Support Vector Machines

Mushroom Classification (https://www.kaggle.com/uciml/mushroom-classification)

Content

This dataset includes descriptions of hypothetical samples corresponding to 23 species of gilled mushrooms in the Agaricus and Lepiota Family Mushroom drawn from The Audubon Society Field Guide to North American Mushrooms (1981). Each species is identified as definitely edible, definitely poisonous, or of unknown edibility and not recommended. This latter class was combined with the poisonous one. The Guide clearly states that there is no simple rule for determining the edibility of a mushroom; no rule like "leaflets three, let it be" for Poisonous Oak and Ivy.

Attribute Information: (classes: edible=e, poisonous=p)

- **cap-shape:**
  - bell=b,
  - conical=c,
  - convex=x,
  - flat=f,
  - knobbed=k,
  - sunken=s
- **cap-surface:**
  - fibrous=f,
  - grooves=g,
  - scaly=y,
  - smooth=s
- **cap-color:**
  - brown=n,
  - buff=b,
  - cinnamon=c,
  - gray=g,
  - green=r,
  - pink=p,
  - purple=u,
  - red=e,
  - white=w,
  - yellow=y
- **bruises:**
  - bruises=t,
  - no=f
- **odor:**
  - almond=a,
  - anise=l,
  - creosote=c,
  - fishy=y,

    - foul=f,
    - musty=m,
    - none=n,
    - pungent=p,
    - spicy=s
- **gill-attachment:**
    - attached=a,
    - descending=d,
    - free=f,
    - notched=n
- **gill-spacing:**
    - close=c,
    - crowded=w,
    - distant=d
- **gill-size:**
    - broad=b,
    - narrow=n
- **gill-color:**
    - black=k,
    - brown=n,
    - buff=b,
    - chocolate=h,
    - gray=g,
    - green=r,
    - orange=o,
    - pink=p,
    - purple=u,
    - red=e,
    - white=w,
    - yellow=y
- **stalk-shape:**
    - enlarging=e,
    - tapering=t
- **stalk-root:**
    - bulbous=b,
    - club=c,
    - cup=u,
    - equal=e,
    - rhizomorphs=z,
    - rooted=r,
    - missing=?
- **stalk-surface-above-ring:**
    - fibrous=f,
    - scaly=y,
    - silky=k,
    - smooth=s
- **stalk-surface-below-ring:**
    - fibrous=f,
    - scaly=y,
    - silky=k,
    - smooth=s
- **stalk-color-above-ring:**

    - brown=n,
    - buff=b,
    - cinnamon=c,
    - gray=g,
    - orange=o,
    - pink=p,
    - red=e,
    - white=w,
    - yellow=y
- **stalk-color-below-ring:**
    - brown=n,
    - buff=b,
    - cinnamon=c,
    - gray=g,
    - orange=o,
    - pink=p,
    - red=e,
    - white=w,
    - yellow=y
- **veil-type:**
    - partial=p,
    - universal=u
- **veil-color:**
    - brown=n,
    - orange=o,
    - white=w,
    - yellow=y
- **ring-number:**
    - none=n,
    - one=o,
    - two=t
- **ring-type:**
    - cobwebby=c,
    - evanescent=e,
    - flaring=f,
    - large=l,
    - none=n,
    - pendant=p,
    - sheathing=s,
    - zone=z
- **spore-print-color:**
    - black=k,
    - brown=n,
    - buff=b,
    - chocolate=h,
    - green=r,
    - orange=o,
    - purple=u,
    - white=w,
    - yellow=y
- **population:**
    - abundant=a,

    - clustered=c,
    - numerous=n,
    - scattered=s,
    - several=v,
    - solitary=y
- **habitat:**
    - grasses=g,
    - leaves=l,
    - meadows=m,
    - paths=p,
    - urban=u,
    - waste=w,
    - woods=d

Type *Markdown* and LaTeX: α^2

In [1]:

```
import pandas as pd
```

In [2]:

```
df = pd.read_csv('datasets/mushrooms.csv')
df.head()
```

Out[2]:

cap-hape	cap-surface	cap-color	bruises	odor	gill-attachment	gill-spacing	gill-size	gill-color	...	stalk-surface-below-ring	stalk-color-above-ring	stal colo belov rir
x	s	n	t	p	f	c	n	k	...	s	w	
x	s	y	t	a	f	c	b	k	...	s	w	
b	s	w	t	l	f	c	b	n	...	s	w	
x	y	w	t	p	f	c	n	n	...	s	w	
x	s	g	f	n	f	w	b	k	...	s	w	

columns

In [3]:

```
df.shape
```

Out[3]:

```
(8124, 23)
```

In [4]:

```
df.columns
```

Out[4]:

```
Index(['class', 'cap-shape', 'cap-surface', 'cap-color', 'bruises', 'odor',
       'gill-attachment', 'gill-spacing', 'gill-size', 'gill-color',
       'stalk-shape', 'stalk-root', 'stalk-surface-above-ring',
       'stalk-surface-below-ring', 'stalk-color-above-ring',
       'stalk-color-below-ring', 'veil-type', 'veil-color', 'ring-number',
       'ring-type', 'spore-print-color', 'population', 'habitat'],
      dtype='object')
```

In [5]:

```
cc = df['class'].value_counts()
cc
```

Out[5]:

```
e    4208
p    3916
Name: class, dtype: int64
```

In [6]:

```
cc.plot(kind = 'bar')
```

Out[6]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1e25b8a1208>
```

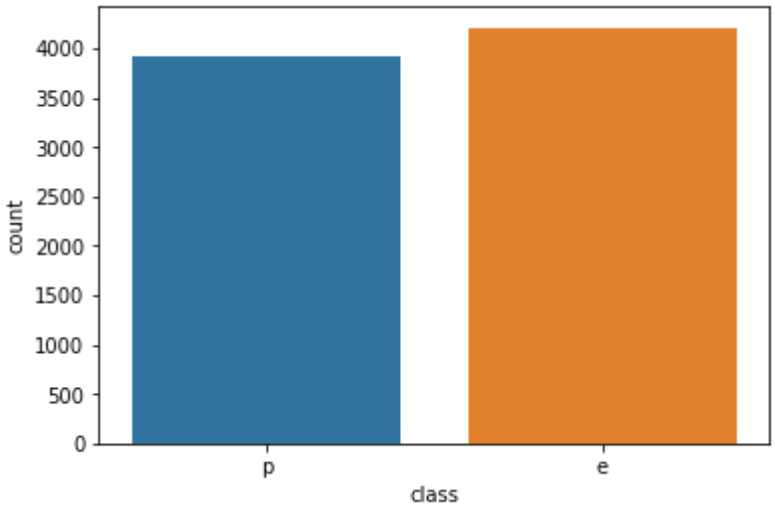
In [7]:

```
import seaborn as sns

sns.countplot(df['class'])
```

Out[7]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1e25cf0d630>
```



In [8]:

```
from sklearn.preprocessing import LabelEncoder
def lbc():
    Lbc = LabelEncoder()
    for col in df.columns:
        df[col] = Lbc.fit_transform(df[col])
    return
lbc()
df.head()
```

Out[8]:

cap-hape	cap-surface	cap-color	bruises	odor	gill-attachment	gill-spacing	gill-size	gill-color	...	stalk-surface-below-ring	stalk-color-above-ring	stal colo belo rir
5	2	4	1	6	1	0	1	4	...	2	7	
5	2	9	1	0	1	0	0	4	...	2	7	
0	2	8	1	3	1	0	0	5	...	2	7	
5	3	8	1	6	1	0	1	5	...	2	7	
5	2	3	0	5	1	1	0	4	...	2	7	

columns

In [9]:

```
Y = df['class']
X = df.drop('class',axis=1)
```

In [10]:

```
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, random_state = 4
```

In [11]:

```
from sklearn.svm import SVC

svc_clf = SVC(degree=3,kernel='poly',probability=True)

svc_clf.fit(X_train,Y_train)
```

```
C:\Users\Jesus\Anaconda3\lib\site-packages\sklearn\svm\base.py:196: FutureWa
rning: The default value of gamma will change from 'auto' to 'scale' in vers
ion 0.22 to account better for unscaled features. Set gamma explicitly to 'a
uto' or 'scale' to avoid this warning.
  "avoid this warning.", FutureWarning)
```

Out[11]:

```
SVC(C=1.0, cache_size=200, class_weight=None, coef0=0.0,
  decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
  kernel='poly', max_iter=-1, probability=True, random_state=None,
  shrinking=True, tol=0.001, verbose=False)
```

In [12]:

```
Y_pred = svc_clf.predict(X_test)

from sklearn.metrics import accuracy_score,confusion_matrix

acc = accuracy_score(Y_test,Y_pred)
confusion_matrix(Y_test,Y_pred)
```

Out[12]:

```
array([[1257,    0],
       [   0, 1181]], dtype=int64)
```

In [13]:

```
acc
```

Out[13]:

```
1.0
```

In [14]:

```
1 y_pro = svc_clf.predict_proba(X_test)
```

In [15]:

```
1 y_pro
```

Out[15]:

```
array([[9.99999370e-01, 6.29626941e-07],
       [1.91041554e-09, 9.99999998e-01],
       [2.64532129e-08, 9.99999974e-01],
       ...,
       [9.01805101e-06, 9.99990982e-01],
       [9.99999900e-01, 1.00000010e-07],
       [9.99767635e-01, 2.32365280e-04]])
```

In [16]:

```
1 y_pro[:,:1]
```

Out[16]:

```
array([[9.99999370e-01],
       [1.91041554e-09],
       [2.64532129e-08],
       ...,
       [9.01805101e-06],
       [9.99999900e-01],
       [9.99767635e-01]])
```