Training and classification of 3 iris flowers species

Measurement of the structure of Iris flower, belonging to the species Virginica, Versicolor and Setosa

Importing dataset and making a Pandas Dataframe

In [31]:
```
import csv
import pandas as pd
import numpy as np
from sklearn.cluster import KMeans
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB

import matplotlib.pyplot as plt
import seaborn as sns
```

In [49]:
```
#temp_tot = {'stem': cols[0], 'stem2': cols[1], 'stem3': cols[2], 'stem4': cols[3],

iris=pd.read_csv("iris.csv")
iris.rename(columns={'5.1': 'Sepal width [cm]', '3.5': 'Sepal length [cm]','1.4':
iris.head()
```

Out[49]:

	Sepal width [cm]	Sepal length [cm]	Petal width [cm]	Petal length	Variety name
0	4.9	3.0	1.4	0.2	Iris-setosa
1	4.7	3.2	1.3	0.2	Iris-setosa
2	4.6	3.1	1.5	0.2	Iris-setosa
3	5.0	3.6	1.4	0.2	Iris-setosa
4	5.4	3.9	1.7	0.4	Iris-setosa

Some clustering to observe if are there patterns

In [50]:
```
y = iris['a']
x1 = iris['b']
iris['e'] = iris['e'].map({'Iris-setosa': 1, 'Iris-versicolor': 2,'Iris-virginica'
iris_np=pd.DataFrame(iris[['a', 'b', 'c','d','e']]).to_numpy().astype(np.float32)

iris_np[:,1]
```

```
---------------------------------------------------------------------------
KeyError                                  Traceback (most recent call last)
File ~\anaconda3\envs\myenv\lib\site-packages\pandas\core\indexes\base.py:3621, in
Index.get_loc(self, key, method, tolerance)
   3620 try:
-> 3621     return self._engine.get_loc(casted_key)
   3622 except KeyError as err:

File ~\anaconda3\envs\myenv\lib\site-packages\pandas\_libs\index.pyx:136, in panda
s._libs.index.IndexEngine.get_loc()

File ~\anaconda3\envs\myenv\lib\site-packages\pandas\_libs\index.pyx:163, in panda
s._libs.index.IndexEngine.get_loc()

File pandas\_libs\hashtable_class_helper.pxi:5198, in pandas._libs.hashtable.PyObj
ectHashTable.get_item()

File pandas\_libs\hashtable_class_helper.pxi:5206, in pandas._libs.hashtable.PyObj
ectHashTable.get_item()

KeyError: 'a'

The above exception was the direct cause of the following exception:

KeyError                                  Traceback (most recent call last)
Input In [50], in <cell line: 1>()
----> 1 y = iris['a']
      2 x1 = iris['b']
      3 iris['e'] = iris['e'].map({'Iris-setosa': 1, 'Iris-versicolor': 2,'Iris-vi
rginica': 3})

File ~\anaconda3\envs\myenv\lib\site-packages\pandas\core\frame.py:3505, in DataFr
ame.__getitem__(self, key)
   3503 if self.columns.nlevels > 1:
   3504     return self._getitem_multilevel(key)
-> 3505 indexer = self.columns.get_loc(key)
   3506 if is_integer(indexer):
   3507     indexer = [indexer]

File ~\anaconda3\envs\myenv\lib\site-packages\pandas\core\indexes\base.py:3623, in
Index.get_loc(self, key, method, tolerance)
   3621     return self._engine.get_loc(casted_key)
   3622 except KeyError as err:
-> 3623     raise KeyError(key) from err
   3624 except TypeError:
   3625     # If we have a listlike key, _check_indexing_error will raise
   3626     #  InvalidIndexError. Otherwise we fall through and re-raise
   3627     #  the TypeError.
   3628     self._check_indexing_error(key)

KeyError: 'a'
```

In [ ]:

```
#data processing
clus_C=KMeans(n_clusters=3)
out=clus_C.fit_predict(iris_np[:,0:3])

plt.scatter(y,x1,c=out)
plt.xlabel('size')
plt.ylabel('price')

plt.show()
```

Decision trees

In [ ]:
```
X=iris_np[:, :-1]
Y_truth=iris_np[:,-1] #labels, groud truth
X.shape
```

In [ ]:
```
Y_truth
```

get list of possible classes, and check if the sample is balances

In [ ]:
```
np.unique(Y_truth, return_counts=True)
```

the sample is balanced, even if small

Create train and test sets

In [ ]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X,Y_truth,test_size=0.2)
X_train.shape
```

In [ ]:
```
X_test.shape
```

Train the classifier model

In [51]:
```
clf=GaussianNB()
clf.fit(X_train,Y_train)
Y_test_predicted=clf.predict(X_test)
```

In [52]:
```
Y_test_predicted
```

Out[52]:
```
array([3., 1., 3., 3., 3., 2., 2., 2., 3., 2., 1., 3., 3., 1., 3., 2., 3.,
       2., 3., 3., 1., 2., 1., 1., 1., 2., 3., 2., 3., 3.], dtype=float32)
```

In [53]:
```
Y_test
```

Out[53]:
```
array([3., 1., 3., 3., 3., 2., 2., 2., 3., 2., 1., 3., 3., 1., 3., 2., 3.,
       2., 3., 3., 1., 2., 1., 1., 1., 2., 3., 2., 3., 3.], dtype=float32)
```

Evaluate the model

In [54]:
```
from sklearn.metrics import accuracy_score, precision_recall_fscore_support

acc=accuracy_score(Y_test,Y_test_predicted)
```

In [55]:
```
acc
```

Out[55]:
```
1.0
```

quite good!

In [56]:
```
#precision, recall and support of each class

p, r, f1, s=precision_recall_fscore_support(Y_test,Y_test_predicted)
```

```
for c in range(len(p)):
    print(f"Class: {c}" )
    print(f"Number of items: {s[c]}" )
    print(f"Precision: {p[c]}" )
    print(f"Recall: {r[c]}" )
    print(f"F1_score: {f1[c]}\n \n" )
```

```
Class: 0
Number of items: 7
Precision: 1.0
Recall: 1.0
F1_score: 1.0


Class: 1
Number of items: 9
Precision: 1.0
Recall: 1.0
F1_score: 1.0


Class: 2
Number of items: 14
Precision: 1.0
Recall: 1.0
F1_score: 1.0
```

yes very good: 1) the F1 score is close to 1

2) the samples are balanced, if they were not, the the accuracy would not be indicative, as it does not give importnace to classes with small support, but this is not the case

Confusion matrix with seaborn

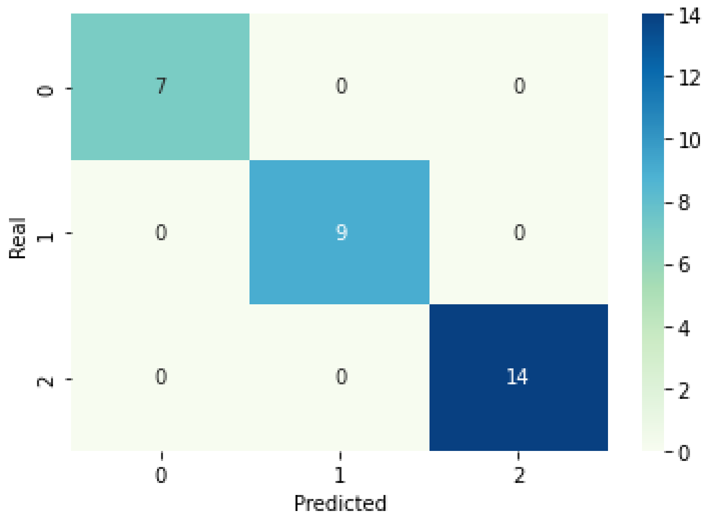
In [57]:
```
from sklearn.metrics import confusion_matrix

conf_matrix= confusion_matrix(Y_test,Y_test_predicted)
conf_matrix
```

Out[57]:
```
array([[ 7,  0,  0],
       [ 0,  9,  0],
       [ 0,  0, 14]], dtype=int64)
```

In [58]:
```
#make it pandas
#label_names=np.arange(len(p))
conf_matrix_df=pd.DataFrame(conf_matrix)
conf_matrix_df.index.name= 'Real'
conf_matrix_df.columns.name= 'Predicted'
```

In [59]:
```
sns.heatmap(conf_matrix_df, annot=True, cmap='GnBu')
plt.show()
```



```
In [ ]:
```

```
In [ ]:
```