0 0 0 0 1 1 1]
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 47ms/step - accuracy: 0.5000 - loss: 0.7234
Test Accuracy: 0.5
Model: "sequential"
┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━┓
┃ Layer (type)                    ┃ Output Shape           ┃       Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━┩
│ dense (Dense)                   │ (None, 8)              │            24 │
├─────────────────────────────────┼────────────────────────┼───────────────┤
│ dense_1 (Dense)                 │ (None, 1)              │             9 │
└─────────────────────────────────┴────────────────────────┴───────────────┘
 Total params: 101 (408.00 B)
 Trainable params: 33 (132.00 B)
 Non-trainable params: 0 (0.00 B)
 Optimizer params: 68 (276.00 B)
○ jayraj@jayrajs-MacBook-Air deep-learning % █
```

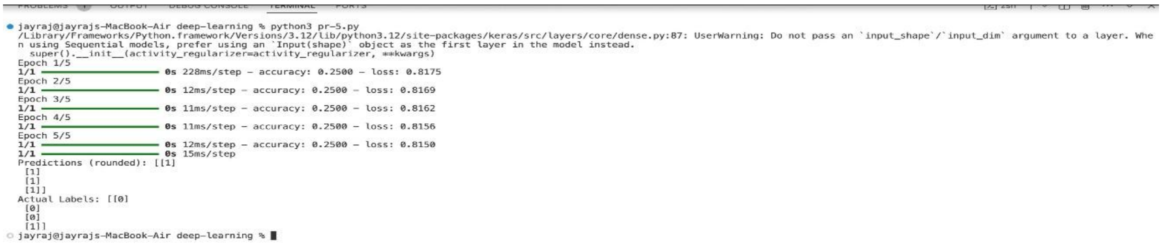
Practical 5

Aim : Write a python program to implement perceptron using tensorflow

Code:

```
import numpy as np import tensorflow as tf
from tensorflow.keras import layers, models
x_train = np.array([[0, 0], [0, 1], [1, 0], [1, 1]])  y_train =
np.array([[0], [0], [0], [1]])
model = models.Sequential([
    layers.Dense(1, activation='sigmoid', input_shape=(2,))
])
weights = np.array([[0.4], [0.6]])  bias =
np.array([0.2])

# Set weights and bias for the Dense layer
model.layers[0].set_weights([weights, bias])

model.compile(optimizer='adam', loss='binary_crossentropy',
metrics=['accuracy'])

# Train the model
model.fit(x_train, y_train, epochs=5)

# Make predictions
predictions = model.predict(x_train) print("Predictions
(rounded):", np.round(predictions).astype(int))
print("Actual Labels:", y_train)
```

Output:



```
jayraj@jayrajs-MacBook-Air deep-learning % python3 pr-5.py
/Library/Frameworks/Python.framework/Versions/3.12/lib/python3.12/site-packages/keras/src/layers/core/dense.py:87: UserWarning: Do not pass an `input_shape`/`input_dim` argument to a layer. Whe
n using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/5
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 228ms/step - accuracy: 0.2500 - loss: 0.8175
Epoch 2/5
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 12ms/step - accuracy: 0.2500 - loss: 0.8169
Epoch 3/5
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 11ms/step - accuracy: 0.2500 - loss: 0.8162
Epoch 4/5
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 11ms/step - accuracy: 0.2500 - loss: 0.8156
Epoch 5/5
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 12ms/step - accuracy: 0.2500 - loss: 0.8150
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 15ms/step
Predictions (rounded): [[1]
 [1]
 [1]
 [1]]
Actual Labels: [[0]
 [0]
 [0]
 [1]]
jayraj@jayrajs-MacBook-Air deep-learning % 
```

Practical 6

Aim : Write a program to implement an autoencoder for image reconstruction

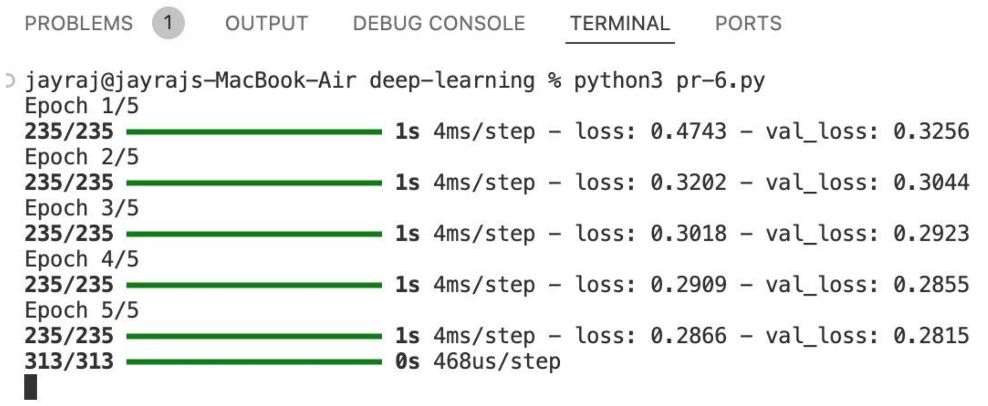
Code:

```
import numpy as np import os
import matplotlib.pyplot as plt from
tensorflow.keras import layers, models import
pandas as pd

def load_fashion_mnist_data():
    base_path = './fashion-mnist/'
    # Load data directly if CSV format is provided     x_train =
pd.read_csv(os.path.join(base_path, 'fashion-
mnist_train.csv')).values[:, 1:] / 255.0
    x_test = pd.read_csv(os.path.join(base_path, 'fashion-
mnist_test.csv')).values[:, 1:] / 255.0     return
x_train, x_test


x_train, x_test = load_fashion_mnist_data() encoding_dim = 64

input_img = layers.Input(shape=(784,))
encoded = layers.Dense(encoding_dim, activation='relu')
(input_img) decoded = layers.Dense(784,

activation='sigmoid')(encoded)

# Combine encoder and decoder into the autoencoder model autoencoder =
models.Model(input_img, decoded)


autoencoder.compile(optimizer='adam', loss='binary_crossentropy')
autoencoder.fit(x_train, x_train,
epochs=5,                 batch_size=256,
shuffle=True,
                validation_data=(x_test, x_test))

# Encode and decode some images (reconstruction) decoded_imgs =
autoencoder.predict(x_test)

# Reshape images back to 28x28 for visualization
decoded_imgs = decoded_imgs.reshape((x_test.shape[0], 28, 28))


n = 10
```

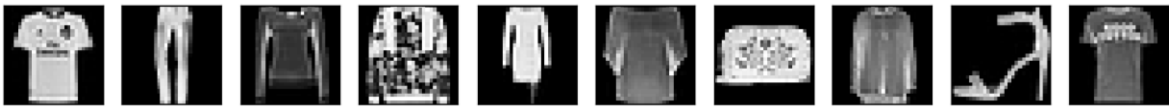
```
plt.figure(figsize=(20, 4)) for i in
range(n):
    # Display original images      ax =
plt.subplot(2, n, i + 1)
    plt.imshow(x_test[i].reshape(28, 28), cmap='gray')
    ax.get_xaxis().set_visible(False)
ax.get_yaxis().set_visible(False)

    # Display reconstructed images


ax = plt.subplot(2, n, i + 1 + n)


plt.imshow(decoded_imgs[i], cmap='gray')


ax.get_xaxis().set_visible(False)


ax.get_yaxis().set_visible(False) plt.show()
```

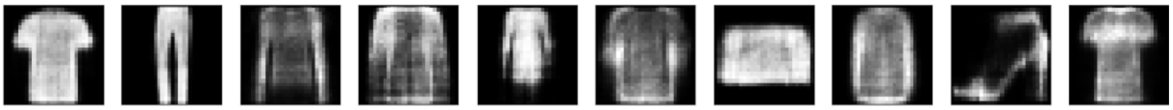
Output:-

original images



```
jayraj@jayrajs-MacBook-Air deep-learning % python3 pr-6.py
Epoch 1/5
235/235 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - loss: 0.4743 - val_loss: 0.3256
Epoch 2/5
235/235 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - loss: 0.3202 - val_loss: 0.3044
Epoch 3/5
235/235 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - loss: 0.3018 - val_loss: 0.2923
Epoch 4/5
235/235 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - loss: 0.2909 - val_loss: 0.2855
Epoch 5/5
235/235 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - loss: 0.2866 - val_loss: 0.2815
313/313 ━━━━━━━━━━━━━━━━━━━━ 0s 468us/step
```





reconstructed images

Practical 7

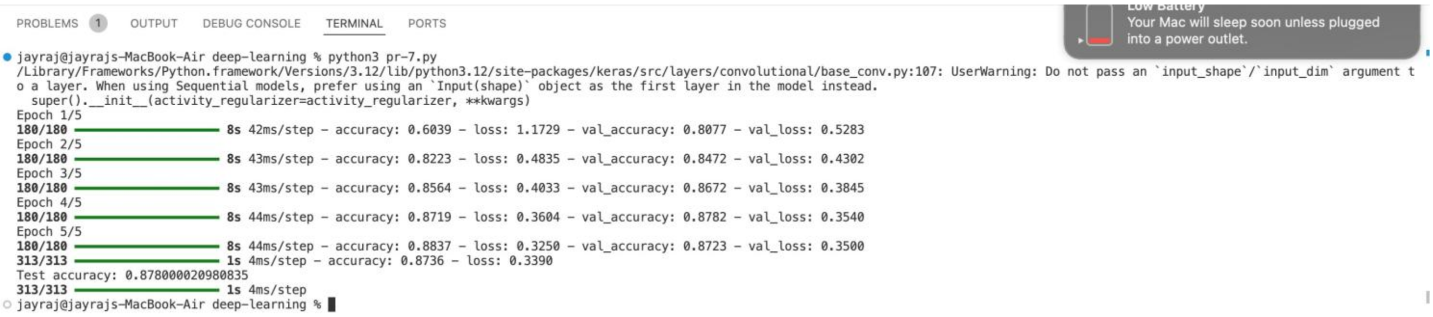
Aim :Write a program in python for image classification using CNN (using tensorflow.

Code

```
import numpy as np import os
import matplotlib.pyplot as plt
import pandas as pd import
tensorflow as tf
from tensorflow.keras import layers, models

# Load the Fashion MNIST dataset def
load_fashion_mnist_data():
    base_path = './fashion-mnist/'
    x_train = pd.read_csv(os.path.join(base_path, 'fashion-
mnist_train.csv')).values[:, 1:]
    x_test = pd.read_csv(os.path.join(base_path, 'fashion-
mnist_test.csv')).values[:, 1:]

    # Reshape data to 28x28 and scale to [0, 1]     x_train =
x_train.reshape(-1, 28, 28, 1) / 255.0     x_test =
x_test.reshape(-1, 28, 28, 1) / 255.0
    # Extract labels
    y_train = pd.read_csv(os.path.join(base_path, 'fashion-
mnist_train.csv')).values[:, 0]
    y_test = pd.read_csv(os.path.join(base_path,

'fashionmnist_test.csv')).values[:, 0]     return x_train, y_train,

x_test, y_test

x_train, y_train, x_test, y_test = load_fashion_mnist_data()

model = models.Sequential([
    layers.Conv2D(32, (3, 3), activation='relu',
input_shape=(28, 28, 1)),     layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation=‘relu'),
layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.Flatten(),
    layers.Dense(64, activation='relu'),
    layers.Dense(10, activation='softmax')  # 10 classes for
Fashion MNIST
])
model.compile(optimizer='adam',
              loss='sparse_categorical_crossentropy',
metrics=['accuracy'])
model.fit(x_train, y_train, epochs=5, batch_size=300,
validation_split=0.1)
test_loss, test_acc = model.evaluate(x_test, y_test)

print('Test accuracy:', test_acc) predictions =

model.predict(x_test)
```

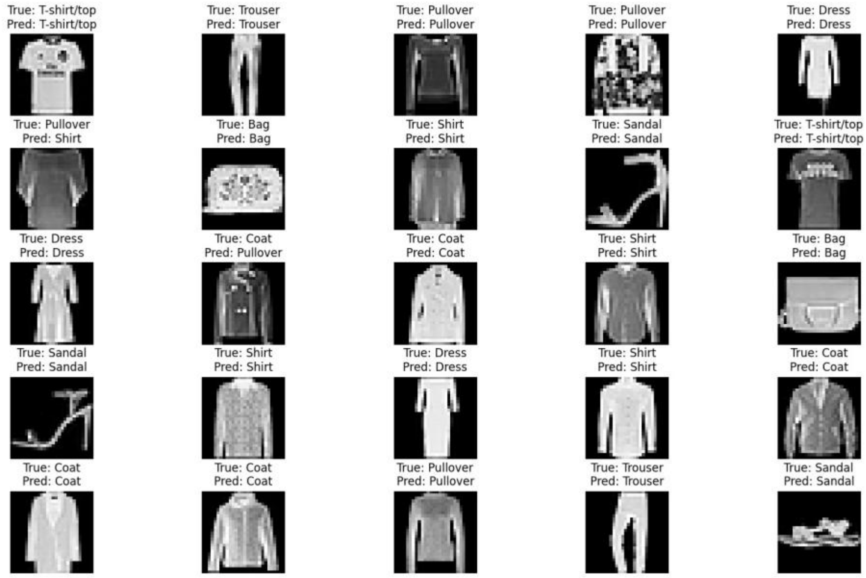
```
def plot_predictions(x, y_true, y_pred, class_names):
plt.figure(figsize=(10, 10))      for i in range(25):
plt.subplot(5, 5, i + 1)
        plt.imshow(x[i].reshape(28, 28), cmap='gray')
plt.title(f"True: {class_names[y_true[i]]}\nPred:
{class_names[np.argmax(y_pred[i])]}")
        plt.axis('off')
plt.tight_layout()     plt.show()

# Define class names for Fashion MNIST
class_names = ['T-shirt/top', 'Trouser', 'Pullover', 'Dress',
'Coat',
               'Sandal', 'Shirt', 'Sneaker', 'Bag', 'Ankle boot']
# Plot the predictions
plot_predictions(x_test, y_test, predictions, class_names)
```

Output



PROBLEMS 1
OUTPUT
DEBUG CONSOLE
TERMINAL
PORTS
Low Battery
Your Mac will sleep soon unless plugged into a power outlet.

```
● jayraj@jayrajs-MacBook-Air deep-learning % python3 pr-7.py
/Library/Frameworks/Python.framework/Versions/3.12/lib/python3.12/site-packages/keras/src/layers/convolutional/base_conv.py:107: UserWarning: Do not pass an `input_shape`/`input_dim` argument t
o a layer. When using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/5
180/180 ━━━━━━━━━━━━━━━━━━━━ 8s 42ms/step - accuracy: 0.6039 - loss: 1.1729 - val_accuracy: 0.8077 - val_loss: 0.5283
Epoch 2/5
180/180 ━━━━━━━━━━━━━━━━━━━━ 8s 43ms/step - accuracy: 0.8223 - loss: 0.4835 - val_accuracy: 0.8472 - val_loss: 0.4302
Epoch 3/5
180/180 ━━━━━━━━━━━━━━━━━━━━ 8s 43ms/step - accuracy: 0.8564 - loss: 0.4033 - val_accuracy: 0.8672 - val_loss: 0.3845
Epoch 4/5
180/180 ━━━━━━━━━━━━━━━━━━━━ 8s 44ms/step - accuracy: 0.8719 - loss: 0.3604 - val_accuracy: 0.8782 - val_loss: 0.3540
Epoch 5/5
180/180 ━━━━━━━━━━━━━━━━━━━━ 8s 44ms/step - accuracy: 0.8837 - loss: 0.3250 - val_accuracy: 0.8723 - val_loss: 0.3500
313/313 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step - accuracy: 0.8736 - loss: 0.3390
Test accuracy: 0.878000020980835
313/313 ━━━━━━━━━━━━━━━━━━━━ 1s 4ms/step
○ jayraj@jayrajs-MacBook-Air deep-learning % █
```



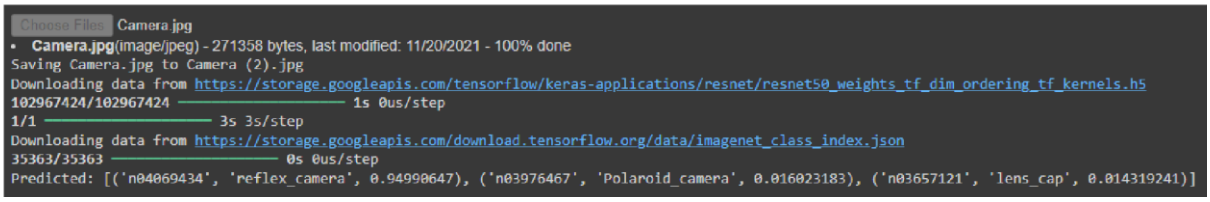
Practical 8

Aim : Write a program to use a pre-trained model (e.g., VGG16, Reset) for a custom image classification task. Code:-

```
from google.colab import files uploaded =
files.upload()
```

```
import keras
from keras.applications.resnet50 import ResNet50 from
keras.applications.resnet50 import preprocess_input,
decode_predictions import numpy as np
from keras.applications.resnet50 import ResNet50
# Load the pre-trained ResNet50 model model =
ResNet50(weights='imagenet')
img_path= 'Camera.jpg'
img = keras.utils.load_img(img_path, target_size=(224, 224))
x= keras.utils.img_to_array(img) x = np.expand_dims(x, axis=0) x =
preprocess_input(x) preds = model.predict(x) print('Predicted:',
decode_predictions (preds, top=3) [0])
```

Output:-



```
Choose Files  Camera.jpg
• Camera.jpg(image/jpeg) - 271358 bytes, last modified: 11/20/2021 - 100% done
Saving Camera.jpg to Camera (2).jpg
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/resnet/resnet50_weights_tf_dim_ordering_tf_kernels.h5
102967424/102967424 ━━━━━━━━━━━━━━━━━━━━ 1s 0us/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 3s 3s/step
Downloading data from https://storage.googleapis.com/download.tensorflow.org/data/imagenet_class_index.json
35363/35363 ━━━━━━━━━━━━━━━━━━━━ 0s 0us/step
Predicted: [('n04069434', 'reflex_camera', 0.94990647), ('n03976467', 'Polaroid_camera', 0.016023183), ('n03657121', 'lens_cap', 0.014319241)]
```

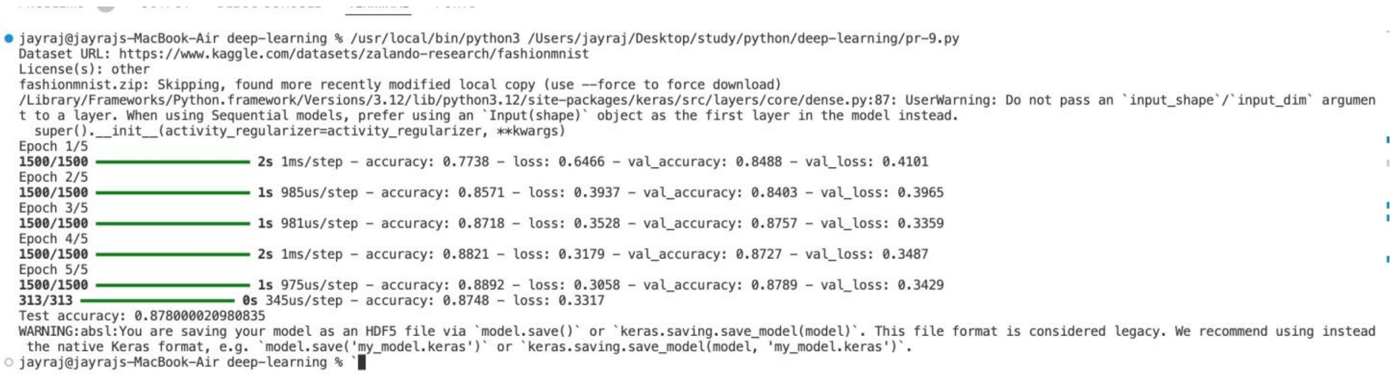
Practical 9

Aim : Write a program to fine-tune the pre-trained model on a new dataset and Compare the performance of the fine-tuned model with a model trained from scratch. Code:-

```
import os import
zipfile import numpy
as np import pandas as
pd
from tensorflow.keras.models import Sequential from
tensorflow.keras.layers import Dense from
sklearn.model_selection import train_test_split from
tensorflow.keras.utils import to_categorical

os.makedirs(os.path.expanduser("~/.kaggle"), exist_ok=True)
kaggle_json_path = os.path.expanduser("~/.kaggle/kaggle.json") if not
os.path.exists(kaggle_json_path):     raise FileNotFoundError("kaggle.json
file not found.
Please set up Kaggle API key as described.")

# Download Fashion MNIST dataset from Kaggle os.system('kaggle datasets
download -d zalando-research/ fashionmnist')

# Unzip the dataset with zipfile.ZipFile('fashionmnist.zip', 'r') as
zip_ref:     zip_ref.extractall('fashionmnist')

train_data = pd.read_csv('fashionmnist/fashionmnist_train.csv')
test_data = pd.read_csv('fashionmnist/fashion-mnist_test.csv')

x_train = train_data.iloc[:, 1:].values y_train =
train_data.iloc[:, 0].values x_test =
test_data.iloc[:, 1:].values y_test =
test_data.iloc[:, 0].values
x_train = x_train / 255.0 x_test =
x_test / 255.0
# Convert labels to categorical (one-hot encoding)
```

```
y_train = to_categorical(y_train, 10) y_test =
to_categorical(y_test, 10)

# Split train set into train and validation set x_train, x_val,
y_train, y_val = train_test_split(x_train, y_train, test_size=0.2,
random_state=42)

# Build the model model =
Sequential([
    Dense(128, activation='relu',
input_shape=(x_train.shape[1],)),      Dense(64,
activation='relu'),
    Dense(10, activation='softmax')  # 10 classes for Fashion
MNIST
])

# Compile the model model.compile(
optimizer='adam',
    loss='categorical_crossentropy',
    metrics=['accuracy']
)

# Train the model
model.fit(x_train, y_train, epochs=5, batch_size=32,
validation_data=(x_val, y_val))

# Evaluate the model on the test set
test_loss, test_acc = model.evaluate(x_test, y_test) print(f'Test
accuracy: {test_acc}')
# Save the model model.save('fashion_mnist_model.h5')
```

Output:-



```
● jayraj@jayrajs-MacBook-Air deep-learning % /usr/local/bin/python3 /Users/jayraj/Desktop/study/python/deep-learning/pr-9.py
Dataset URL: https://www.kaggle.com/datasets/zalando-research/fashionmnist
License(s): other
fashionmnist.zip: Skipping, found more recently modified local copy (use --force to force download)
/Library/Frameworks/Python.framework/Versions/3.12/lib/python3.12/site-packages/keras/src/layers/core/dense.py:87: UserWarning: Do not pass an `input_shape`/`input_dim` argumen
t to a layer. When using Sequential models, prefer using an `Input(shape)` object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer, **kwargs)
Epoch 1/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 2s 1ms/step - accuracy: 0.7738 - loss: 0.6466 - val_accuracy: 0.8488 - val_loss: 0.4101
Epoch 2/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 1s 985us/step - accuracy: 0.8571 - loss: 0.3937 - val_accuracy: 0.8403 - val_loss: 0.3965
Epoch 3/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 1s 981us/step - accuracy: 0.8718 - loss: 0.3528 - val_accuracy: 0.8757 - val_loss: 0.3359
Epoch 4/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 2s 1ms/step - accuracy: 0.8821 - loss: 0.3179 - val_accuracy: 0.8727 - val_loss: 0.3487
Epoch 5/5
1500/1500 ━━━━━━━━━━━━━━━━━━━━ 1s 975us/step - accuracy: 0.8892 - loss: 0.3058 - val_accuracy: 0.8789 - val_loss: 0.3429
313/313 ━━━━━━━━━━━━━━━━━━━━ 0s 345us/step - accuracy: 0.8748 - loss: 0.3317
Test accuracy: 0.878000020980835
WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or `keras.saving.save_model(model)`. This file format is considered legacy. We recommend using instead
 the native Keras format, e.g. `model.save('my_model.keras')` or `keras.saving.save_model(model, 'my_model.keras')`.
○ jayraj@jayrajs-MacBook-Air deep-learning % `▊
```

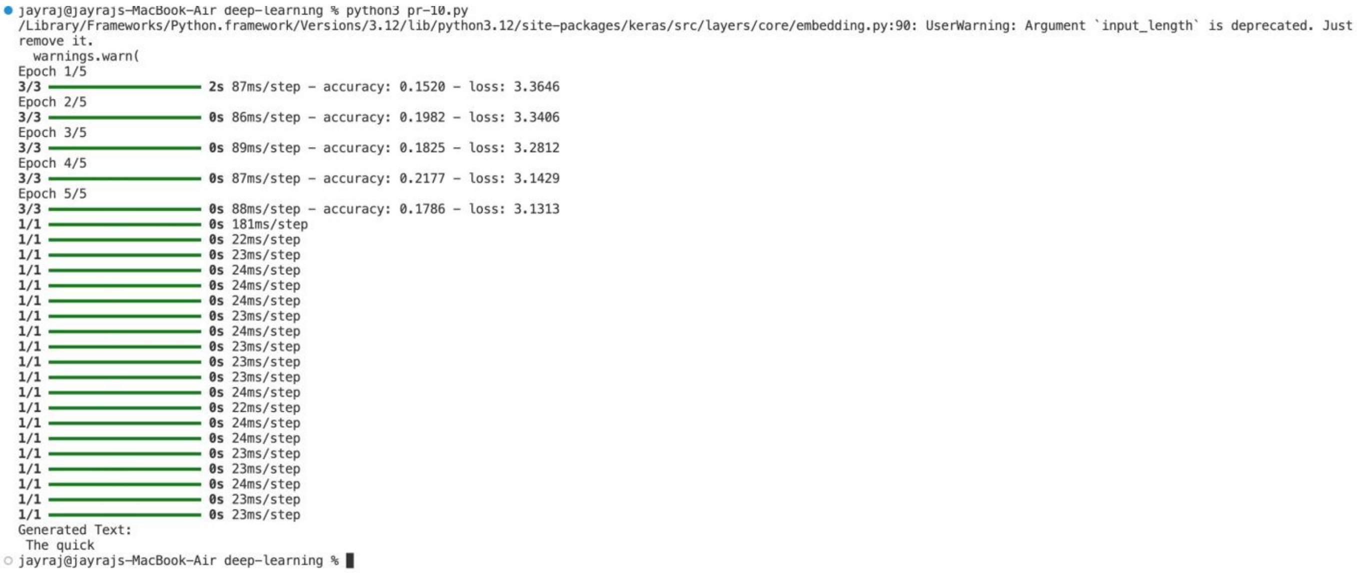
Practical 10

Aim : Write a program to implement an RNN/LSTM for text generation.

Code:-

```
import numpy as np import
tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Embedding, Dropout
from tensorflow.keras.preprocessing.text import Tokenizer from
tensorflow.keras.preprocessing.sequence import pad_sequences


text = """The quick brown fox jumps over the lazy dog. The quick brown fox
jumps over the lazy dog."""


tokenizer = Tokenizer(char_level=True)
tokenizer.fit_on_texts([text]) total_chars =
len(tokenizer.word_index) + 1 input_sequences = []
for i in range(1, len(text)):     seq = text[:i+1]
    input_sequences.append(tokenizer.texts_to_sequences([seq])
[0])
max_sequence_len = max([len(seq) for seq in input_sequences])
input_sequences = pad_sequences(input_sequences, maxlen=max_sequence_len,
padding='pre')
input_sequences = np.array(input_sequences)
X = input_sequences[:, :-1] y =
input_sequences[:, -1]
y = tf.keras.utils.to_categorical(y, num_classes=total_chars)

# Build the LSTM model model =
Sequential()
model.add(Embedding(total_chars,
50, input_length=max_sequence_len
- 1)) model.add(LSTM(100,
return_sequences=True))
model.add(Dropout(0.2)) model.add(LSTM(100))
model.add(Dense(total_chars, activation='softmax'))

# Compile the model
model.compile(loss='categorical_crossentropy', optimizer='adam',
metrics=['accuracy'])

# Train the model
history = model.fit(X, y, epochs=5)

# Function to generate text def
generate_text(seed_text, next_chars=10):     for _ in
range(next_chars):         tokenized_seq =
tokenizer.texts_to_sequences([seed_text])[0]         tokenized_seq =
pad_sequences([tokenized_seq], maxlen=max_sequence_len,
padding='pre')         predicted_char_index =
np.argmax(model.predict(tokenized_seq), axis=-1)         next_char =
tokenizer.index_word[predicted_char_index[0]]
        seed_text += next_char     return
seed_text
seed_text = "The quick"
generated_text = generate_text(seed_text, next_chars=20) print("Generated
Text: \n", generated_text)
```

Output:-



```
● jayraj@jayrajs-MacBook-Air deep-learning % python3 pr-10.py
  /Library/Frameworks/Python.framework/Versions/3.12/lib/python3.12/site-packages/keras/src/layers/core/embedding.py:90: UserWarning: Argument `input_length` is deprecated. Just
  remove it.
    warnings.warn(
  Epoch 1/5
  3/3 ━━━━━━━━━━━━━━━━━━━━ 2s 87ms/step - accuracy: 0.1520 - loss: 3.3646
  Epoch 2/5
  3/3 ━━━━━━━━━━━━━━━━━━━━ 0s 86ms/step - accuracy: 0.1982 - loss: 3.3406
  Epoch 3/5
  3/3 ━━━━━━━━━━━━━━━━━━━━ 0s 89ms/step - accuracy: 0.1825 - loss: 3.2812
  Epoch 4/5
  3/3 ━━━━━━━━━━━━━━━━━━━━ 0s 87ms/step - accuracy: 0.2177 - loss: 3.1429
  Epoch 5/5
  3/3 ━━━━━━━━━━━━━━━━━━━━ 0s 88ms/step - accuracy: 0.1786 - loss: 3.1313
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 181ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 22ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 22ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 24ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 23ms/step
  Generated Text:
   The quick
○ jayraj@jayrajs-MacBook-Air deep-learning % █
```

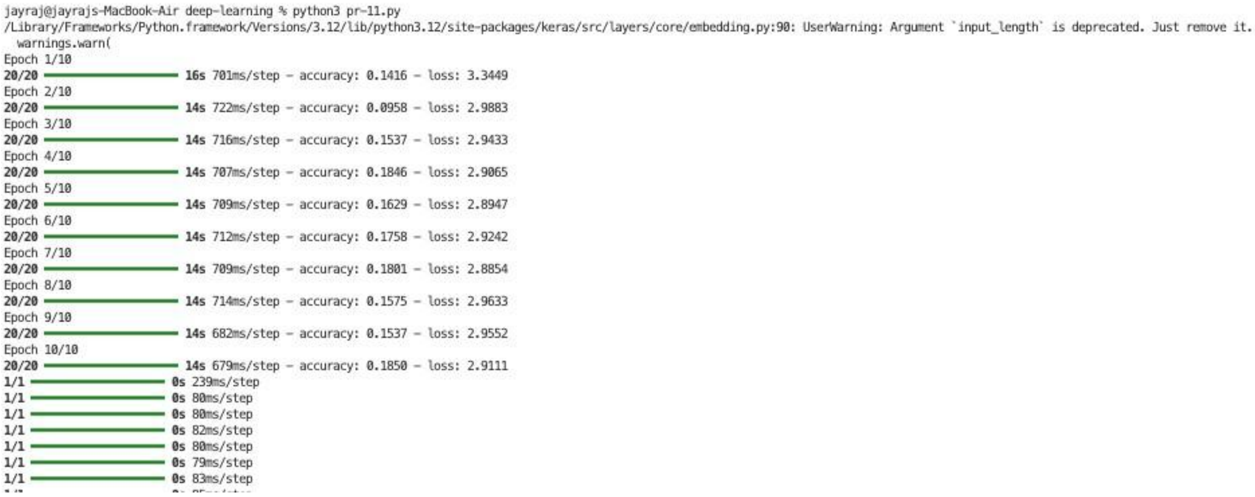
Practical 11

Aim : Write a program to train the model on a text corpus (e.g., Shakespeare's works). Code:-

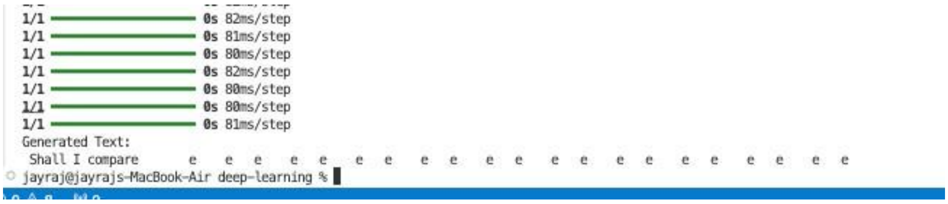
```
import numpy as np import
tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Embedding, Dropout
from tensorflow.keras.preprocessing.text import Tokenizer from
tensorflow.keras.preprocessing.sequence import pad_sequences

text = """Shall I compare thee to a summer's day?
Thou art more lovely and more temperate:
Rough winds do shake the darling buds of May, And summer's
lease hath all too short a date:
Sometime too hot the eye of heaven shines,
And often is his gold complexion dimm'd;
And every fair from fair sometime declines,
By chance or nature's changing course untrimm'd;
But thy eternal summer shall not fade
Nor lose possession of that fair thou owest;
Nor shall Death brag thou wanderest in his shade, When in eternal
lines to time thou growest:
So long as men can breathe or eyes can see,
So long lives this, and this gives life to thee."""


tokenizer = Tokenizer(char_level=True) tokenizer.fit_on_texts([text])
total_chars = len(tokenizer.word_index) + 1  # Total unique characters


input_sequences = [] for i in
range(1, len(text)):     seq =
text[:i+1]
    input_sequences.append(tokenizer.texts_to_sequences([seq]) [0])
max_sequence_len = max([len(seq) for seq in input_sequences])
input_sequences = pad_sequences(input_sequences, maxlen=max_sequence_len,
padding='pre')

input_sequences = np.array(input_sequences)
X = input_sequences[:, :-1] y =
input_sequences[:, -1]
y = tf.keras.utils.to_categorical(y, num_classes=total_chars)
# Build the LSTM model model =
Sequential()
model.add(Embedding(total_chars, 50, input_length=max_sequence_len
- 1)) model.add(LSTM(100, return_sequences=True))
model.add(Dropout(0.2)) model.add(LSTM(100))
model.add(Dense(total_chars, activation='softmax'))

# Compile the model
model.compile(loss='categorical_crossentropy', optimizer='adam',
metrics=['accuracy'])

# Train the model
history = model.fit(X, y, epochs=10, verbose=1)
```

```
# Function to generate text def
generate_text(seed_text, next_chars=100):      for _ in
range(next_chars):          tokenized_seq =
tokenizer.texts_to_sequences([seed_text])[0]          tokenized_seq =
pad_sequences([tokenized_seq], maxlen=max_sequence_len,
padding='pre')          predicted_char_index =
np.argmax(model.predict(tokenized_seq), axis=-1)          next_char =
tokenizer.index_word[predicted_char_index[0]]
        seed_text += next_char     return
seed_text

seed_text = "Shall I compare"
generated_text = generate_text(seed_text, next_chars=100)
print("Generated Text: \n", generated_text)
```

Output:-



```
jayraj@jayrajs-MacBook-Air deep-learning % python3 pr-11.py
/Library/Frameworks/Python.framework/Versions/3.12/lib/python3.12/site-packages/keras/src/layers/core/embedding.py:90: UserWarning: Argument `input_length` is deprecated. Just remove it.
  warnings.warn(
Epoch 1/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 16s 701ms/step - accuracy: 0.1416 - loss: 3.3449
Epoch 2/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 722ms/step - accuracy: 0.0958 - loss: 2.9883
Epoch 3/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 716ms/step - accuracy: 0.1537 - loss: 2.9433
Epoch 4/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 707ms/step - accuracy: 0.1846 - loss: 2.9065
Epoch 5/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 709ms/step - accuracy: 0.1629 - loss: 2.8947
Epoch 6/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 712ms/step - accuracy: 0.1758 - loss: 2.9242
Epoch 7/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 709ms/step - accuracy: 0.1801 - loss: 2.8854
Epoch 8/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 714ms/step - accuracy: 0.1575 - loss: 2.9633
Epoch 9/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 682ms/step - accuracy: 0.1537 - loss: 2.9552
Epoch 10/10
20/20 ━━━━━━━━━━━━━━━━━━━━ 14s 679ms/step - accuracy: 0.1850 - loss: 2.9111
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 239ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 80ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 80ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 82ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 80ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 79ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 83ms/step
```



```
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 82ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 81ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 80ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 82ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 80ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 80ms/step
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 81ms/step
Generated Text:
 Shall I compare      e   e  e   e  e   e  e   e  e   e  e   e  e   e  e   e  e   e  e   e  e
jayraj@jayrajs-MacBook-Air deep-learning %
```

Practical 12

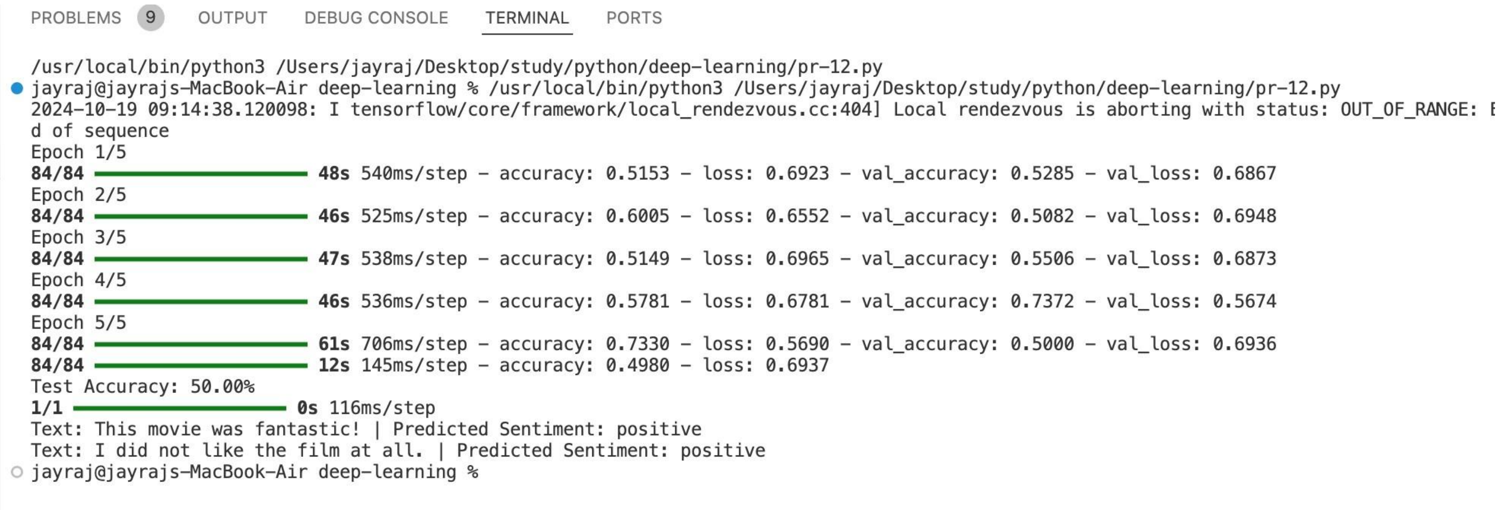
Aim : Write a program to implement an RNN/LSTM for sentiment analysis for any text data such as tweets, instagram comment etc. Code:-

```
import tensorflow as tf import tensorflow_datasets as
tfds from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, LSTM, Dense, Dropout
from tensorflow.keras.preprocessing.sequence import pad_sequences

# Load the dataset
dataset, info = tfds.load("imdb_reviews", with_info=True,
as_supervised=True)
train_data, test_data = dataset['train'], dataset['test']
```

```
vocab_size = 10000  max_length = 200
embedding_dim = 64   batch_size =
300


train_texts     =     []     for     text,     label     in     train_data:
train_texts.append(text.numpy().decode('utf-8'))   # Decode from bytes to
string


tokenizer =
tf.keras.preprocessing.text.Tokenizer(num_words=vocab_size,
oov_token="<OOV>")
tokenizer.fit_on_texts(train_texts)

def encode_and_pad(text, label):     #
Tokenize and pad the text
    text =
tokenizer.texts_to_sequences([text.numpy().decode('utf-8')])
    text = pad_sequences(text, maxlen=max_length,
padding='post', truncating='post')
    return tf.convert_to_tensor(text[0], dtype=tf.int32),
tf.convert_to_tensor(label, dtype=tf.int64)

def encode_and_pad_tf(text, label):     text, label =
tf.py_function(func=encode_and_pad, inp=[text, label],
Tout=(tf.int32, tf.int64))
    text.set_shape([max_length])
label.set_shape([])      return text,
label

# Apply the transformation
train_data = train_data.map(encode_and_pad_tf) test_data =
test_data.map(encode_and_pad_tf)

# Shuffle, batch, and prefetch the datasets train_data =
train_data.shuffle(10000).batch(batch_size).prefetch(tf.data.e
xperimental.AUTOTUNE) test_data =
test_data.batch(batch_size).prefetch(tf.data.experimental.AUTO
TUNE)

# LSTM model model =
Sequential([
    Embedding(vocab_size, embedding_dim),  # Removed
input_length
    LSTM(64, return_sequences=True),
    Dropout(0.5),
    LSTM(32),
    Dense(32, activation='relu'),
    Dense(1, activation='sigmoid')
])

model.compile(loss='binary_crossentropy', optimizer='adam',
metrics=['accuracy'])

steps_per_epoch = len(train_data) // batch_size model.fit(train_data,
epochs=5, validation_data=test_data, steps_per_epoch=steps_per_epoch)
```

```
loss, accuracy = model.evaluate(test_data) print(f'Test Accuracy:
{accuracy * 100:.2f}%’) new_texts = ["This movie was fantastic!",
"I did not like the film at all."]
new_sequences = tokenizer.texts_to_sequences(new_texts)
new_padded_sequences = pad_sequences(new_sequences, maxlen=max_length,
padding='post')

predictions = model.predict(new_padded_sequences) for i, text in
enumerate(new_texts):     sentiment = "positive" if predictions[i]
> 0.5 else
"negative"     print(f"Text: {text} | Predicted Sentiment: {sentiment}")
```

Output:-



```
/usr/local/bin/python3 /Users/jayraj/Desktop/study/python/deep-learning/pr-12.py
● jayraj@jayrajs-MacBook-Air deep-learning % /usr/local/bin/python3 /Users/jayraj/Desktop/study/python/deep-learning/pr-12.py
2024-10-19 09:14:38.120098: I tensorflow/core/framework/local_rendezvous.cc:404] Local rendezvous is aborting with status: OUT_OF_RANGE: E
d of sequence
Epoch 1/5
84/84 ━━━━━━━━━━━━━━━━━━━━ 48s 540ms/step - accuracy: 0.5153 - loss: 0.6923 - val_accuracy: 0.5285 - val_loss: 0.6867
Epoch 2/5
84/84 ━━━━━━━━━━━━━━━━━━━━ 46s 525ms/step - accuracy: 0.6005 - loss: 0.6552 - val_accuracy: 0.5082 - val_loss: 0.6948
Epoch 3/5
84/84 ━━━━━━━━━━━━━━━━━━━━ 47s 538ms/step - accuracy: 0.5149 - loss: 0.6965 - val_accuracy: 0.5506 - val_loss: 0.6873
Epoch 4/5
84/84 ━━━━━━━━━━━━━━━━━━━━ 46s 536ms/step - accuracy: 0.5781 - loss: 0.6781 - val_accuracy: 0.7372 - val_loss: 0.5674
Epoch 5/5
84/84 ━━━━━━━━━━━━━━━━━━━━ 61s 706ms/step - accuracy: 0.7330 - loss: 0.5690 - val_accuracy: 0.5000 - val_loss: 0.6936
84/84 ━━━━━━━━━━━━━━━━━━━━ 12s 145ms/step - accuracy: 0.4980 - loss: 0.6937
Test Accuracy: 50.00%
1/1 ━━━━━━━━━━━━━━━━━━━━ 0s 116ms/step
Text: This movie was fantastic! | Predicted Sentiment: positive
Text: I did not like the film at all. | Predicted Sentiment: positive
○ jayraj@jayrajs-MacBook-Air deep-learning %
```