QUESTION 1

```
import torch
import torch.nn as nn
import torch.optim as optim
from torch.utils.data import DataLoader, random_split
from torchvision import datasets, transforms, models
from sklearn.metrics import classification_report
import matplotlib.pyplot as plt
import numpy as np
import zipfile
import os
from google.colab import files


file = files.upload()
zip_path = "/content/archive (1).zip"
with zipfile.ZipFile(zip_path, 'r') as zip_ref:
    zip_ref.extractall("/content/dataset")
print("File unzipped successfully!")
```

Show hidden output

```
transform = transforms.Compose([
    transforms.Resize((224, 224)),
    transforms.ToTensor(),
    transforms.Normalize([0.485, 0.456, 0.406], [0.229, 0.224, 0.225])
])

dataset = datasets.ImageFolder('/content/dataset/Data', transform=transform)

train_size = int(0.7 * len(dataset))
test_size = len(dataset) - train_size
train_dataset, test_dataset = random_split(dataset, [train_size, test_size])

train_loader = DataLoader(train_dataset, batch_size=32, shuffle=True)
test_loader = DataLoader(test_dataset, batch_size=32, shuffle=False)


device = torch.device("cuda" if torch.cuda.is_available() else "cpu")

# Scratch Model
model = models.resnet18(pretrained=False)
model.fc = nn.Linear(model.fc.in_features, 4)
model = model.to(device)

epochs = 10
learning_rate = 0.001
Loss_fn = nn.CrossEntropyLoss()
optimizer = optim.Adam(model.parameters(), lr=learning_rate)
```

```
print("Scratch Model")
for epoch in range(epochs):
    model.train()
    running_loss = 0.0
    for inputs, labels in train_loader:
        inputs, labels = inputs.to(device), labels.to(device)
        optimizer.zero_grad()
        outputs = model(inputs)
        loss = Loss_fn(outputs, labels)
        loss.backward()
        optimizer.step()
        running_loss += loss.item()
    print(f"Epoch {epoch+1}, Loss: {running_loss / len(train_loader):.4f}")
```

```
/usr/local/lib/python3.10/dist-packages/torchvision/models/_utils.py:208: UserWarning: The parameter 'pretrained' is deprecated since 0.13 and may be removed in the future, p
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/torchvision/models/_utils.py:223: UserWarning: Arguments other than a weight enum or `None` for 'weights' are deprecated since 0.13 ar
  warnings.warn(msg)
Scratch Model
Epoch 1, Loss: 1.1330
Epoch 2, Loss: 0.7850
Epoch 3, Loss: 0.6625
Epoch 4, Loss: 0.5645
Epoch 5, Loss: 0.4883
Epoch 6, Loss: 0.3899
Epoch 7, Loss: 0.3097
Epoch 8, Loss: 0.2245
Epoch 9, Loss: 0.2080
Epoch 10, Loss: 0.1818
```

```
print("Fine-Tuned Model")

model_finetune = models.resnet18(pretrained=True)
model_finetune.fc = nn.Linear(model_finetune.fc.in_features, 4)
model_finetune = model_finetune.to(device)

# Fine tune
for param in model_finetune.parameters():
    param.requires_grad = True

optimizer_finetune = optim.Adam(model_finetune.parameters(), lr=learning_rate)

for epoch in range(epochs):
    model_finetune.train()
    running_loss = 0.0
    for inputs, labels in train_loader:
        inputs, labels = inputs.to(device), labels.to(device)
        optimizer_finetune.zero_grad()
        outputs = model_finetune(inputs)
        loss = Loss_fn(outputs, labels)
        loss.backward()
        optimizer_finetune.step()
        running_loss += loss.item()
```

```
    print(f"Epoch {epoch+1}, Loss: {running_loss / len(train_loader):.4f}")
```

```
Fine-Tuned Model
/usr/local/lib/python3.10/dist-packages/torchvision/models/_utils.py:208: UserWarning: The parameter 'pretrained' is deprecated since 0.13 and may be removed in the future, p
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/torchvision/models/_utils.py:223: UserWarning: Arguments other than a weight enum or `None` for 'weights' are deprecated since 0.13 ar
  warnings.warn(msg)
Downloading: "https://download.pytorch.org/models/resnet18-f37072fd.pth" to /root/.cache/torch/hub/checkpoints/resnet18-f37072fd.pth
100%|██████████| 44.7M/44.7M [00:00<00:00, 169MB/s]
Epoch 1, Loss: 0.5773
Epoch 2, Loss: 0.2415
Epoch 3, Loss: 0.1739
Epoch 4, Loss: 0.2021
Epoch 5, Loss: 0.1144
Epoch 6, Loss: 0.0778
Epoch 7, Loss: 0.0976
Epoch 8, Loss: 0.1221
Epoch 9, Loss: 0.0719
Epoch 10, Loss: 0.0440
```

```
def evaluate_model(model, test_loader):
    model.eval()
    all_labels = []
    all_preds = []
    with torch.no_grad():
        for inputs, labels in test_loader:
            inputs, labels = inputs.to(device), labels.to(device)
            outputs = model(inputs)
            _, preds = torch.max(outputs, 1)
            all_labels.append(labels.cpu().numpy())
            all_preds.append(preds.cpu().numpy())
    all_labels = np.concatenate(all_labels)
    all_preds = np.concatenate(all_preds)
    return classification_report(all_labels, all_preds, target_names=['Normal', 'Glioma Tumor', 'Meningioma Tumor', 'Pituitary Tumor'])

print("Model from Scratch")
report_scratch = evaluate_model(model, test_loader)
print(report_scratch)

print("Fine-Tuned Model")
report_finetune = evaluate_model(model_finetune, test_loader)
print(report_finetune)
```

```
Model from Scratch
                    precision    recall  f1-score   support

            Normal       0.89      0.82      0.85       274
       Glioma Tumor       0.89      0.73      0.80       273
   Meningioma Tumor       0.84      0.94      0.89       137
    Pituitary Tumor       0.80      0.98      0.88       245

          accuracy                           0.85       929
         macro avg       0.86      0.87      0.86       929
      weighted avg       0.86      0.85      0.85       929
```

```
Fine-Tuned Model
                  precision    recall  f1-score   support

          Normal       1.00      0.79      0.88       274
    Glioma Tumor       0.86      0.94      0.90       273
Meningioma Tumor       0.96      0.94      0.95       137
 Pituitary Tumor       0.87      1.00      0.93       245

        accuracy                           0.91       929
       macro avg       0.92      0.92      0.91       929
    weighted avg       0.92      0.91      0.91       929
```

QUESTION 2

```
import pandas as pd
import numpy as np
import torch
from sklearn.preprocessing import MinMaxScaler
import torch.nn as nn
from torch.optim import Adam
from torch.utils.data import DataLoader, TensorDataset

dataset = pd.read_csv('AMZN.csv')
close = dataset['Close'].values

def create_sequences(data, lookback):
    X, y = [], []
    for i in range(len(data) - lookback):
        X.append(data[i:i + lookback])
        y.append(data[i + lookback])
    return np.array(X), np.array(y)

#Preprocess
lookback = 10
X, y = create_sequences(close, lookback)
print(X.shape, y.shape)
```

Show hidden output

```
# Scale
scaler = MinMaxScaler(feature_range=(0, 1))
X_scaled = scaler.fit_transform(X.reshape(-1, 1)).reshape(X.shape)
y_scaled = scaler.transform(y.reshape(-1, 1))

print(X_scaled.shape, y_scaled.shape)
```

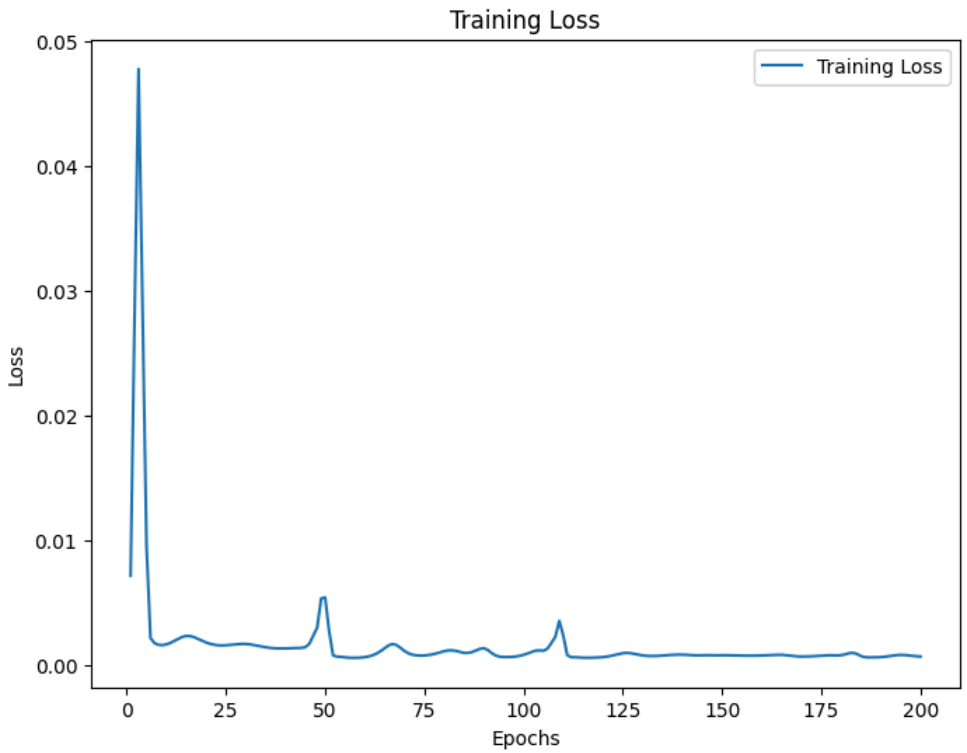
```
(6506, 10) (6506, 1)
```

```
class LSTMModel(nn.Module):
    def __init__(self, input_size=1, hidden_size=50, num_layers=1, output_size=1):
        super(LSTMModel, self).__init__()
        self.lstm = nn.LSTM(input_size, hidden_size, num_layers, batch_first=True)
        self.linear = nn.Linear(hidden_size, output_size)

    def forward(self, x):
        x, _ = self.lstm(x)
        x = x[:, -1, :]
        x = self.linear(x)
        return x


X_tensor = torch.tensor(X_scaled, dtype=torch.float32)
y_tensor = torch.tensor(y_scaled, dtype=torch.float32)

#Model
model = LSTMModel(input_size=1, hidden_size=50, num_layers=1, output_size=1)
loss_function = nn.MSELoss()
optimizer = Adam(model.parameters(), lr=0.001)

# Batch
dataset = TensorDataset(X_tensor, y_tensor)
dataloader = DataLoader(dataset, batch_size=64, shuffle=False)

# Train the model
num_epochs = 200
train_losses = []

for epoch in range(num_epochs):
    model.train()
    epoch_loss = 0
    for batch_X, batch_y in dataloader:
        optimizer.zero_grad()
        output = model(batch_X.unsqueeze(-1))
        loss = loss_function(output.squeeze(), batch_y)
        loss.backward()
        optimizer.step()
        epoch_loss += loss.item()

    avg_epoch_loss = epoch_loss / len(dataloader)
    train_losses.append(avg_epoch_loss)

    if (epoch + 1) % 10 == 0:
        print(f'Epoch {epoch+1}/{num_epochs}, Loss: {avg_epoch_loss}')
```

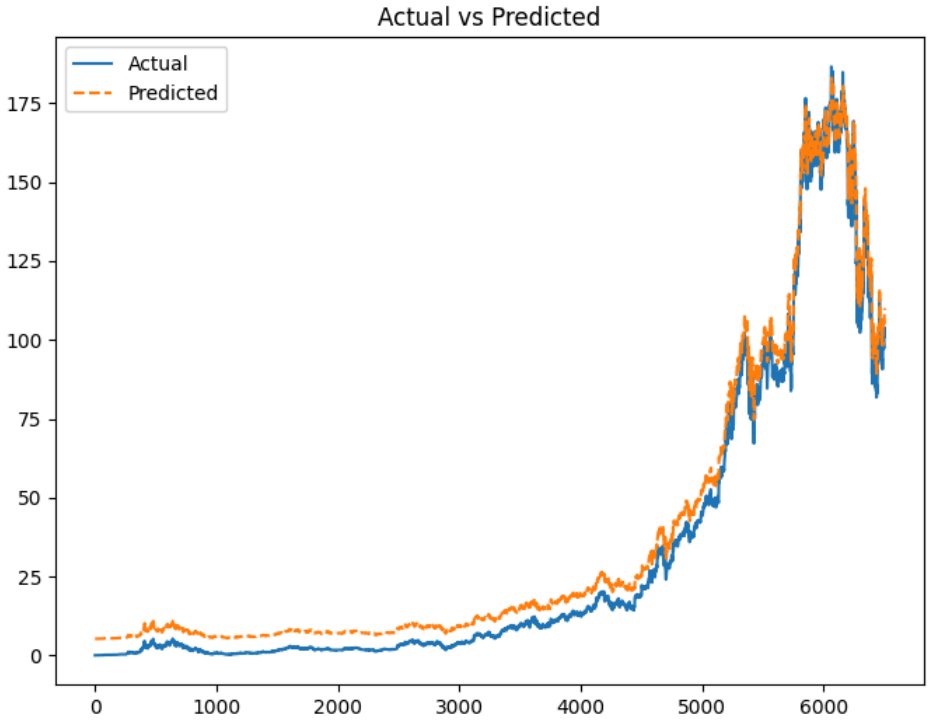
Show hidden output

```
plt.figure(figsize=(8,6))
plt.plot(range(1, num_epochs+1), train_losses, label='Training Loss')
plt.title('Training Loss')
plt.xlabel('Epochs')
plt.ylabel('Loss')
```

```
plt.legend()
plt.show()
```




```
model.eval()
predictions = []

with torch.no_grad():
    for i in range(len(X_tensor)):
        input = X_tensor[i].unsqueeze(0).unsqueeze(-1)
        predict = model(input)
        predictions.append(predict.item())

predicted = scaler.inverse_transform(np.array(predictions).reshape(-1, 1))
actual = scaler.inverse_transform(y_tensor.numpy().reshape(-1, 1))

# Plot
plt.figure(figsize=(8,6))
plt.plot(actual, label='Actual')
plt.plot(predicted, label='Predicted', linestyle='--')
plt.title('Actual vs Predicted')
plt.legend()
plt.show()
```



QUESTION 3

```
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.svm import SVC
from sklearn.metrics import classification_report
```

```
lungs = files.upload()
```

Show hidden output

```
zip_path = "/content/archive (2).zip"
with zipfile.ZipFile(zip_path, 'r') as zip_ref:
    zip_ref.extractall("/content/lungs")
print("File unzipped successfully!")
```

Show hidden output

```
df = pd.read_csv('/content/lungs/survey lung cancer.csv')
```

```
df.head()
```

Show hidden output

```
# Encoding 'GENDER' and 'LUNG_CANCER'
#1->M 0->F
df['GENDER'] = df['GENDER'].apply(lambda x: 1 if x == 'M' else 0)
#1->YES 0->NO
df['LUNG_CANCER'] = df['LUNG_CANCER'].apply(lambda x: 1 if x == 'YES' else 0)
```

```
df.head()
```

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	PEER_PRESSURE	CHRONIC DISEASE	FATIGUE	ALLERGY	WHEEZING	ALCOHOL CONSUMING	COUGHING	SHORTNESS OF BREATH	SWALLOWING DIFFICULTY	CHEST PAIN	LUNG_CANCER
0	1	69	1	2	2	1	1	2	1	2	2	2	2	2	2	1
1	1	74	2	1	1	1	2	2	2	1	1	1	2	2	2	1
2	0	59	1	1	1	2	1	2	1	2	1	2	2	1	2	0
3	1	63	2	2	2	1	1	1	1	1	2	1	1	2	2	0
4	0	63	1	2	1	1	1	1	1	2	1	2	2	1	1	0

```
# Separate features and target
X = df.drop(columns=['LUNG_CANCER'])
y = df['LUNG_CANCER']

#70% training and 30% testing
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
print(f"Training shape: {X_train.shape}, Test shape: {X_test.shape}")
```

Show hidden output

```
svm = SVC(kernel='linear', random_state=42)

svm.fit(X_train, y_train)
y_train_pred = svm.predict(X_train)
y_test_pred = svm.predict(X_test)

train_report = classification_report(y_train, y_train_pred)
test_report = classification_report(y_test, y_test_pred)

print("Training Set Classification Report:\n", train_report)
print("Testing Set Classification Report:\n", test_report)
```

```
Training Set Classification Report:
                precision    recall  f1-score   support

           0       0.75      0.75      0.75        32
           1       0.96      0.96      0.96       184

    accuracy                           0.93       216
```

```
   macro avg       0.85      0.85      0.85       216
weighted avg       0.93      0.93      0.93       216

Testing Set Classification Report:
              precision    recall  f1-score   support

           0       0.83      0.71      0.77         7
           1       0.98      0.99      0.98        86

    accuracy                           0.97        93
   macro avg       0.91      0.85      0.88        93
weighted avg       0.97      0.97      0.97        93
```