In [1]:
```
!pip install tensorflow
```

```
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: tensorflow in c:\users\jadal\appdata\roaming\python\python312\site-packages (2.16.2)
Requirement already satisfied: tensorflow-intel==2.16.2 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow) (2.16.2)
Requirement already satisfied: absl-py>=1.0.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (2.1.0)
Requirement already satisfied: astunparse>=1.6.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (1.6.3)
Requirement already satisfied: flatbuffers>=23.5.26 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (24.3.25)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (0.6.0)
Requirement already satisfied: google-pasta>=0.1.1 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (0.2.0)
Requirement already satisfied: h5py>=3.10.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (3.11.0)
Requirement already satisfied: libclang>=13.0.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (18.1.1)
Requirement already satisfied: ml-dtypes~=0.3.1 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (0.3.2)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (3.3.0)
Requirement already satisfied: packaging in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (24.1)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!=4.21.3,!=4.21.4,!=4.21.5,<5.0.0dev,>=3.20.3 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorfl
ow-intel==2.16.2->tensorflow) (4.25.3)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (2.32.3)
Requirement already satisfied: setuptools in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (70.1.0)
Requirement already satisfied: six>=1.12.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (1.16.0)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (2.4.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (4.12.2)
Requirement already satisfied: wrapt>=1.11.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (1.16.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (1.64.1)
Requirement already satisfied: tensorboard<2.17,>=2.16 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (2.16.2)
Requirement already satisfied: keras>=3.0.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (3.4.1)
Requirement already satisfied: numpy<2.0.0,>=1.26.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorflow-intel==2.16.2->tensorflow) (1.26.4)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from astunparse>=1.6.0->tensorflow-intel==2.16.2->tensorflow) (0.43.0)
Requirement already satisfied: rich in c:\users\jadal\appdata\roaming\python\python312\site-packages (from keras>=3.0.0->tensorflow-intel==2.16.2->tensorflow) (13.7.1)
Requirement already satisfied: namex in c:\users\jadal\appdata\roaming\python\python312\site-packages (from keras>=3.0.0->tensorflow-intel==2.16.2->tensorflow) (0.0.8)
Requirement already satisfied: optree in c:\users\jadal\appdata\roaming\python\python312\site-packages (from keras>=3.0.0->tensorflow-intel==2.16.2->tensorflow) (0.11.0)
Requirement already satisfied: charset-normalizer<4,>=2 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.2->tensorflow) (3.3.
2)
Requirement already satisfied: idna<4,>=2.5 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.2->tensorflow) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.2->tensorflow) (2.2.2)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from requests<3,>=2.21.0->tensorflow-intel==2.16.2->tensorflow) (2024.6.2)
Requirement already satisfied: markdown>=2.6.8 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorboard<2.17,>=2.16->tensorflow-intel==2.16.2->tensorflow) (3.6)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorboard<2.17,>=2.16->tensorflow-intel==2.16.2->
tensorflow) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from tensorboard<2.17,>=2.16->tensorflow-intel==2.16.2->tensorflow) (3.0.3)
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from werkzeug>=1.0.1->tensorboard<2.17,>=2.16->tensorflow-intel==2.16.2->ten
sorflow) (2.1.5)
Requirement already satisfied: markdown-it-py>=2.2.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from rich->keras>=3.0.0->tensorflow-intel==2.16.2->tensorflow) (3.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from rich->keras>=3.0.0->tensorflow-intel==2.16.2->tensorflow) (2.18.
0)
Requirement already satisfied: mdurl~=0.1 in c:\users\jadal\appdata\roaming\python\python312\site-packages (from markdown-it-py>=2.2.0->rich->keras>=3.0.0->tensorflow-intel==2.16.2->tensorflo
w) (0.1.2)
[notice] A new release of pip is available: 24.0 -> 24.1.1
[notice] To update, run: python.exe -m pip install --upgrade pip
```

In [5]:
```
import pandas as pd
import numpy as np
import seaborn as sns
from tensorflow import keras
```

In [6]:
```
df = pd.read_csv('Irisdataset.csv')
df.head()
```

Out[6]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	Iris-setosa
1	2	4.9	3.0	1.4	0.2	Iris-setosa
2	3	4.7	3.2	1.3	0.2	Iris-setosa
3	4	4.6	3.1	1.5	0.2	Iris-setosa
4	5	5.0	3.6	1.4	0.2	Iris-setosa

In [7]:
```
df['Species'].value_counts()
```

Out[7]:
```
Species
Iris-setosa        50
Iris-versicolor    50
Iris-virginica     50
Name: count, dtype: int64
```

In [8]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 6 columns):
 #   Column         Non-Null Count  Dtype
---  ------         --------------  -----
 0   Id             150 non-null    int64
 1   SepalLengthCm  150 non-null    float64
 2   SepalWidthCm   150 non-null    float64
 3   PetalLengthCm  150 non-null    float64
 4   PetalWidthCm   150 non-null    float64
 5   Species        150 non-null    object
dtypes: float64(4), int64(1), object(1)
memory usage: 7.2+ KB
```

In [9]:
```
df.isnull().sum()
```

Out[9]:
```
Id               0
SepalLengthCm    0
SepalWidthCm     0
PetalLengthCm    0
PetalWidthCm     0
Species          0
dtype: int64
```

In [10]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
df['Species'] = le.fit_transform(df['Species'])
df.head()
```

Out[10]:

	Id	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm	Species
0	1	5.1	3.5	1.4	0.2	0
1	2	4.9	3.0	1.4	0.2	0
2	3	4.7	3.2	1.3	0.2	0
3	4	4.6	3.1	1.5	0.2	0
4	5	5.0	3.6	1.4	0.2	0

In [11]:
```
species_name = le.classes_
print(species_name)
```

```
['Iris-setosa' 'Iris-versicolor' 'Iris-virginica']
```

In [12]:
```
X = df.drop(columns=['Id', 'Species'])
y = df['Species']
X.head(3)
```

Out[12]:

	SepalLengthCm	SepalWidthCm	PetalLengthCm	PetalWidthCm
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

In [13]:
```
print(y[:5])
```

```
0    0
1    0
2    0
3    0
4    0
Name: Species, dtype: int32
```

In [14]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(X, y, test_size=0.3, shuffle=True, random_state=69)
```

In [15]:
```
x_train.shape
```

Out[15]:
```
(105, 4)
```

In [16]:
```
from sklearn.preprocessing import StandardScaler
sc = StandardScaler()
print(x_train[:1])
x_train = sc.fit_transform(x_train)
x_test = sc.transform(x_test)
print(x_train[:1])
```

```
    SepalLengthCm  SepalWidthCm  PetalLengthCm  PetalWidthCm
57            4.9           2.4            3.3           1.0
[[-1.14630942 -1.44374444 -0.25650655 -0.258263  ]]
```

In [17]:
```
y_train = keras.utils.to_categorical(y_train, num_classes=3)
print(y_train[:5])
```

```
[[0. 1. 0.]
 [0. 0. 1.]
 [0. 1. 0.]
 [0. 1. 0.]
 [0. 1. 0.]]
```

In [18]:
```
from keras.models import Sequential
from keras.layers import Dense, Dropout
```

In [20]:
```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout, Input

# Define the model
model = Sequential()

# Add the input layer
model.add(Input(shape=(x_train.shape[-1],)))

# Add subsequent layers
model.add(Dense(units=32, activation='relu'))
model.add(Dense(units=32, activation='relu'))
model.add(Dropout(0.5))
model.add(Dense(units=3, activation='softmax'))
```

In [21]:
```
model.compile(optimizer='Adam', loss='categorical_crossentropy', metrics=['accuracy'])
model.summary()
```

Model: "sequential_1"

Layer (type)	Output Shape	Param #
dense_3 (Dense)	(None, 32)	160
dense_4 (Dense)	(None, 32)	1,056
dropout_1 (Dropout)	(None, 32)	0
dense_5 (Dense)	(None, 3)	99

Total params: 1,315 (5.14 KB)
Trainable params: 1,315 (5.14 KB)
Non-trainable params: 0 (0.00 B)

In [22]:
```
model.fit(x_train, y_train, epochs=100, verbose=2)
```

```
Epoch 1/100
4/4 - 2s - 623ms/step - accuracy: 0.3619 - loss: 1.0886
Epoch 2/100
4/4 - 0s - 15ms/step - accuracy: 0.3714 - loss: 1.0793
Epoch 3/100
4/4 - 0s - 16ms/step - accuracy: 0.3714 - loss: 1.0201
Epoch 4/100
4/4 - 0s - 17ms/step - accuracy: 0.5048 - loss: 0.9349
Epoch 5/100
4/4 - 0s - 41ms/step - accuracy: 0.6000 - loss: 0.8759
Epoch 6/100
4/4 - 0s - 14ms/step - accuracy: 0.5714 - loss: 0.8188
Epoch 7/100
4/4 - 0s - 14ms/step - accuracy: 0.6286 - loss: 0.7829
Epoch 8/100
4/4 - 0s - 12ms/step - accuracy: 0.6286 - loss: 0.7359
Epoch 9/100
4/4 - 0s - 12ms/step - accuracy: 0.6381 - loss: 0.7035
Epoch 10/100
4/4 - 0s - 11ms/step - accuracy: 0.6952 - loss: 0.6977
Epoch 11/100
4/4 - 0s - 11ms/step - accuracy: 0.6571 - loss: 0.6996
Epoch 12/100
4/4 - 0s - 11ms/step - accuracy: 0.6952 - loss: 0.6523
Epoch 13/100
4/4 - 0s - 12ms/step - accuracy: 0.7714 - loss: 0.6135
Epoch 14/100
4/4 - 0s - 12ms/step - accuracy: 0.7143 - loss: 0.6251
Epoch 15/100
4/4 - 0s - 12ms/step - accuracy: 0.7619 - loss: 0.5928
Epoch 16/100
4/4 - 0s - 21ms/step - accuracy: 0.7429 - loss: 0.5621
Epoch 17/100
4/4 - 0s - 9ms/step - accuracy: 0.8000 - loss: 0.5374
Epoch 18/100
4/4 - 0s - 19ms/step - accuracy: 0.7714 - loss: 0.5448
Epoch 19/100
4/4 - 0s - 14ms/step - accuracy: 0.7810 - loss: 0.5397
Epoch 20/100
4/4 - 0s - 13ms/step - accuracy: 0.8095 - loss: 0.5224
Epoch 21/100
4/4 - 0s - 19ms/step - accuracy: 0.7714 - loss: 0.5353
Epoch 22/100
4/4 - 0s - 14ms/step - accuracy: 0.8000 - loss: 0.5025
Epoch 23/100
4/4 - 0s - 19ms/step - accuracy: 0.7429 - loss: 0.5117
Epoch 24/100
4/4 - 0s - 20ms/step - accuracy: 0.8000 - loss: 0.4520
Epoch 25/100
4/4 - 0s - 19ms/step - accuracy: 0.8190 - loss: 0.4742
Epoch 26/100
4/4 - 0s - 13ms/step - accuracy: 0.8667 - loss: 0.4422
Epoch 27/100
4/4 - 0s - 13ms/step - accuracy: 0.8190 - loss: 0.4587
Epoch 28/100
4/4 - 0s - 39ms/step - accuracy: 0.8381 - loss: 0.4492
Epoch 29/100
4/4 - 0s - 18ms/step - accuracy: 0.8381 - loss: 0.4412
Epoch 30/100
4/4 - 0s - 11ms/step - accuracy: 0.8000 - loss: 0.4220
Epoch 31/100
4/4 - 0s - 12ms/step - accuracy: 0.8857 - loss: 0.3801
Epoch 32/100
4/4 - 0s - 25ms/step - accuracy: 0.8571 - loss: 0.3917
Epoch 33/100
4/4 - 0s - 15ms/step - accuracy: 0.8571 - loss: 0.3955
Epoch 34/100
4/4 - 0s - 21ms/step - accuracy: 0.8762 - loss: 0.3580
Epoch 35/100
4/4 - 0s - 11ms/step - accuracy: 0.8476 - loss: 0.4249
Epoch 36/100
4/4 - 0s - 16ms/step - accuracy: 0.8762 - loss: 0.3654
Epoch 37/100
4/4 - 0s - 17ms/step - accuracy: 0.8857 - loss: 0.3375
Epoch 38/100
4/4 - 0s - 13ms/step - accuracy: 0.8095 - loss: 0.3776
Epoch 39/100
4/4 - 0s - 11ms/step - accuracy: 0.8381 - loss: 0.3386
Epoch 40/100
4/4 - 0s - 11ms/step - accuracy: 0.8952 - loss: 0.3295
Epoch 41/100
4/4 - 0s - 18ms/step - accuracy: 0.8571 - loss: 0.3451
Epoch 42/100
4/4 - 0s - 13ms/step - accuracy: 0.8571 - loss: 0.3304
Epoch 43/100
4/4 - 0s - 12ms/step - accuracy: 0.8952 - loss: 0.3183
Epoch 44/100
4/4 - 0s - 20ms/step - accuracy: 0.8857 - loss: 0.2997
Epoch 45/100
4/4 - 0s - 15ms/step - accuracy: 0.8762 - loss: 0.3050
Epoch 46/100
4/4 - 0s - 12ms/step - accuracy: 0.9143 - loss: 0.2928
Epoch 47/100
4/4 - 0s - 12ms/step - accuracy: 0.9048 - loss: 0.2880
Epoch 48/100
4/4 - 0s - 23ms/step - accuracy: 0.9048 - loss: 0.3005
Epoch 49/100
4/4 - 0s - 13ms/step - accuracy: 0.9143 - loss: 0.2638
Epoch 50/100
4/4 - 0s - 14ms/step - accuracy: 0.8762 - loss: 0.3161
Epoch 51/100
4/4 - 0s - 12ms/step - accuracy: 0.9238 - loss: 0.2654
Epoch 52/100
4/4 - 0s - 10ms/step - accuracy: 0.9333 - loss: 0.2690
Epoch 53/100
4/4 - 0s - 11ms/step - accuracy: 0.9143 - loss: 0.2722
Epoch 54/100
4/4 - 0s - 16ms/step - accuracy: 0.9143 - loss: 0.2536
Epoch 55/100
4/4 - 0s - 14ms/step - accuracy: 0.9048 - loss: 0.2819
Epoch 56/100
4/4 - 0s - 23ms/step - accuracy: 0.9048 - loss: 0.2436
Epoch 57/100
4/4 - 0s - 12ms/step - accuracy: 0.9238 - loss: 0.2409
Epoch 58/100
4/4 - 0s - 12ms/step - accuracy: 0.9048 - loss: 0.2715
Epoch 59/100
4/4 - 0s - 13ms/step - accuracy: 0.9429 - loss: 0.2213
Epoch 60/100
4/4 - 0s - 11ms/step - accuracy: 0.9238 - loss: 0.2349
Epoch 61/100
4/4 - 0s - 12ms/step - accuracy: 0.9238 - loss: 0.2632
Epoch 62/100
4/4 - 0s - 12ms/step - accuracy: 0.9238 - loss: 0.2169
Epoch 63/100
4/4 - 0s - 11ms/step - accuracy: 0.9048 - loss: 0.2661
Epoch 64/100
4/4 - 0s - 13ms/step - accuracy: 0.9333 - loss: 0.2308
Epoch 65/100
4/4 - 0s - 12ms/step - accuracy: 0.9048 - loss: 0.2289
Epoch 66/100
4/4 - 0s - 12ms/step - accuracy: 0.8667 - loss: 0.2499
Epoch 67/100
4/4 - 0s - 11ms/step - accuracy: 0.9238 - loss: 0.2198
Epoch 68/100
4/4 - 0s - 12ms/step - accuracy: 0.9524 - loss: 0.1963
Epoch 69/100
4/4 - 0s - 12ms/step - accuracy: 0.9238 - loss: 0.2338
Epoch 70/100
4/4 - 0s - 11ms/step - accuracy: 0.9143 - loss: 0.2301
Epoch 71/100
4/4 - 0s - 11ms/step - accuracy: 0.9333 - loss: 0.2145
Epoch 72/100
4/4 - 0s - 11ms/step - accuracy: 0.9143 - loss: 0.2162
Epoch 73/100
4/4 - 0s - 11ms/step - accuracy: 0.9524 - loss: 0.1704
Epoch 74/100
4/4 - 0s - 12ms/step - accuracy: 0.9143 - loss: 0.2375
Epoch 75/100
4/4 - 0s - 12ms/step - accuracy: 0.9619 - loss: 0.1992
Epoch 76/100
4/4 - 0s - 12ms/step - accuracy: 0.9619 - loss: 0.1661
Epoch 77/100
4/4 - 0s - 12ms/step - accuracy: 0.9524 - loss: 0.2164
Epoch 78/100
4/4 - 0s - 20ms/step - accuracy: 0.9333 - loss: 0.1878
Epoch 79/100
4/4 - 0s - 13ms/step - accuracy: 0.9238 - loss: 0.1761
Epoch 80/100
4/4 - 0s - 12ms/step - accuracy: 0.9333 - loss: 0.1873
Epoch 81/100
4/4 - 0s - 10ms/step - accuracy: 0.9333 - loss: 0.1926
Epoch 82/100
4/4 - 0s - 12ms/step - accuracy: 0.9429 - loss: 0.1585
Epoch 83/100
4/4 - 0s - 8ms/step - accuracy: 0.9524 - loss: 0.1703
Epoch 84/100
4/4 - 0s - 12ms/step - accuracy: 0.9429 - loss: 0.1926
Epoch 85/100
4/4 - 0s - 21ms/step - accuracy: 0.9333 - loss: 0.1749
Epoch 86/100
4/4 - 0s - 16ms/step - accuracy: 0.9524 - loss: 0.1952
Epoch 87/100
4/4 - 0s - 15ms/step - accuracy: 0.9333 - loss: 0.1849
Epoch 88/100
4/4 - 0s - 16ms/step - accuracy: 0.9524 - loss: 0.1929
Epoch 89/100
4/4 - 0s - 12ms/step - accuracy: 0.9524 - loss: 0.1513
Epoch 90/100
4/4 - 0s - 13ms/step - accuracy: 0.9524 - loss: 0.1632
Epoch 91/100
4/4 - 0s - 15ms/step - accuracy: 0.9619 - loss: 0.1529
Epoch 92/100
4/4 - 0s - 14ms/step - accuracy: 0.9714 - loss: 0.1570
Epoch 93/100
4/4 - 0s - 13ms/step - accuracy: 0.9619 - loss: 0.1793
Epoch 94/100
4/4 - 0s - 11ms/step - accuracy: 0.9429 - loss: 0.1789
Epoch 95/100
4/4 - 0s - 17ms/step - accuracy: 0.9524 - loss: 0.1530
Epoch 96/100
4/4 - 0s - 12ms/step - accuracy: 0.9524 - loss: 0.1735
Epoch 97/100
4/4 - 0s - 17ms/step - accuracy: 0.9333 - loss: 0.1740
Epoch 98/100
4/4 - 0s - 12ms/step - accuracy: 0.9619 - loss: 0.1420
Epoch 99/100
4/4 - 0s - 10ms/step - accuracy: 0.9619 - loss: 0.1497
Epoch 100/100
4/4 - 0s - 9ms/step - accuracy: 0.9714 - loss: 0.1456
```

Out[22]:
```
<keras.src.callbacks.history.History at 0x1fb85ba8e30>
```

In [23]:
```
prediction = model.predict(x_test)
print(prediction[:5])
```

```
2/2 ━━━━━━━━━━━━━━━━━━━━ 0s 53ms/step
[[9.99966621e-01 1.34209477e-05 1.98717989e-05]
 [5.64658176e-03 9.26387787e-01 6.79656714e-02]
 [9.99868751e-01 7.82671996e-05 5.29615136e-05]
 [1.00378515e-04 9.11357068e-03 9.90786076e-01]
 [9.99792755e-01 1.21366196e-04 8.59556167e-05]]
```

In [24]:
```
prediction = np.argmax(prediction, axis=-1)
print(prediction[:5])
```

```
[0 1 0 2 0]
```

In [25]:
```
print(y_test[:5])
```

```
4      0
58     1
20     0
114    2
31     0
Name: Species, dtype: int32
```

In [26]:
```
from sklearn.metrics import accuracy_score, confusion_matrix
print(accuracy_score(y_test, prediction))
```

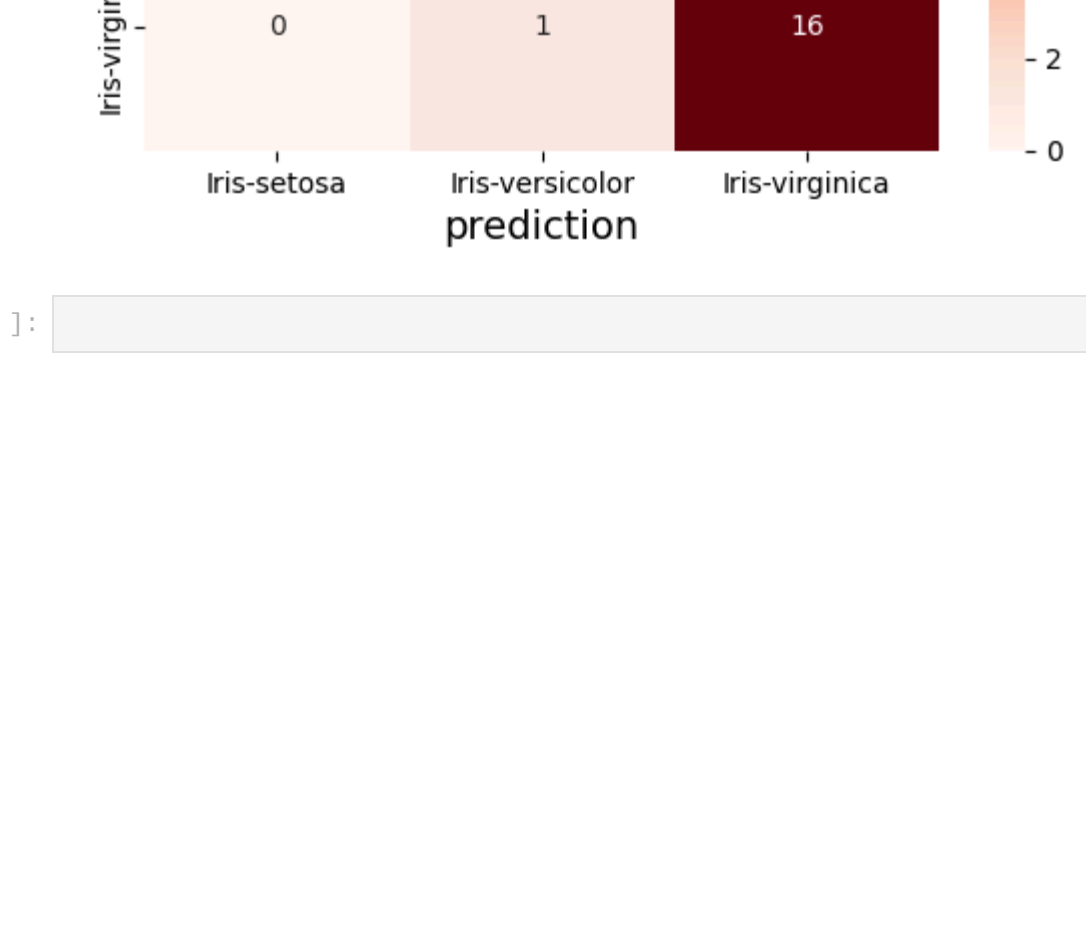
```
0.9777777777777777
```

In [27]:
```
cm = confusion_matrix(y_test, prediction)
print(cm)
```

```
[[16  0  0]
 [ 0 12  0]
 [ 0  1 16]]
```

In [28]:
```
ax = sns.heatmap(cm, annot=True, fmt='d', cmap='Reds', xticklabels=species_name, yticklabels=species_name)
ax.set_title('confusion matrix for irsis dataset prediction')
ax.set_xlabel('prediction', fontsize=14)
ax.set_ylabel('actual', fontsize=14)
```

Out[28]:
```
Text(50.72222222222221, 0.5, 'actual')
```



In [ ]: