# Import libraries

In [38]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.datasets import load_iris
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB
from mlxtend.plotting import plot_confusion_matrix
from sklearn.metrics import confusion_matrix, accuracy_score, classification_r
import warnings
warnings.filterwarnings("ignore")
%matplotlib inline
```

# Load data

In [3]:
```
iris = load_iris()
iris.keys()
```

Out[3]:
```
dict_keys(['data', 'target', 'frame', 'target_names', 'DESCR', 'feature_name
s', 'filename', 'data_module'])
```

In [4]:
```
x = pd.DataFrame(iris['data'], columns=iris['feature_names'])
y = pd.DataFrame(iris['target'], columns=['target'])
```

In [5]:
```
x.head()
```

Out[5]:

| | 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 |

# Basic stats

In [9]:
```
x.shape, y.shape
```

Out[9]:
```
((150, 4), (150, 1))
```

In [10]:
```
x.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 4 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   sepal length (cm)  150 non-null    float64
 1   sepal width (cm)   150 non-null    float64
 2   petal length (cm)  150 non-null    float64
 3   petal width (cm)   150 non-null    float64
dtypes: float64(4)
memory usage: 4.8 KB
```

In [11]:
```
y.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 150 entries, 0 to 149
Data columns (total 1 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   target  150 non-null    int32
dtypes: int32(1)
memory usage: 728.0 bytes
```

In [12]:
```
x.describe()
```

Out[12]:

| | sepal length (cm) | sepal width (cm) | petal length (cm) | petal width (cm) |
|---|---|---|---|---|
| **count** | 150.000000 | 150.000000 | 150.000000 | 150.000000 |
| **mean** | 5.843333 | 3.057333 | 3.758000 | 1.199333 |
| **std** | 0.828066 | 0.435866 | 1.765298 | 0.762238 |
| **min** | 4.300000 | 2.000000 | 1.000000 | 0.100000 |
| **25%** | 5.100000 | 2.800000 | 1.600000 | 0.300000 |
| **50%** | 5.800000 | 3.000000 | 4.350000 | 1.300000 |
| **75%** | 6.400000 | 3.300000 | 5.100000 | 1.800000 |
| **max** | 7.900000 | 4.400000 | 6.900000 | 2.500000 |

# Data preparation

In [14]:
```
scaler = StandardScaler()
x = scaler.fit_transform(x.values)
```

In [15]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y.values, test_size=0.2
```

In [16]:
```
x_train.shape, x_test.shape, y_train.shape, y_test.shape
```

Out[16]:
```
((120, 4), (30, 4), (120, 1), (30, 1))
```

# Model building

In [17]:
```
model = GaussianNB()
```

In [18]:
```
model.fit(x_train, y_train)
```

Out[18]:
```
GaussianNB()
```

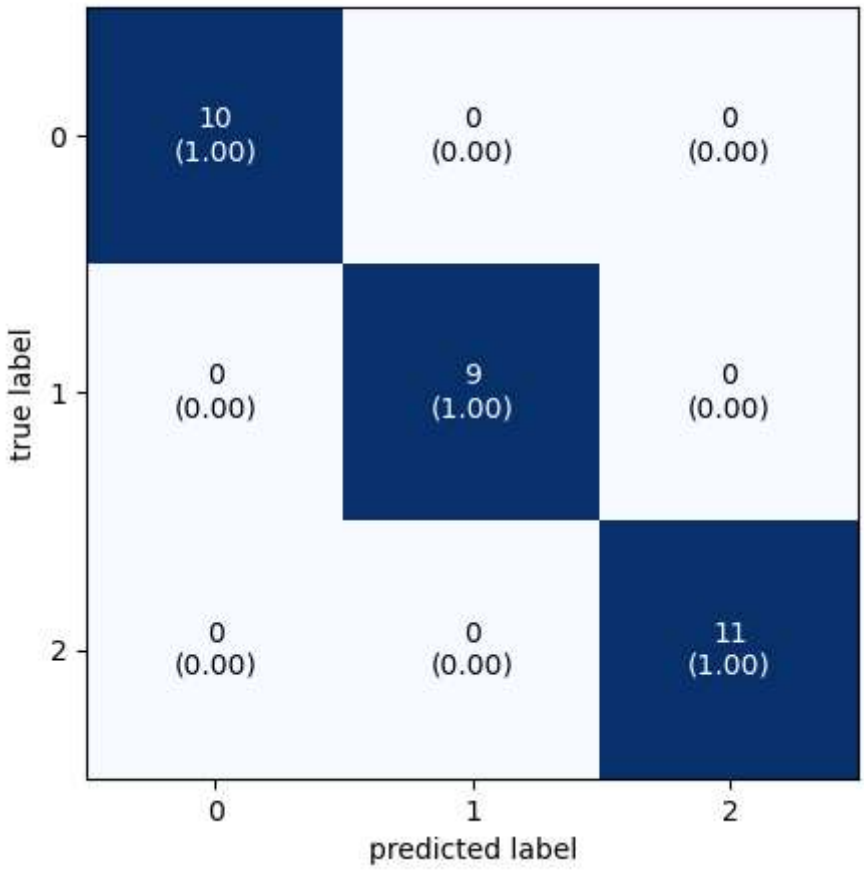
In [19]:
```
y_pred = model.predict(x_test)
```

# Evalutation

In [20]:
```
cm = confusion_matrix(y_test, y_pred)
print(cm)
```

```
[[10  0  0]
 [ 0  9  0]
 [ 0  0 11]]
```

In [21]:
```
plot_confusion_matrix(conf_mat=cm, figsize=(5,5), show_normed=True)
plt.show()
```




In [23]:
```
print(f"TP value is {cm[0,0]}")
print(f"TN value is {cm[1,1] + cm[2,2]}")
print(f"FP value is {cm[0,1] + cm[0,2]}")
print(f"FN value is {cm[1,0] + cm[2,0]}")
```

```
TP value is 10
TN value is 20
FP value is 0
FN value is 0
```

In [24]:
```
print(f"Accuracy score is {accuracy_score(y_test, y_pred)}")
```

```
Accuracy score is 1.0
```

In [25]:
```
print(f"Error rate is {1 - accuracy_score(y_test, y_pred)}")
```

```
Error rate is 0.0
```

In [28]:
```
print(f"Precision score is {precision_score(y_test, y_pred, average='macro')}"
```

```
Precision score is 1.0
```

In [29]:
```
print(f"Recall score is {recall_score(y_test, y_pred, average='macro')}")
```

```
Recall score is 1.0
```

In [30]:
```
print(classification_report(y_test, y_pred))
```

```
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        10
           1       1.00      1.00      1.00         9
           2       1.00      1.00      1.00        11

    accuracy                           1.00        30
   macro avg       1.00      1.00      1.00        30
weighted avg       1.00      1.00      1.00        30
```