**MLA0201-Fundamentals of Machine Learning**

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Experiment 4:

Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

**Code:**

import pandas as pd

import matplotlib.pyplot as plt

from sklearn.neural\_network import MLPClassifier

from sklearn.preprocessing import LabelEncoder, StandardScaler

from sklearn.model\_selection import train\_test\_split

from sklearn.metrics import accuracy\_score

data = pd.read\_csv("car\_data.csv")

X = data.iloc[:, :-1].copy()

y = data.iloc[:, -1]

encoders = {}

for column in X.columns:

if X[column].dtype == 'object':

encoders[column] = LabelEncoder()

X[column] = encoders[column].fit\_transform(X[column])

target\_encoder = LabelEncoder()

y = target\_encoder.fit\_transform(y)

scaler = StandardScaler()

X = scaler.fit\_transform(X)

X\_train, X\_test, y\_train, y\_test = train\_test\_split(

X, y, test\_size=0.3, random\_state=1

)

model = MLPClassifier(

hidden\_layer\_sizes=(10, 8),

activation='relu',

solver='adam',

max\_iter=2000,

random\_state=1

)

model.fit(X\_train, y\_train)

print("ANN trained successfully using Backpropagation")

new\_sample = pd.DataFrame([{

'Brand': 'Toyota',

'Fuel': 'Petrol',

'Transmission': 'Automatic',

'EngineCC': 2000,

'Mileage': 15,

'Seats': 5

}])

for column in new\_sample.columns:

if column in encoders:

new\_sample[column] = encoders[column].transform(new\_sample[column])

new\_sample\_scaled = scaler.transform(new\_sample)

prediction = model.predict(new\_sample\_scaled)

predicted\_class = target\_encoder.inverse\_transform(prediction)

print("Predicted Class for new sample:", predicted\_class[0])

y\_pred = model.predict(X\_test)

accuracy = accuracy\_score(y\_test, y\_pred)

print("Model Accuracy:", accuracy)

layers = [

X.shape[1],

10,

8,

len(target\_encoder.classes\_)

]

layer\_names = [

"Input Layer",

"Hidden Layer 1",

"Hidden Layer 2",

"Output Layer"

]

plt.figure(figsize=(10, 6))

for i, layer\_size in enumerate(layers):

x = [i] \* layer\_size

y = range(layer\_size)

plt.scatter(x, y, s=600)

if i > 0:

for prev\_y in range(layers[i - 1]):

for curr\_y in range(layer\_size):

plt.plot([i - 1, i], [prev\_y, curr\_y], 'gray', linewidth=0.5)

for i, name in enumerate(layer\_names):

plt.text(i, max(layers) + 1, name, ha='center', fontsize=10, fontweight='bold')

plt.axis('off')

plt.title("Artificial Neural Network Architecture (Backpropagation)")

plt.show()

plt.figure()

plt.bar(['ANN Accuracy'], [accuracy])

plt.ylim(0, 1)

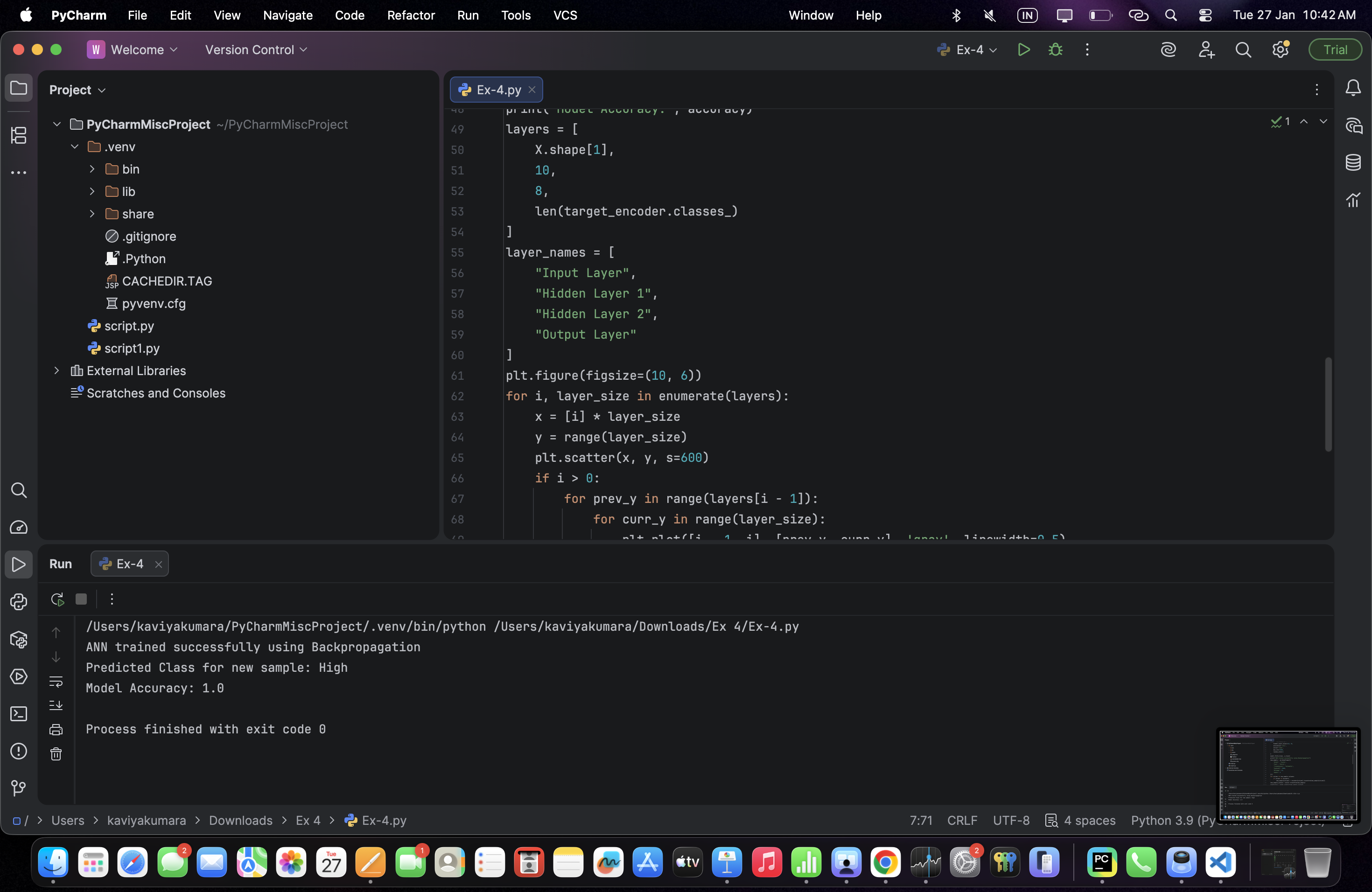
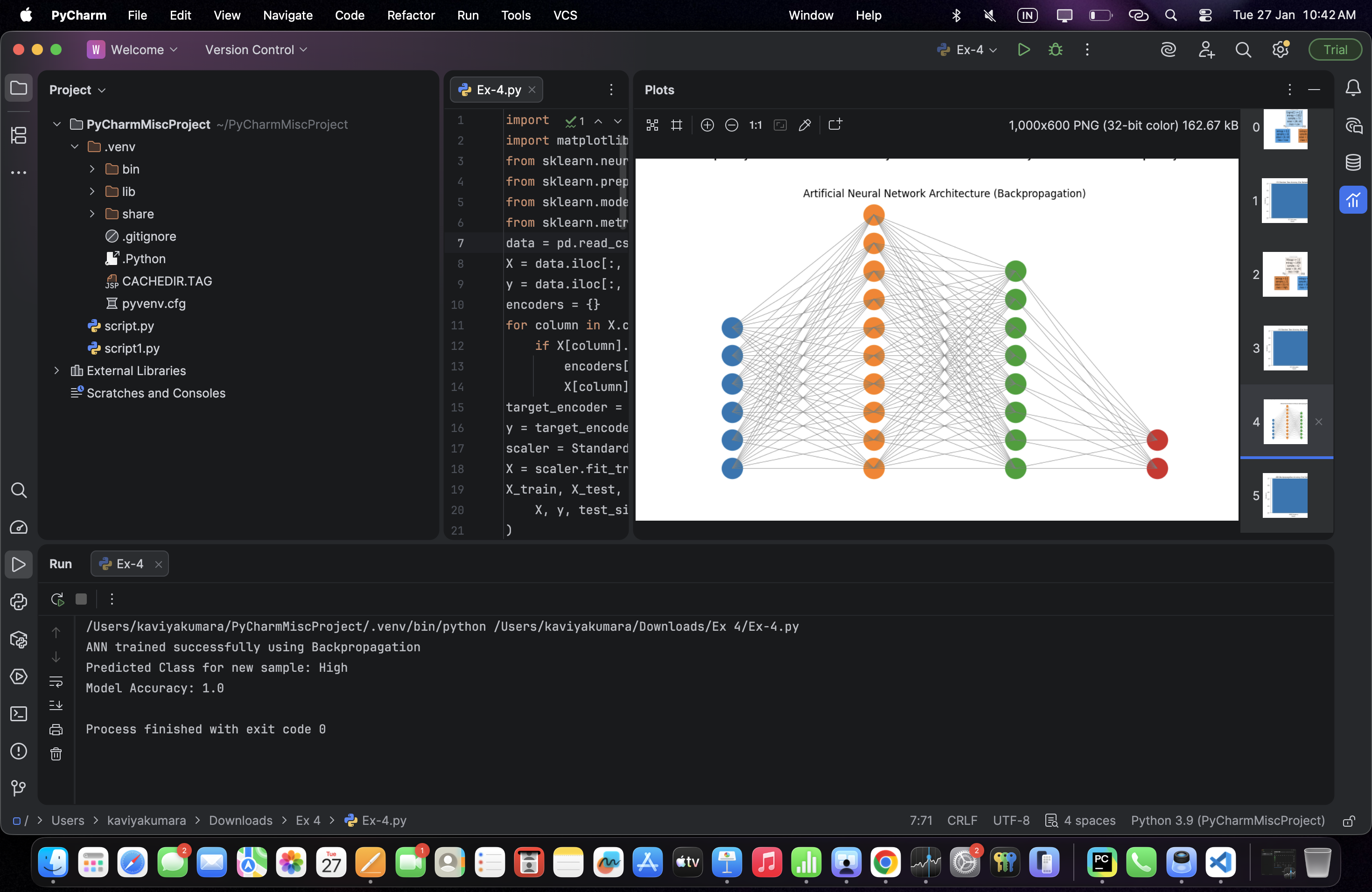
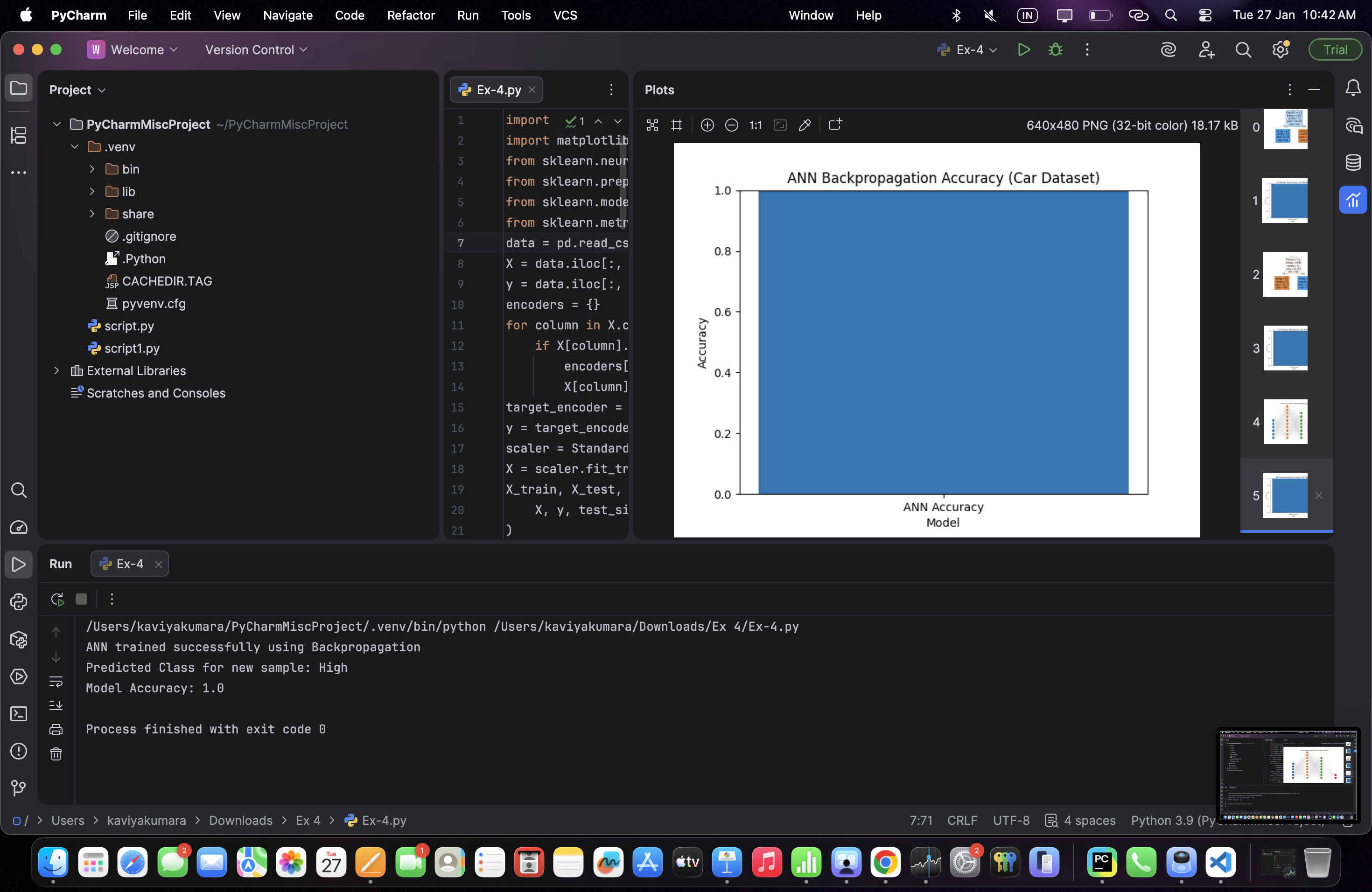
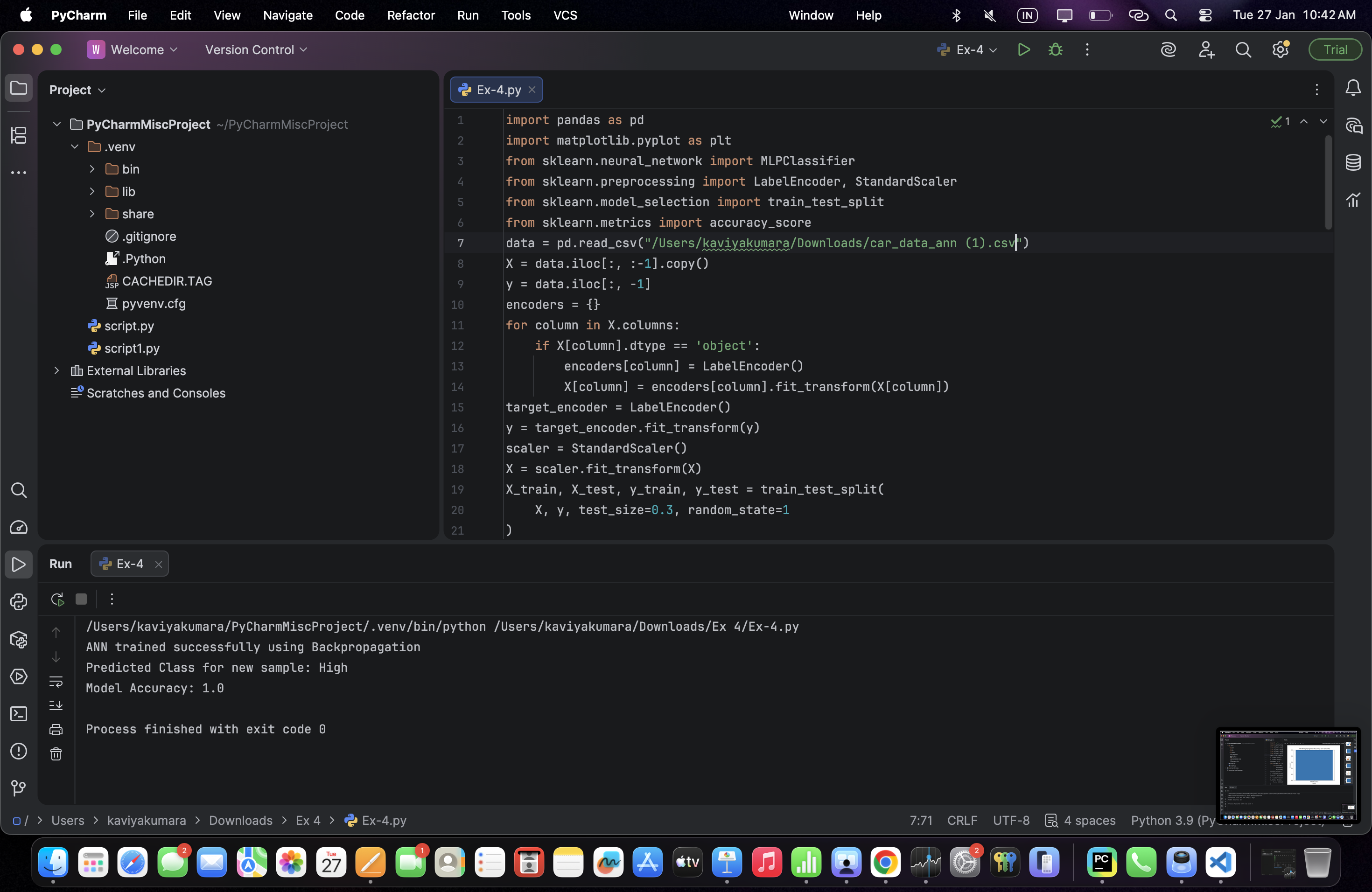
plt.xlabel("Model")

plt.ylabel("Accuracy")

plt.title("ANN Backpropagation Accuracy (Car Dataset)")

plt.show()

**Output:**

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