# KNN - Vecinos mas próximos

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Como caso práctico se implementará un sistema CBR básico para determinar la calidad del vino rojo. Para ello, se trabajará con el corpus Wine Quality Data Set.

El corpus se compone de un total de 1599 muestras de vino rojo que contienen información de pruebas fisicoquímicas realizadas en vinos rojos

Para ello, se deberá considerar lo siguiente:

## Las tareas a realizar son las siguientes:

- Preprocesar los datos del corpus de acuerdo a las sugerencias desarrolladas por wguillen
- Aplicar la técnicas de los vecinos más cercanos indicada en clase y empleando la fórmula propuesta por wguillen

  ## Máximos y Mínimos de los atributos:
  fixed acidity min→ 4.6 max→ 15.9 volatile acidity min→ 0.12 max→ 1.58 citric acid min→ 0 max→ 1 residual sugar min→ 0.9 max→ 13.9 chlorides min→ 0.0120.012 max→ 0.611 free sulfur dioxide min→ 1 max→ 72 total sulfur dioxide min→ 6 max→ 289 density min→ 0.99 max→ 1 pH min→ 2.74 max→ 4.01 sulphates min→ 0.33 max→ 2 alcohol min→ 8.4 max→ 14.9
- Desarrollar una pequeña interfaz en Python u otro lenguaje donde se coloquen los atributos y el sistema indique la calidad del vino
- Realizar un pequeño informe del trabajo desarrollado, considerando los aspectos principales y qué tan preciso es el sistema.

In [18]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.colors import ListedColormap
import matplotlib.patches as mpatches
import seaborn as sb

%matplotlib inline
plt.rcParams['figure.figsize'] = (16, 9)
plt.style.use('ggplot')

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import MinMaxScaler
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix
```

### Lectura de datos

In [19]:
```
dataframe = pd.read_csv(r"winequality-red.csv",sep=';')
dataframe.head(10)
```

Out[19]:

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphates | alcohol | quality |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 7.4 | 0.70 | 0.00 | 1.9 | 0.076 | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 | 5 |
| 1 | 7.8 | 0.88 | 0.00 | 2.6 | 0.098 | 25.0 | 67.0 | 0.9968 | 3.20 | 0.68 | 9.8 | 5 |
| 2 | 7.8 | 0.76 | 0.04 | 2.3 | 0.092 | 15.0 | 54.0 | 0.9970 | 3.26 | 0.65 | 9.8 | 5 |
| 3 | 11.2 | 0.28 | 0.56 | 1.9 | 0.075 | 17.0 | 60.0 | 0.9980 | 3.16 | 0.58 | 9.8 | 6 |
| 4 | 7.4 | 0.70 | 0.00 | 1.9 | 0.076 | 11.0 | 34.0 | 0.9978 | 3.51 | 0.56 | 9.4 | 5 |
| 5 | 7.4 | 0.66 | 0.00 | 1.8 | 0.075 | 13.0 | 40.0 | 0.9978 | 3.51 | 0.56 | 9.4 | 5 |
| 6 | 7.9 | 0.60 | 0.06 | 1.6 | 0.069 | 15.0 | 59.0 | 0.9964 | 3.30 | 0.46 | 9.4 | 5 |
| 7 | 7.3 | 0.65 | 0.00 | 1.2 | 0.065 | 15.0 | 21.0 | 0.9946 | 3.39 | 0.47 | 10.0 | 7 |
| 8 | 7.8 | 0.58 | 0.02 | 2.0 | 0.073 | 9.0 | 18.0 | 0.9968 | 3.36 | 0.57 | 9.5 | 7 |
| 9 | 7.5 | 0.50 | 0.36 | 6.1 | 0.071 | 17.0 | 102.0 | 0.9978 | 3.35 | 0.80 | 10.5 | 5 |

In [20]:
```
dataframe.describe()
```

Out[20]:

| | fixed acidity | volatile acidity | citric acid | residual sugar | chlorides | free sulfur dioxide | total sulfur dioxide | density | pH | sulphat |
|---|---|---|---|---|---|---|---|---|---|---|
| count | 1517.000000 | 1517.000000 | 1517.000000 | 1517.000000 | 1517.000000 | 1517.000000 | 1517.000000 | 1517.000000 | 1517.000000 | 1517.0000 |
| mean | 8.160185 | 0.526747 | 0.262353 | 2.447132 | 0.087056 | 15.839156 | 46.132498 | 0.996546 | 3.316882 | 0.6558 |
| std | 1.560862 | 0.177613 | 0.191117 | 1.179501 | 0.047791 | 10.335556 | 32.901447 | 0.001666 | 0.151839 | 0.1702 |
| min | 4.600000 | 0.120000 | 0.000000 | 0.900000 | 0.012000 | 1.000000 | 6.000000 | 0.990070 | 2.740000 | 0.3300 |
| 25% | 7.100000 | 0.390000 | 0.090000 | 1.900000 | 0.070000 | 7.000000 | 22.000000 | 0.995530 | 3.220000 | 0.5500 |
| 50% | 7.800000 | 0.520000 | 0.250000 | 2.200000 | 0.079000 | 14.000000 | 37.000000 | 0.996610 | 3.320000 | 0.6200 |
| 75% | 9.000000 | 0.640000 | 0.410000 | 2.500000 | 0.089000 | 21.000000 | 62.000000 | 0.997600 | 3.400000 | 0.7200 |
| max | 15.900000 | 1.580000 | 1.000000 | 13.900000 | 0.611000 | 72.000000 | 289.000000 | 1.000000 | 4.010000 | 2.0000 |

### Preparación del modelo

In [21]:
```
X = dataframe[['citric acid','alcohol']].values
y = dataframe['quality'].values

X_train, X_test, y_train, y_test = train_test_split(X, y, random_state=0)
scaler = MinMaxScaler()
X_train = scaler.fit_transform(X_train)
X_test = scaler.transform(X_test)
```

### Entrenamiento

In [22]:
```
n_neighbors = 7

knn = KNeighborsClassifier(n_neighbors)
knn.fit(X_train, y_train)
print('Accuracy of K-NN classifier on training set: {:.2f}'
     .format(knn.score(X_train, y_train)))
print('Accuracy of K-NN classifier on test set: {:.2f}'
     .format(knn.score(X_test, y_test)))
```

```
Accuracy of K-NN classifier on training set: 0.67
Accuracy of K-NN classifier on test set: 0.57
```

### Esta parte nos ayuda a apreciar los valores obtenidos como la matriz de confusión

In [23]:
```
pred = knn.predict(X_test)
print(confusion_matrix(y_test, pred))
print(classification_report(y_test, pred))
```

```
[[  0   9   3   0   0]
 [  0 127  40   3   0]
 [  0  66  76   9   0]
 [  1  12  16  13   0]
 [  0   1   2   2   0]]
              precision    recall  f1-score   support

           4       0.00      0.00      0.00        12
           5       0.59      0.75      0.66       170
           6       0.55      0.50      0.53       151
           7       0.48      0.31      0.38        42
           8       0.00      0.00      0.00         5

    accuracy                           0.57       380
   macro avg       0.33      0.31      0.31       380
weighted avg       0.54      0.57      0.55       380
```

```
C:\Users\jhonn\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1221: UndefinedMetricWa
rning: Precision and F-score are ill-defined and being set to 0.0 in labels with no predicted sample
s. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

### Gráfica

In [24]:
```
h = .02  # step size in the mesh

# Create color maps
cmap_light = ListedColormap(['#FFAAAA', '#ffcc99', '#ffffb3','#b3ffff','#c2f0c2'])
cmap_bold = ListedColormap(['#FF0000', '#ff9933','#FFFF00','#00ffff','#00FF00'])

# we create an instance of Neighbours Classifier and fit the data.
clf = KNeighborsClassifier(n_neighbors, weights='distance')
clf.fit(X, y)

# Plot the decision boundary. For that, we will assign a color to each
# point in the mesh [x_min, x_max]x[y_min, y_max].
x_min, x_max = X[:, 0].min() - 1, X[:, 0].max() + 1
y_min, y_max = X[:, 1].min() - 1, X[:, 1].max() + 1
xx, yy = np.meshgrid(np.arange(x_min, x_max, h),
                     np.arange(y_min, y_max, h))
Z = clf.predict(np.c_[xx.ravel(), yy.ravel()])

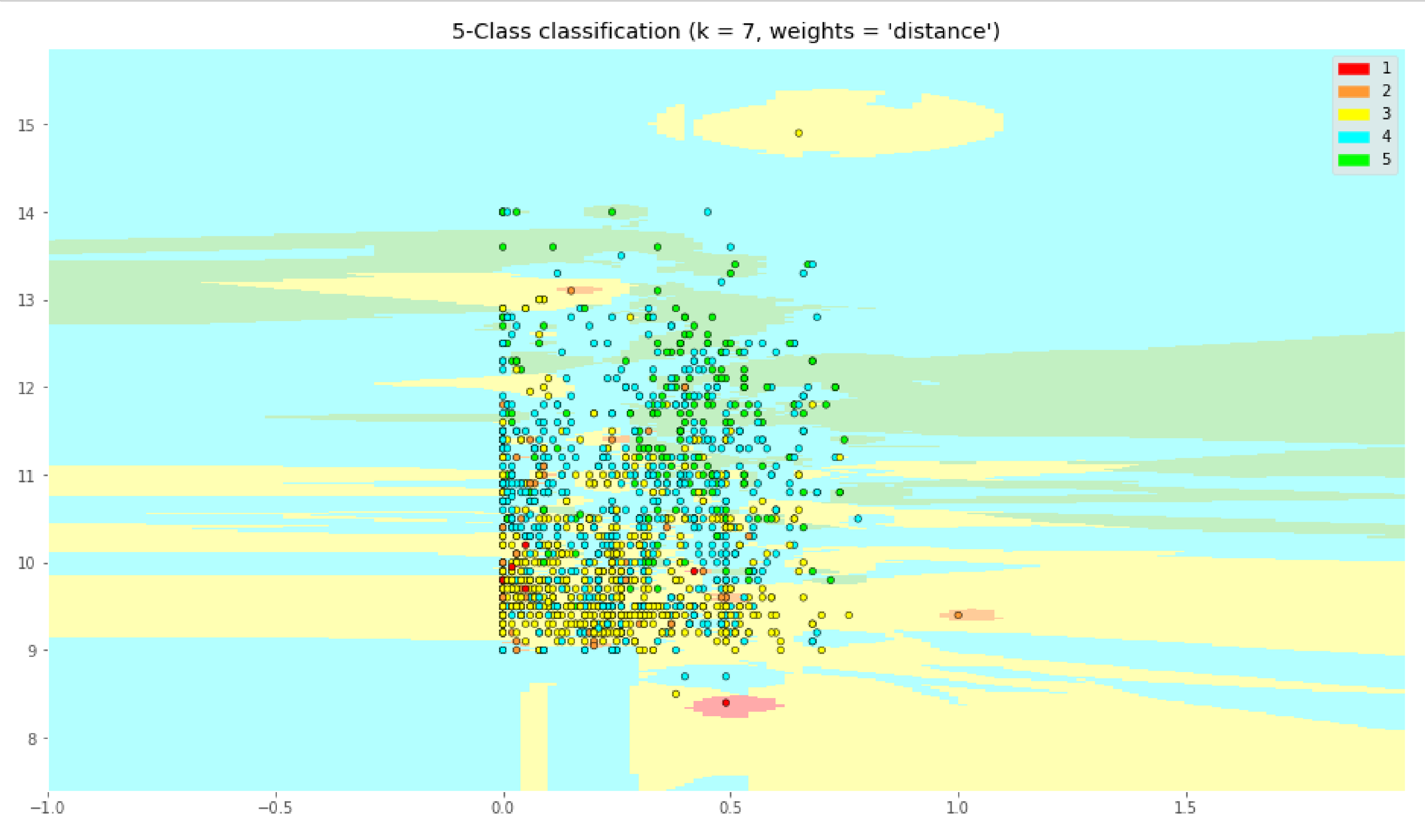
# Put the result into a color plot
Z = Z.reshape(xx.shape)
plt.figure()
plt.pcolormesh(xx, yy, Z, cmap=cmap_light)

# Plot also the training points
plt.scatter(X[:, 0], X[:, 1], c=y, cmap=cmap_bold,
                edgecolor='k', s=20)
plt.xlim(xx.min(), xx.max())
plt.ylim(yy.min(), yy.max())

patch0 = mpatches.Patch(color='#FF0000', label='1')
patch1 = mpatches.Patch(color='#ff9933', label='2')
patch2 = mpatches.Patch(color='#FFFF00', label='3')
patch3 = mpatches.Patch(color='#00ffff', label='4')
patch4 = mpatches.Patch(color='#00FF00', label='5')
plt.legend(handles=[patch0, patch1, patch2, patch3,patch4])

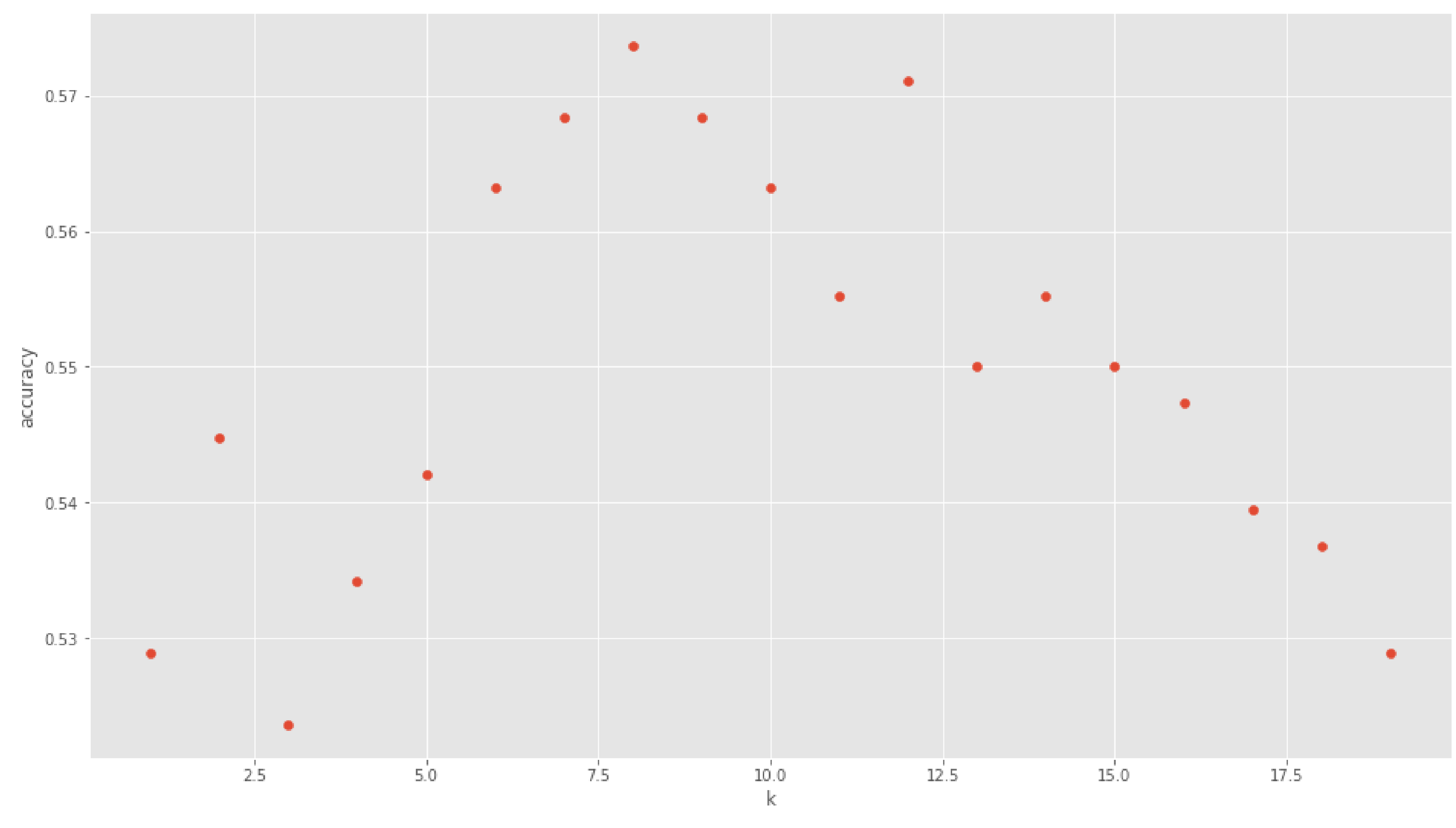

plt.title("5-Class classification (k = %i, weights = '%s')"
              % (n_neighbors, 'distance'))

plt.show()
```




In [25]:
```
k_range = range(1, 20)
scores = []
for k in k_range:
    knn = KNeighborsClassifier(n_neighbors = k)
    knn.fit(X_train, y_train)
    scores.append(knn.score(X_test, y_test))
plt.figure()
plt.xlabel('k')
plt.ylabel('accuracy')
plt.scatter(k_range, scores)
```

Out[25]: <matplotlib.collections.PathCollection at 0x13ed4505d30>




### Esta parte imprime la clasificación del nuevo vino que ingresamos de acuerdo a los parámetros que enviamos en el vector.

In [26]:
```
print(clf.predict([[90, 15]]))
```

```
[7]
```

### Finalmente la implementación de una interfaz gráfica para facilitar el uso.

In [31]:
```
def function():

    cuadro_nombre.get()
    cuadro_Apellido.get()
    cuadro_Direccion.insert(0,clf.predict([[ cuadro_nombre.get(), cuadro_Apellido.get()]]))

    #print("hola mundo")
```

In [32]:
```
def entrenar():
    numero1=int(vecinos.get())
    n_neighbors = numero1

    knn = KNeighborsClassifier(n_neighbors)
    knn.fit(X_train, y_train)

    cuadropre.insert(0,knn.score(X_train, y_train))
    print('Accuracy of K-NN classifier on training set: {:.2f}'
         .format(knn.score(X_train, y_train)))

    print('Accuracy of K-NN classifier on test set: {:.2f}'
         .format(knn.score(X_test, y_test)))
```

In [33]:
```
def limpiar():
    cuadro_nombre.delete("0","end")
    cuadro_Apellido.delete("0","end")
    cuadro_Direccion.delete("0","end")
    cuadropre.delete("0","end")
    vecinos.delete("0","end")
```

In [34]:
```
from tkinter import *
raiz = Tk()
raiz.geometry("800x200")
raiz.title("Formulario Simple")
miFrame= Frame()
miFrame.pack()
bienvenido = Label(miFrame, text="BIENVENIDO")
bienvenido.grid(row=0, column=2)
bienvenido.config(font=('Arial', 16))
#-----Seccion de Nombre-----
nombre_label= Label(miFrame, text="Ingrese nivel de Ácido Cítrico:")
nombre_label.grid(row=1, column=0)
nombre_label.config(padx=10, pady=10)

pre= Label(miFrame, text="Número de vecinos a calcular:")
pre.grid(row=1, column=3)
pre.config(padx=10, pady=10)

pre= Label(miFrame, text="Presición")
pre.grid(row=3, column=2)
pre.config(padx=10, pady=10)

vecinos=Entry(miFrame)
vecinos.grid(row=2, column=3)

cuadropre=Entry(miFrame)
cuadropre.grid(row=3, column=3)

generar=Button(miFrame, text="Probar", command=entrenar)
generar.grid(row=3, column=4)


cuadro_nombre=Entry(miFrame)
cuadro_nombre.grid(row=1, column=1)
#-----Seccion de Apellido-----
apellido_label=Label(miFrame, text="Ingrese nivel de alcohol: ")
apellido_label.grid(row=2, column=0)
apellido_label.config(padx=10, pady=10)
cuadro_Apellido=Entry(miFrame)
cuadro_Apellido.grid(row=2, column=1)
#-----Seccion de Dirección-----
direccion=Label(miFrame, text="Resultado: ")
direccion.grid(row=3, column=0)
direccion.config(padx=10, pady=10)
cuadro_Direccion=Entry(miFrame)
cuadro_Direccion.grid(row=3, column=1)
mostrar=Button(miFrame, text="Mostrar", command=function)
mostrar.grid(row=4, column=1)
limpiar=Button(miFrame, text="Limpiar", command=limpiar)
limpiar.grid(row=4, column=2)
raiz.mainloop()
```

```
C:\Users\jhonn\anaconda3\lib\site-packages\sklearn\utils\validation.py:73: FutureWarning: Beginning i
n version 0.22, arrays of bytes/strings will be converted to decimal numbers if dtype='numeric'. It i
s recommended that you convert the array to a float dtype before using it in scikit-learn, for exampl
e by using your_array = your_array.astype(np.float64).
  return f(**kwargs)
C:\Users\jhonn\anaconda3\lib\site-packages\sklearn\utils\validation.py:73: FutureWarning: Beginning i
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