In [1]:

```python
import pandas as pd
import numpy as np
import seaborn as sb
import matplotlib.pyplot as plt
import scipy as spy
import keras
from sklearn.metrics import accuracy_score, recall_score, confusion_matrix
from sklearn.model_selection import train_test_split
from keras.models import Sequential
from keras.layers import Dense,Dropout,Input
from keras.optimizers import Adam,RMSprop
df = pd.read_csv('winequality-white.csv')
```

```
2021-08-11 12:11:24.330688: W tensorflow/stream_executor/platform/default/dso_loader.cc:6
4] Could not load dynamic library 'libcudart.so.11.0'; dlerror: libcudart.so.11.0: cannot
open shared object file: No such file or directory
2021-08-11 12:11:24.330706: I tensorflow/stream_executor/cuda/cudart_stub.cc:29] Ignore ab
ove cudart dlerror if you do not have a GPU set up on your machine.
```

Olhando abaixo, não temos nenhum valor N/A, então não precisamos tratar isso.

In [2]:

```python
df.isna().sum()
```

Out[2]:

```
fixed acidity           0
volatile acidity        0
citric acid             0
residual sugar          0
chlorides               0
free sulfur dioxide     0
total sulfur dioxide    0
density                 0
pH                      0
sulphates               0
alcohol                 0
quality                 0
dtype: int64
```

In [3]:

```python
print(len(df))
df
```

```
4898
```

Out[3]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality
0	7.0	0.27	0.36	20.7	0.045	45.0	170.0	1.00100	3.00	0.45	8.8	6
1	6.3	0.30	0.34	1.6	0.049	14.0	132.0	0.99400	3.30	0.49	9.5	6
2	8.1	0.28	0.40	6.9	0.050	30.0	97.0	0.99510	3.26	0.44	10.1	6
3	7.2	0.23	0.32	8.5	0.058	47.0	186.0	0.99560	3.19	0.40	9.9	6
4	7.2	0.23	0.32	8.5	0.058	47.0	186.0	0.99560	3.19	0.40	9.9	6
...	...	...	...	...	...	...	...	...	...	...	...	...
4893	6.2	0.21	0.29	1.6	0.039	24.0	92.0	0.99114	3.27	0.50	11.2	6
4894	6.6	0.32	0.36	8.0	0.047	57.0	168.0	0.99490	3.15	0.46	9.6	5
4895	6.5	0.24	0.19	1.2	0.041	30.0	111.0	0.99254	2.99	0.46	9.4	6
4896	5.5	0.29	0.30	1.1	0.022	20.0	110.0	0.98869	3.34	0.38	12.8	7
4897	6.0	0.21	0.38	0.8	0.020	22.0	98.0	0.98941	3.26	0.32	11.8	6

4898 rows × 12 columns

In [4]:

```
df['quality'].value_counts()
```

Out[4]:

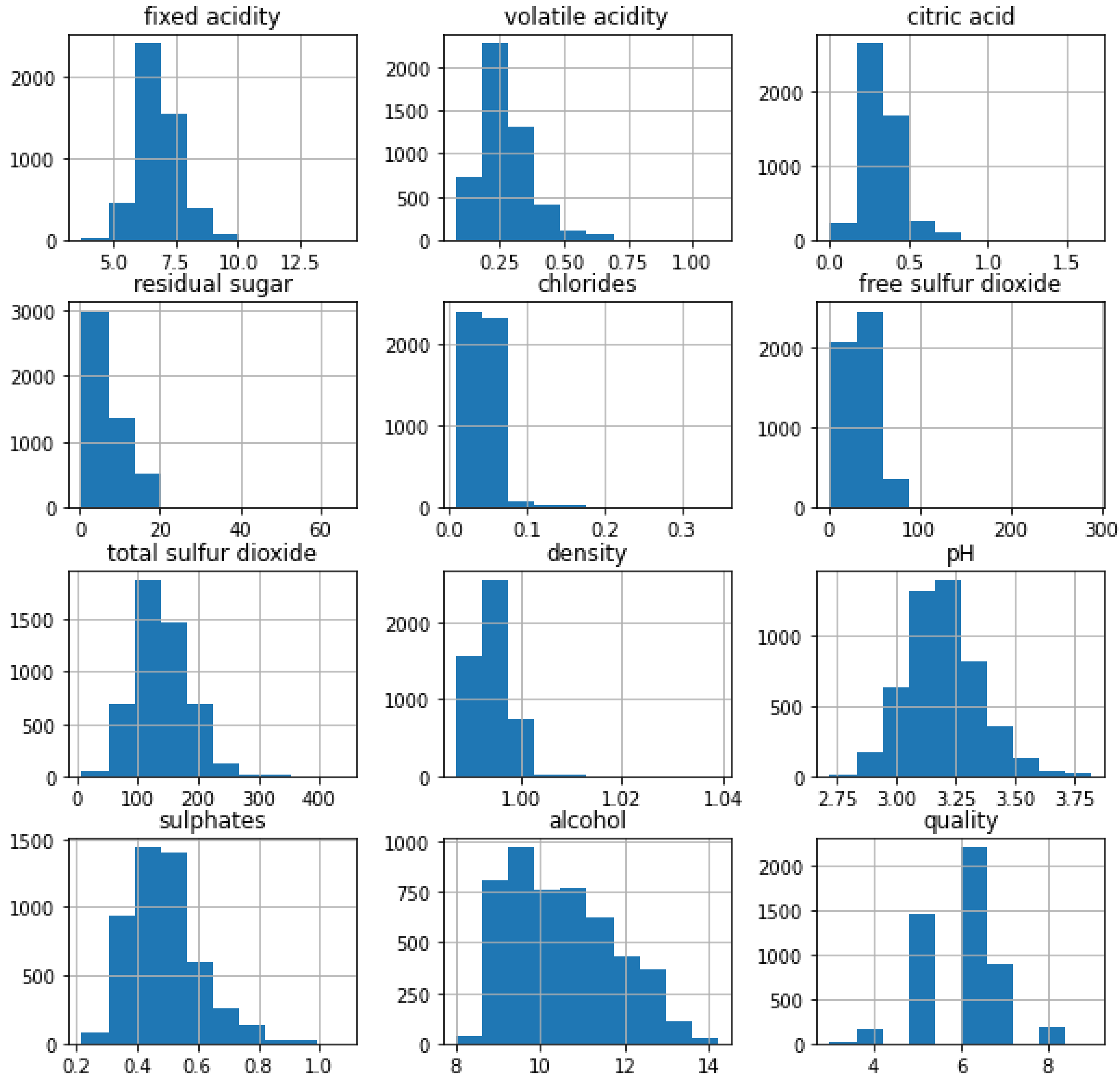
```
6    2198
5    1457
7     880
8     175
4     163
3      20
9       5
Name: quality, dtype: int64
```

In [5]:

```
df.hist(figsize = (10, 10))
```

Out[5]:

```
array([[<AxesSubplot:title={'center':'fixed acidity'}>,
        <AxesSubplot:title={'center':'volatile acidity'}>,
        <AxesSubplot:title={'center':'citric acid'}>],
       [<AxesSubplot:title={'center':'residual sugar'}>,
        <AxesSubplot:title={'center':'chlorides'}>,
        <AxesSubplot:title={'center':'free sulfur dioxide'}>],
       [<AxesSubplot:title={'center':'total sulfur dioxide'}>,
        <AxesSubplot:title={'center':'density'}>,
        <AxesSubplot:title={'center':'pH'}>],
       [<AxesSubplot:title={'center':'sulphates'}>,
        <AxesSubplot:title={'center':'alcohol'}>,
        <AxesSubplot:title={'center':'quality'}>]], dtype=object)
```



Podemos ver acima que temos um desbalancemaneto na quantidade de amostras. Temos muitas regulares e poucas ruins e ótimas. Vamos usar uma técnica chamada SMOTE que consiste em fazer o oversampling das amostras minoritárias, deixando assim o dataset balanceado. Essa técnica foi descrita no artigo.

In [6]:

```
X=df.drop(columns=['quality'])
y=df['quality']
```

In [7]:

```
from imblearn.over_sampling import SMOTE
oversample = SMOTE(k_neighbors=4)
X, y = oversample.fit_resample(X, y)
```

In [8]:

```
print(y.dtypes)
print(y.count())
y.value_counts()
```

```
int64
15386
```

Out[8]:

```
6    2198
5    2198
7    2198
8    2198
4    2198
3    2198
```

```
9    2198
Name: quality, dtype: int64
```

Pronto, agora temos todas as amostras em quantias iguais.

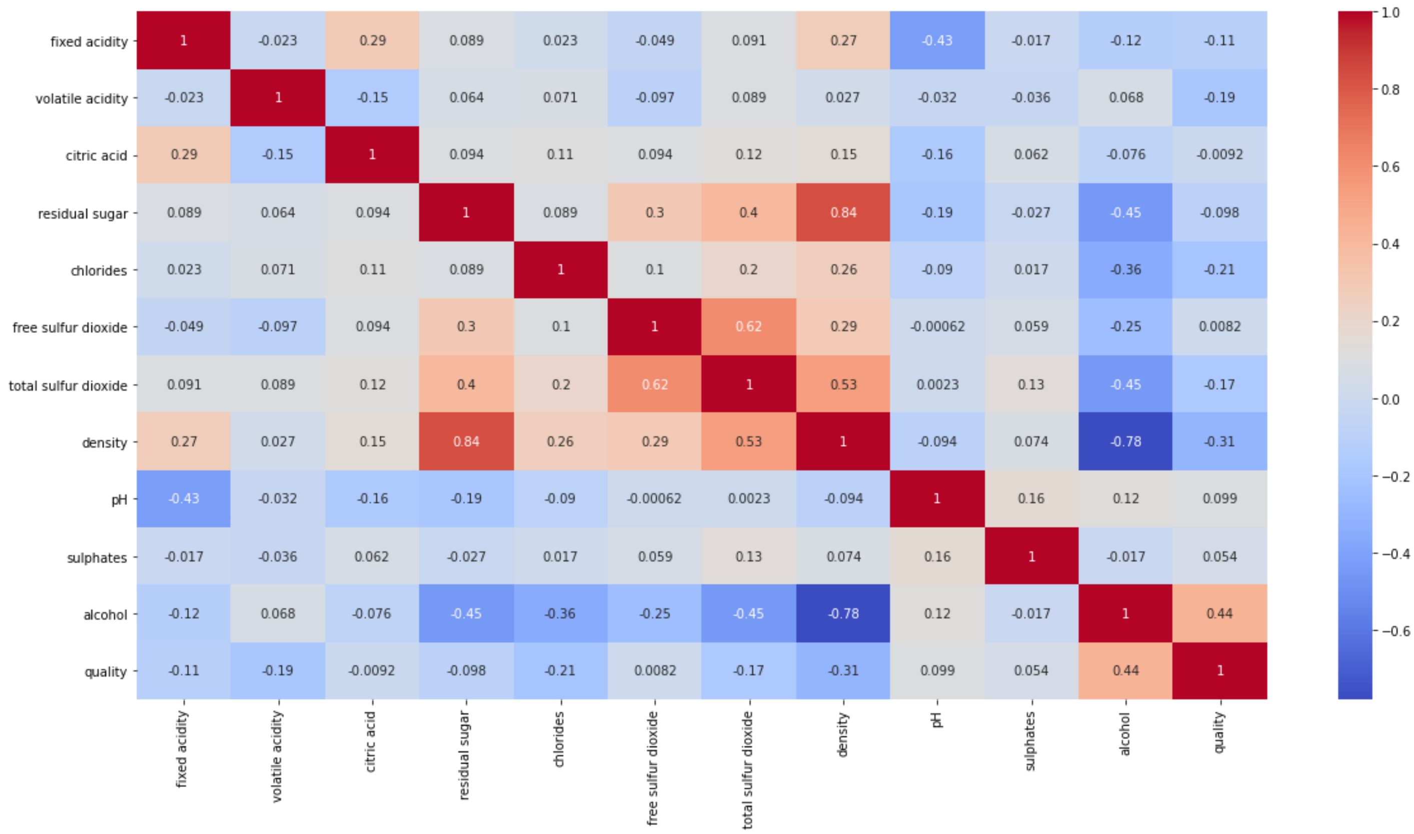
mapa de correlação:

In [9]:

```python
corr=df.corr()
plt.figure(figsize=(20,10))
sb.heatmap(corr,annot=True, cmap='coolwarm')
```

Out[9]:

```
<AxesSubplot:>
```



Também quero codificar essas qualidades numericamente:

In [10]:

```python
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.20,random_state=21)
print('Formato do dataset de treinamento Xs:{}'.format(X_train.shape))
print('Formato do datasett de teste Xs:{}'.format(X_test.shape))
print('Formato do dataset de treino y:{}'.format(y_train.shape))
print('Formato do dataset de test y:{}'.format(y_test.shape))
y_train
```

```
Formato do dataset de treinamento Xs:(12308, 11)
Formato do datasett de teste Xs:(3078, 11)
Formato do dataset de treino y:(12308,)
Formato do dataset de test y:(3078,)
```

Out[10]:

```
12509    8
14261    9
13650    9
7263     4
2851     5
        ..
48       6
8964     4
5944     3
5327     3
```

```
15305    9
Name: quality, Length: 12308, dtype: int64
```

Escalando o dataset

In [11]:

```
from sklearn.preprocessing import StandardScaler
sc=StandardScaler()
X_train =sc.fit_transform(X_train)
X_test=sc.fit_transform(X_test)
X_train
```

Out[11]:

```
array([[-0.22741558, -1.0639914 , -0.38458136, ...,  0.00307363,
        -0.12161052,  0.06661161],
       [-0.16436717,  0.57646457,  0.01817661, ...,  0.50304968,
        -1.14134359,  1.42526059],
       [-0.13978815,  0.48381   ,  0.16594051, ...,  0.55187255,
        -1.11749413,  1.44325812],
       ...,
       [ 1.04942297,  0.19851959,  0.8274273 , ...,  0.16877131,
        -1.44675857,  1.13961914],
       [ 0.87318938, -0.4188991 , -1.07750024, ..., -0.04315277,
         0.59747948, -0.92846942],
       [ 0.16432647, -0.45375517,  1.04106329, ...,  0.89852317,
        -0.39543528,  1.47342487]])
```

In [12]:

```
from sklearn.ensemble import RandomForestClassifier
forest=RandomForestClassifier(n_estimators=10, criterion = 'entropy', random_state=0)
forest.fit(X_train,y_train)
```

Out[12]:

```
RandomForestClassifier(criterion='entropy', n_estimators=10, random_state=0)
```

Outros testes com outro método

avaliação do resultado:

In [15]:

```
  print('Acurácia da floresta: ',forest.score(X_test,y_test))
```

```
Acurácia da floresta:  0.8515269655620533
```

In [ ]:

```
y_pred = forest.predict(X_test)
```

In [ ]:

```
#R2 score
from sklearn.metrics import r2_score
r2_score(y_test, y_pred)
```