Installation of Packages

First install packages like numpy, scikit-learn, matplotlib

In [ ]:
```
!pip install numpy scikit-learn matplotlib
```

```
Requirement already satisfied: numpy in /home/keelah/Documents/Dev/S8-MachineLea
rning/env/lib/python3.10/site-packages (1.24.2)
Requirement already satisfied: scikit-learn in /home/keelah/Documents/Dev/S8-Mac
hineLearning/env/lib/python3.10/site-packages (1.2.1)
Requirement already satisfied: matplotlib in /home/keelah/Documents/Dev/S8-Machi
neLearning/env/lib/python3.10/site-packages (3.7.0)
Requirement already satisfied: threadpoolctl>=2.0.0 in /home/keelah/Documents/De
v/S8-MachineLearning/env/lib/python3.10/site-packages (from scikit-learn)
(3.1.0)
Requirement already satisfied: scipy>=1.3.2 in /home/keelah/Documents/Dev/S8-Mac
hineLearning/env/lib/python3.10/site-packages (from scikit-learn) (1.10.1)
Requirement already satisfied: joblib>=1.1.1 in /home/keelah/Documents/Dev/S8-Ma
chineLearning/env/lib/python3.10/site-packages (from scikit-learn) (1.2.0)
Requirement already satisfied: pillow>=6.2.0 in /home/keelah/Documents/Dev/S8-Ma
chineLearning/env/lib/python3.10/site-packages (from matplotlib) (9.4.0)
Requirement already satisfied: kiwisolver>=1.0.1 in /home/keelah/Documents/Dev/S
8-MachineLearning/env/lib/python3.10/site-packages (from matplotlib) (1.4.4)
Requirement already satisfied: contourpy>=1.0.1 in /home/keelah/Documents/Dev/S
8-MachineLearning/env/lib/python3.10/site-packages (from matplotlib) (1.0.7)
Requirement already satisfied: packaging>=20.0 in /home/keelah/Documents/Dev/S8-
MachineLearning/env/lib/python3.10/site-packages (from matplotlib) (23.0)
Requirement already satisfied: cycler>=0.10 in /home/keelah/Documents/Dev/S8-Mac
hineLearning/env/lib/python3.10/site-packages (from matplotlib) (0.11.0)
Requirement already satisfied: python-dateutil>=2.7 in /home/keelah/Documents/De
v/S8-MachineLearning/env/lib/python3.10/site-packages (from matplotlib) (2.8.2)
Requirement already satisfied: fonttools>=4.22.0 in /home/keelah/Documents/Dev/S
8-MachineLearning/env/lib/python3.10/site-packages (from matplotlib) (4.38.0)
Requirement already satisfied: pyparsing>=2.3.1 in /home/keelah/Documents/Dev/S
8-MachineLearning/env/lib/python3.10/site-packages (from matplotlib) (3.0.9)
Requirement already satisfied: six>=1.5 in /home/keelah/Documents/Dev/S8-Machine
Learning/env/lib/python3.10/site-packages (from python-dateutil>=2.7->matplotli
b) (1.16.0)
```

Importation of packages

We import the necessary packages

In [ ]:
```
import numpy as np
from sklearn.linear_model import Perceptron
from sklearn import datasets, metrics
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plot
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay
```

Load Dataset

We load the necessary IRIS dataset.

In [ ]:
```
iris = datasets.load_iris()
```

Description of the Dataset

Input features

In [ ]:
```
iris.feature_names
```

Out[ ]:
```
['sepal length (cm)',
 'sepal width (cm)',
 'petal length (cm)',
 'petal width (cm)']
```

Target feature

In [ ]:
```
iris.target_names
```

Out[ ]:
```
array(['setosa', 'versicolor', 'virginica'], dtype='<U10')
```

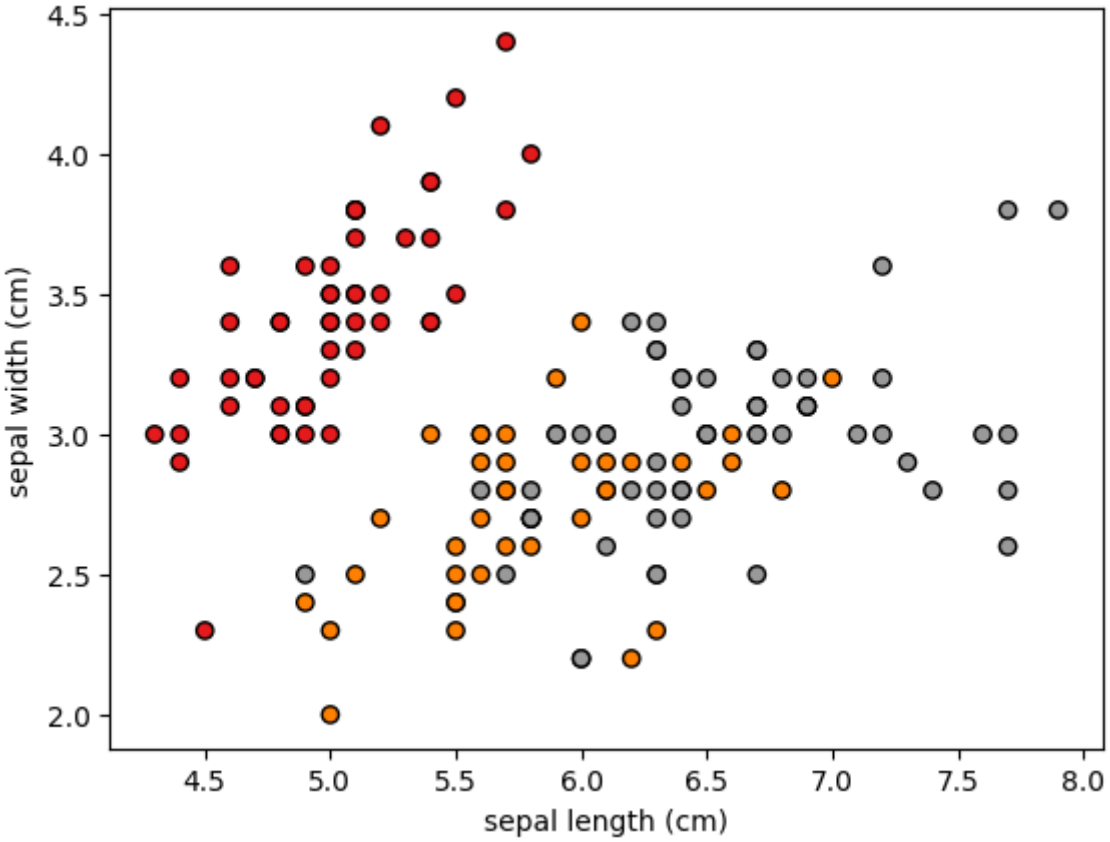
Verify number of records

In [ ]:
```
print(f"Number of Input Records: {len(iris.data)}")
print(f"Number of Target Records: {len(iris.target)}")
```

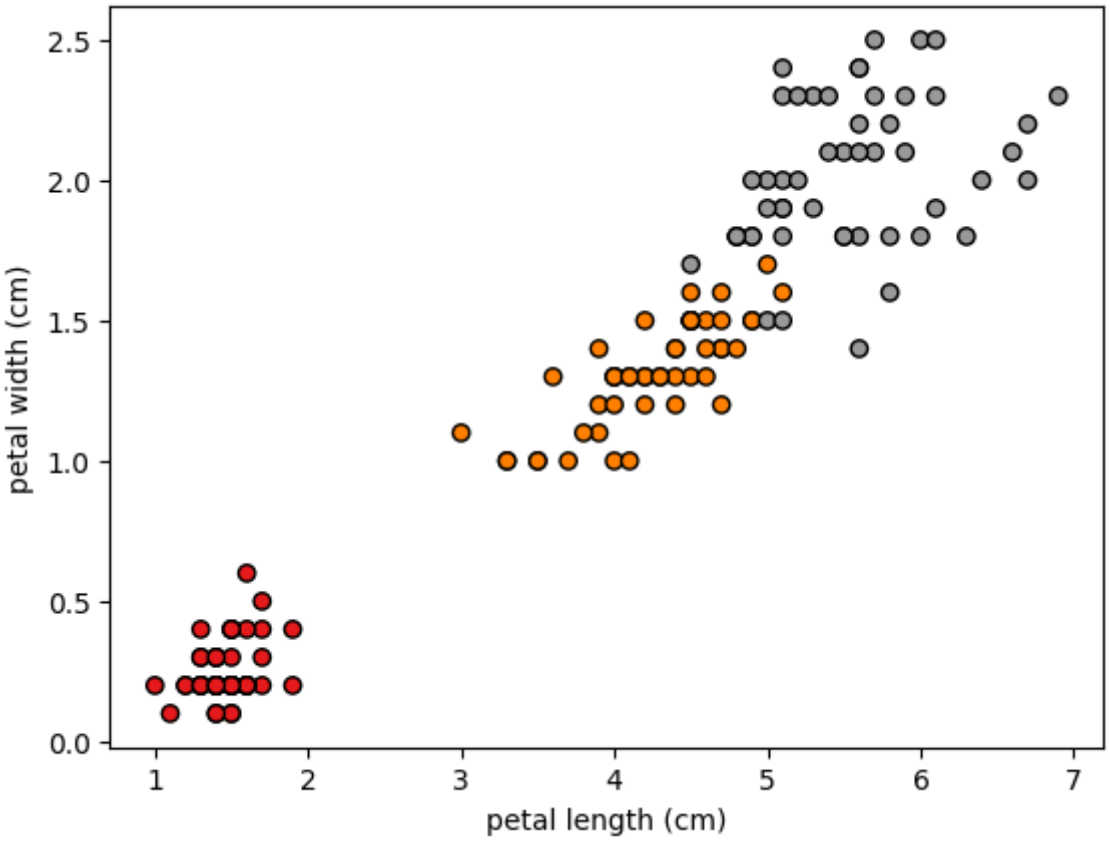
```
Number of Input Records: 150
Number of Target Records: 150
```

Visulizing the dataset

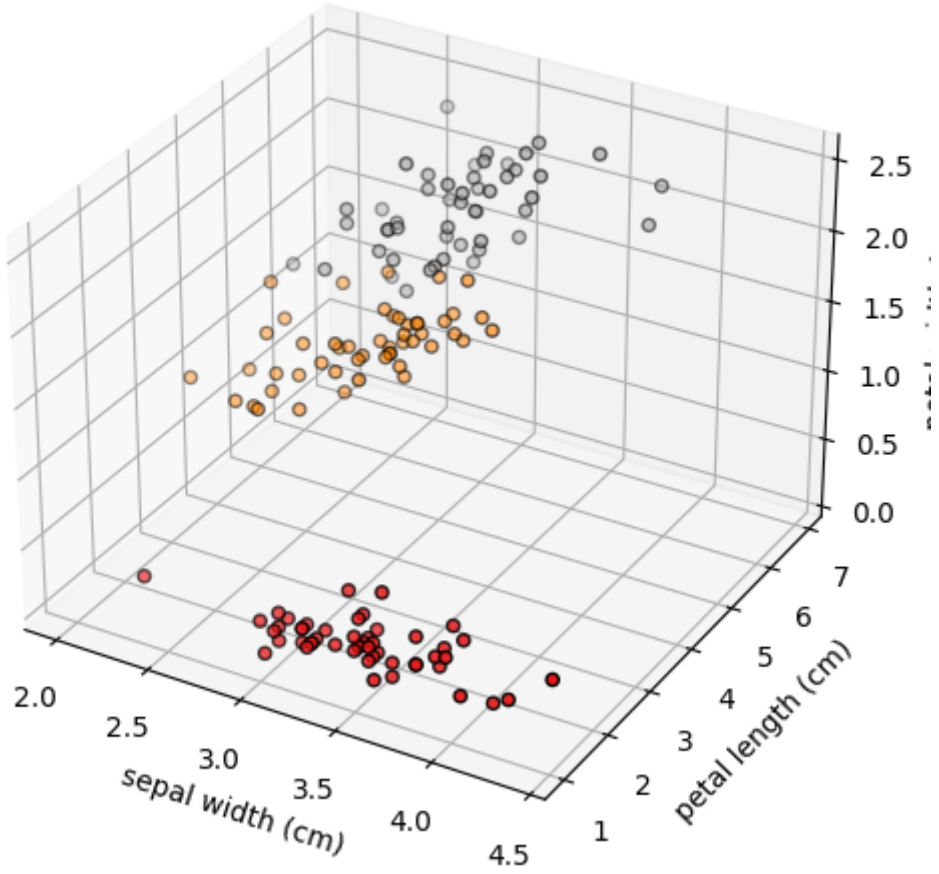
In [ ]:
```
x = iris.data
y = iris.target

plot.scatter(x[:, 0], x[:, 1], c=y, cmap=plot.cm.Set1, edgecolor="k")
plot.xlabel(iris.feature_names[0])
plot.ylabel(iris.feature_names[1])
plot.show()
```



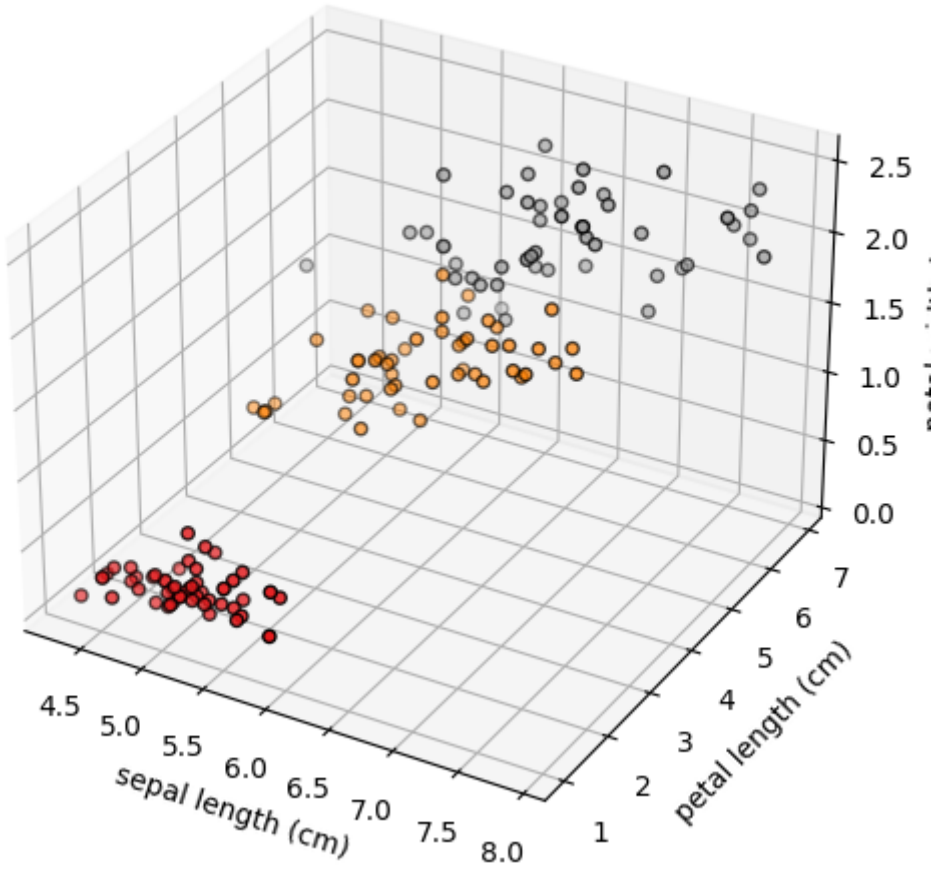
In [ ]:
```
plot.scatter(x[:, 2], x[:, 3], c=y, cmap=plot.cm.Set1, edgecolor="k")
plot.xlabel(iris.feature_names[2])
plot.ylabel(iris.feature_names[3])
plot.show()
```



In [ ]:
```
fig = plot.figure(figsize=(6, 6))
ax = fig.add_subplot(projection="3d")

ax.scatter(x[:, 1], x[:, 2], x[:, 3], c=y, cmap=plot.cm.Set1, edgecolor="k")
ax.set_xlabel(iris.feature_names[1])
ax.set_ylabel(iris.feature_names[2])
ax.set_zlabel(iris.feature_names[3])
plot.show()
```



In [ ]:
```
fig = plot.figure(figsize=(6, 6))
ax = fig.add_subplot(projection="3d")

ax.scatter(x[:, 0], x[:, 2], x[:, 3], c=y, cmap=plot.cm.Set1, edgecolor="k")
ax.set_xlabel(iris.feature_names[0])
ax.set_ylabel(iris.feature_names[2])
ax.set_zlabel(iris.feature_names[3])
plot.show()
```



Training

In [ ]:
```
x = iris.data
y = iris.target

x_train, x_test, y_train, y_test = train_test_split(
    x, y, train_size=0.7, random_state=12, stratify=y
)
```

In [ ]:
```
print(f"Number of Training Records (input): {len(x_train)}")
print(f"Number of Training Records (target): {len(y_train)}")

print(f"Number of Test Records (input): {len(x_test)}")
print(f"Number of Test Records (input): {len(x_test)}")
```

```
Number of Training Records (input): 105
Number of Training Records (target): 105
Number of Test Records (input): 45
Number of Test Records (input): 45
```

Standardization of features

In [ ]:
```
sc = StandardScaler()
sc.fit(x_train)
print(f"Mean: {sc.mean_} \nVariance={sc.var_}")
```

```
Mean: [5.8247619  3.07238095 3.73238095 1.19142857]
Variance=[0.59367256 0.20790385 2.950761   0.55849796]
```

In [ ]:
```
x_train_std = sc.transform(x_train)
x_test_std = sc.transform(x_test)
```

In [ ]:
```
classifier = Perceptron(max_iter=100, eta0=0.1, random_state=12)

# training
classifier.fit(x_train_std, y_train)
```

Out[ ]:
```
▾                    Perceptron

Perceptron(eta0=0.1, max_iter=100, random_state=12)
```

Classification report

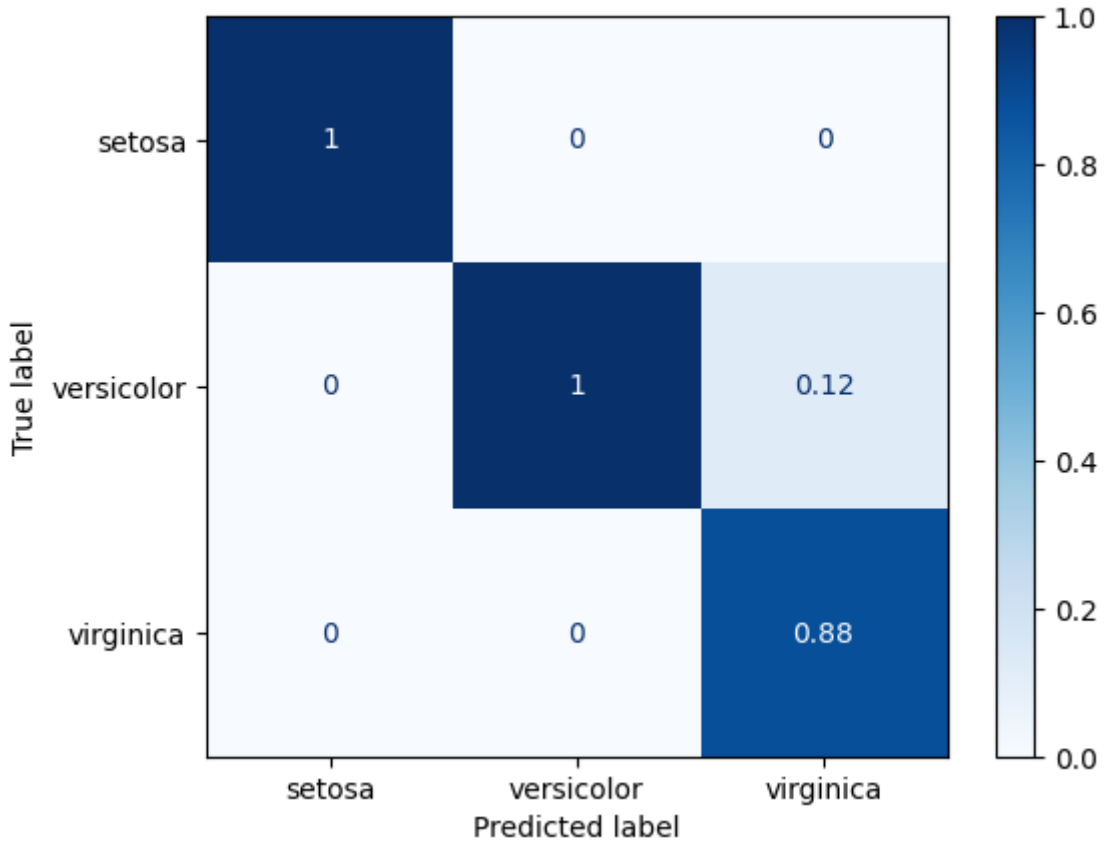
In [ ]:
```
predicted_target = classifier.predict(x_test_std)

# classification report
print(metrics.classification_report(y_test, predicted_target))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        15
           1       1.00      0.87      0.93        15
           2       0.88      1.00      0.94        15

    accuracy                           0.96        45
   macro avg       0.96      0.96      0.96        45
weighted avg       0.96      0.96      0.96        45
```

Confusion matrix

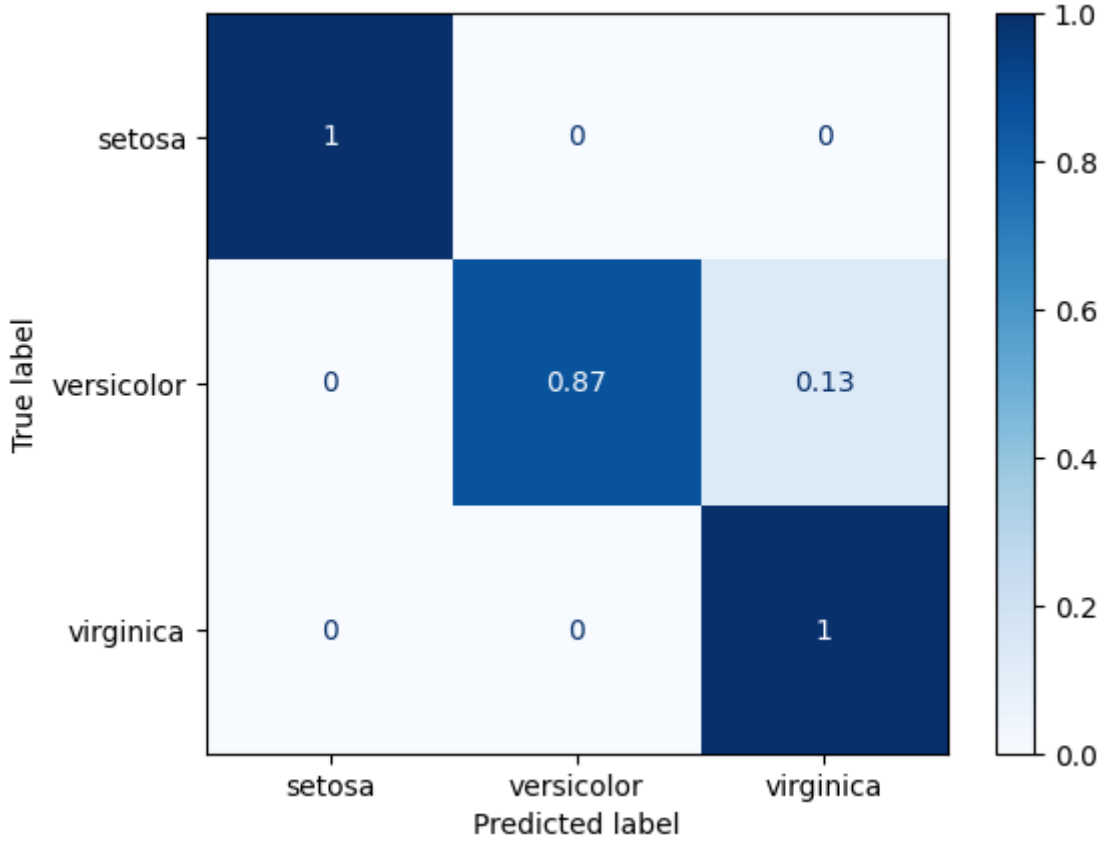
In [ ]:
```
cm = confusion_matrix(y_test, predicted_target, normalize="pred")
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels=iris.target_na
disp.plot(cmap=plot.cm.Blues)
```

Out[ ]:
```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x7f4551d39ab0
>
```



In [ ]:
```
cm = confusion_matrix(y_test, predicted_target, normalize="true")
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels=iris.target_na
disp.plot(cmap=plot.cm.Blues)
```

Out[ ]:
```
<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at 0x7f4551d4fbb0
>
```



References

- The Iris Dataset
- 3D scatterplot
- sklearn.preprocessing.StandardScaler
- sklearn.model_selection.train_test_split
- Iris classification with sklearn perceptron
- plot_confusion_matrix without estimator