Ex No: 6 BUILD A RECURRENT NEURAL NETWORK

Aim:

To build a recurrent neural network with Keras/TensorFlow.

Procedure:

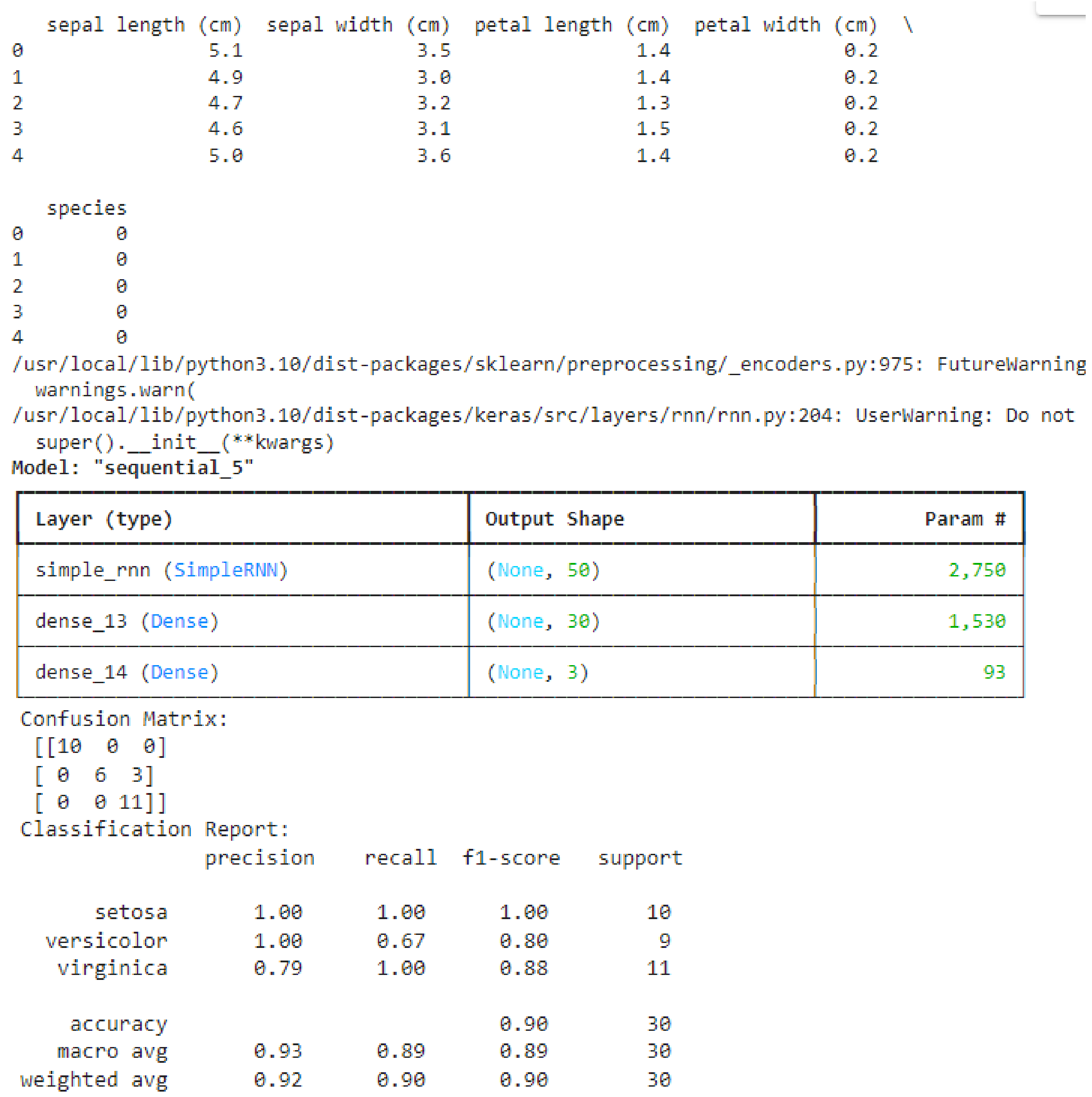
1. Download and load the dataset.
2. Perform analysis and preprocessing of the dataset.
3. Build a simple neural network model using Keras/TensorFlow.
4. Compile and fit the model.
5. Perform prediction with the test dataset.
6. Calculate performance metrics.

Program:

```
import pandas as pd
from sklearn.datasets import load_iris
iris = load_iris()
data = pd.DataFrame(data=iris.data, columns=iris.feature_names)
data['species'] = iris.target
print(data.head())
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import OneHotEncoder
from tensorflow.keras.preprocessing.sequence import pad_sequences
X = data.drop('species', axis=1)
y = data['species']
scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)
X_rnn = X_scaled.reshape((X_scaled.shape[0], 1, X_scaled.shape[1]))
encoder = OneHotEncoder(sparse=False)
```

```
y_encoded = encoder.fit_transform(y.values.reshape(-1, 1))
X_train, X_test, y_train, y_test = train_test_split(X_rnn, y_encoded, test_size=0.2,
random_state=42)
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import SimpleRNN, Dense
model = Sequential()
model.add(SimpleRNN(50, activation='relu', input_shape=(X_train.shape[1],
X_train.shape[2])))
model.add(Dense(30, activation='relu'))
model.add(Dense(3, activation='softmax'))  # 3 classes for the Iris dataset
model.summary()
# Compile the model
model.compile(optimizer='adam',
              loss='categorical_crossentropy',
              metrics=['accuracy'])
history = model.fit(X_train, y_train, epochs=20, batch_size=32, validation_split=0.1)
y_pred = model.predict(X_test)
y_pred_classes = y_pred.argmax(axis=1)
y_true_classes = y_test.argmax(axis=1)
from sklearn.metrics import classification_report, confusion_matrix
conf_matrix = confusion_matrix(y_true_classes, y_pred_classes)
print("Confusion Matrix:\n", conf_matrix)
class_report = classification_report(y_true_classes, y_pred_classes,
target_names=iris.target_names)
print("Classification Report:\n", class_report)
import matplotlib.pyplot as plt
plt.figure(figsize=(12, 6))
plt.plot(history.history['loss'], label='Train Loss')
plt.plot(history.history['val_loss'], label='Validation Loss')
plt.title('Model Loss')
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.legend()
plt.show()
plt.figure(figsize=(12, 6))
plt.plot(history.history['accuracy'], label='Train Accuracy')
plt.plot(history.history['val_accuracy'], label='Validation Accuracy')
plt.title('Model Accuracy')
plt.xlabel('Epoch')
plt.ylabel('Accuracy')
plt.legend()
plt.show()
```

Output:



```
   sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm)  \
0                5.1               3.5                1.4               0.2
1                4.9               3.0                1.4               0.2
2                4.7               3.2                1.3               0.2
3                4.6               3.1                1.5               0.2
4                5.0               3.6                1.4               0.2

   species
0        0
1        0
2        0
3        0
4        0
/usr/local/lib/python3.10/dist-packages/sklearn/preprocessing/_encoders.py:975: FutureWarning
  warnings.warn(
/usr/local/lib/python3.10/dist-packages/keras/src/layers/rnn/rnn.py:204: UserWarning: Do not
  super().__init__(**kwargs)
Model: "sequential_5"
┏━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━━━━━━━━━━━━━┳━━━━━━━━━━━━━━━━━┓
┃ Layer (type)                         ┃ Output Shape                ┃         Param # ┃
┡━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━━━━━━━━━━━━━╇━━━━━━━━━━━━━━━━━┩
│ simple_rnn (SimpleRNN)               │ (None, 50)                  │           2,750 │
├──────────────────────────────────────┼─────────────────────────────┼─────────────────┤
│ dense_13 (Dense)                     │ (None, 30)                  │           1,530 │
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│ dense_14 (Dense)                     │ (None, 3)                   │              93 │
└──────────────────────────────────────┴─────────────────────────────┴─────────────────┘
Confusion Matrix:
 [[10  0  0]
 [ 0  6  3]
 [ 0  0 11]]
Classification Report:
               precision    recall  f1-score   support

      setosa       1.00      1.00      1.00        10
  versicolor       1.00      0.67      0.80         9
   virginica       0.79      1.00      0.88        11

    accuracy                           0.90        30
   macro avg       0.93      0.89      0.89        30
weighted avg       0.92      0.90      0.90        30
```

Result: Thus the program for building a simple recurrent neural network was executed successfully.