EDA With Red Wine Data

February 20, 2024

[2]:
```
import pandas as pd
df=pd.read_csv('winequality-red.csv')
```

[3]:
```
df.head()
```

[3]:

	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

[4]:
```
## check the summary of the dataset

df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1599 entries, 0 to 1598
Data columns (total 12 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   fixed acidity         1599 non-null   float64
 1   volatile acidity      1599 non-null   float64
 2   citric acid           1599 non-null   float64
```

```
 3   residual sugar         1599 non-null   float64
 4   chlorides              1599 non-null   float64
 5   free sulfur dioxide    1599 non-null   float64
 6   total sulfur dioxide   1599 non-null   float64
 7   density                1599 non-null   float64
 8   pH                     1599 non-null   float64
 9   sulphates              1599 non-null   float64
 10  alcohol                1599 non-null   float64
 11  quality                1599 non-null   int64
dtypes: float64(11), int64(1)
memory usage: 150.0 KB
```

[6]:
```
## descriptive summary of the dataset

df.describe()
```

[6]:

	fixed acidity	volatile acidity	citric acid	residual sugar	\
count	1599.000000	1599.000000	1599.000000	1599.000000	
mean	8.319637	0.527821	0.270976	2.538806	
std	1.741096	0.179060	0.194801	1.409928	
min	4.600000	0.120000	0.000000	0.900000	
25%	7.100000	0.390000	0.090000	1.900000	
50%	7.900000	0.520000	0.260000	2.200000	
75%	9.200000	0.640000	0.420000	2.600000	
max	15.900000	1.580000	1.000000	15.500000	

	chlorides	free sulfur dioxide	total sulfur dioxide	density	\
count	1599.000000	1599.000000	1599.000000	1599.000000	
mean	0.087467	15.874922	46.467792	0.996747	
std	0.047065	10.460157	32.895324	0.001887	
min	0.012000	1.000000	6.000000	0.990070	
25%	0.070000	7.000000	22.000000	0.995600	
50%	0.079000	14.000000	38.000000	0.996750	
75%	0.090000	21.000000	62.000000	0.997835	
max	0.611000	72.000000	289.000000	1.003690	

	pH	sulphates	alcohol	quality
count	1599.000000	1599.000000	1599.000000	1599.000000
mean	3.311113	0.658149	10.422983	5.636023
std	0.154386	0.169507	1.065668	0.807569
min	2.740000	0.330000	8.400000	3.000000
25%	3.210000	0.550000	9.500000	5.000000
50%	3.310000	0.620000	10.200000	6.000000
75%	3.400000	0.730000	11.100000	6.000000
max	4.010000	2.000000	14.900000	8.000000

[8]:
```
## shape of the dataset

df.shape
```

[8]:
```
(1599, 12)
```

[10]:
```
## list down all the columns

df.columns
```

[10]:
```
Index(['fixed acidity', 'volatile acidity', 'citric acid', 'residual sugar',
       'chlorides', 'free sulfur dioxide', 'total sulfur dioxide', 'density',
       'pH', 'sulphates', 'alcohol', 'quality'],
      dtype='object')
```

[12]:
```
df['quality'].unique()
```

[12]:
```
array([5, 6, 7, 4, 8, 3])
```

[15]:
```
## conclusion: it is imbalanced dataset

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

[15]:
```
5    681
6    638
7    199
4     53
8     18
3     10
Name: quality, dtype: int64
```

[16]:
```
## always check 1st is there is missing values

df.isnull().sum()
```

[16]:
```
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
```

[18]:
```
## check the duplicate records

df.duplicated()
```

[18]:
```
0       False
1       False
2       False
3       False
4        True
        …
1594    False
1595    False
1596     True
1597    False
1598    False
Length: 1599, dtype: bool
```

[19]:
```
df[df.duplicated()]
```

[19]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates
4	7.4	0.700	0.00	1.90	0.076	11.0	34.0	0.99780	3.51	0.56
11	7.5	0.500	0.36	6.10	0.071	17.0	102.0	0.99780	3.35	0.80
27	7.9	0.430	0.21	1.60	0.106	10.0	37.0	0.99660	3.17	0.91
40	7.3	0.450	0.36	5.90	0.074	12.0	87.0	0.99780	3.33	0.83
65	7.2	0.725	0.05	4.65	0.086	4.0	11.0	0.99620	3.41	0.39
…	…	…	…	…	…	…	…	…	…	…
1563	7.2	0.695	0.13	2.00	0.076	12.0	20.0	0.99546	3.29	0.54
1564	7.2	0.695	0.13	2.00	0.076	12.0	20.0	0.99546	3.29	0.54
1567	7.2	0.695	0.13	2.00	0.076	12.0	20.0	0.99546	3.29	0.54
1581	6.2	0.560	0.09	1.70	0.053	24.0	32.0	0.99402	3.54	0.60
1596	6.3	0.510	0.13	2.30	0.076	29.0	40.0	0.99574	3.42	0.75

```
      alcohol  quality
4         9.4        5
11       10.5        5
27        9.5        5
40       10.5        5
65       10.9        5
…         …        …
1563     10.1        5
1564     10.1        5
1567     10.1        5
1581     11.3        5
1596     11.0        6

[240 rows x 12 columns]
```

[20]:
```
## to remove the duplicate records

df.drop_duplicates(inplace=True)
```

[21]:
```
df.shape
```

[21]:
```
(1359, 12)
```

[22]:
```
df.corr()
```

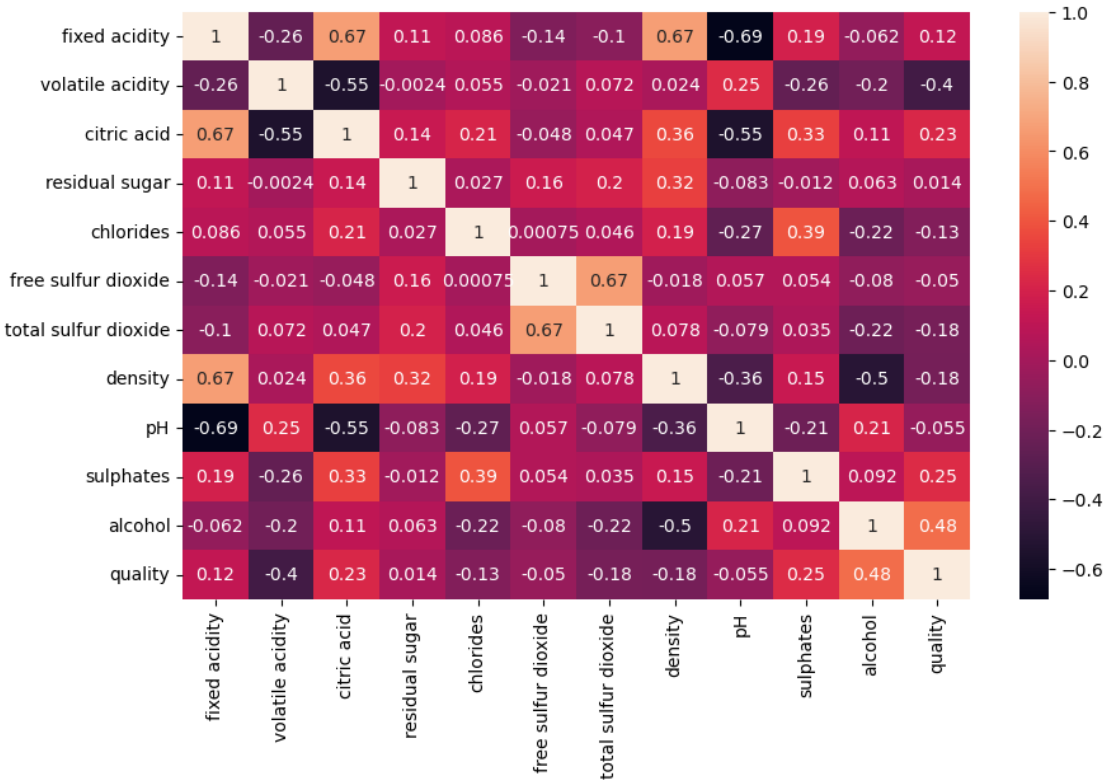
[22]:
```
                      fixed acidity  volatile acidity  citric acid  \
fixed acidity              1.000000         -0.255124     0.667437
volatile acidity          -0.255124          1.000000    -0.551248
citric acid                0.667437         -0.551248     1.000000
residual sugar             0.111025         -0.002449     0.143892
chlorides                  0.085886          0.055154     0.210195
free sulfur dioxide       -0.140580         -0.020945    -0.048004
total sulfur dioxide      -0.103777          0.071701     0.047358
density                    0.670195          0.023943     0.357962
pH                        -0.686685          0.247111    -0.550310
sulphates                  0.190269         -0.256948     0.326062
alcohol                   -0.061596         -0.197812     0.105108
quality                    0.119024         -0.395214     0.228057

                      residual sugar  chlorides  free sulfur dioxide  \
fixed acidity               0.111025   0.085886            -0.140580
volatile acidity           -0.002449   0.055154            -0.020945
citric acid                 0.143892   0.210195            -0.048004
residual sugar              1.000000   0.026656             0.160527
chlorides                   0.026656   1.000000             0.000749
free sulfur dioxide         0.160527   0.000749             1.000000
total sulfur dioxide        0.201038   0.045773             0.667246
```

```
density                   0.324522   0.193592            -0.018071
pH                       -0.083143  -0.270893             0.056631
sulphates                -0.011837   0.394557             0.054126
alcohol                   0.063281  -0.223824            -0.080125
quality                   0.013640  -0.130988            -0.050463

                      total sulfur dioxide   density        pH  sulphates  \
fixed acidity                     -0.103777  0.670195 -0.686685   0.190269
volatile acidity                   0.071701  0.023943  0.247111  -0.256948
citric acid                        0.047358  0.357962 -0.550310   0.326062
residual sugar                     0.201038  0.324522 -0.083143  -0.011837
chlorides                          0.045773  0.193592 -0.270893   0.394557
free sulfur dioxide                0.667246 -0.018071  0.056631   0.054126
total sulfur dioxide               1.000000  0.078141 -0.079257   0.035291
density                            0.078141  1.000000 -0.355617   0.146036
pH                                -0.079257 -0.355617  1.000000  -0.214134
sulphates                          0.035291  0.146036 -0.214134   1.000000
alcohol                           -0.217829 -0.504995  0.213418   0.091621
quality                           -0.177855 -0.184252 -0.055245   0.248835

                       alcohol   quality
fixed acidity        -0.061596  0.119024
volatile acidity     -0.197812 -0.395214
citric acid           0.105108  0.228057
residual sugar        0.063281  0.013640
chlorides            -0.223824 -0.130988
free sulfur dioxide  -0.080125 -0.050463
total sulfur dioxide -0.217829 -0.177855
density              -0.504995 -0.184252
pH                    0.213418 -0.055245
sulphates             0.091621  0.248835
alcohol               1.000000  0.480343
quality               0.480343  1.000000
```

[23]:
```
import matplotlib.pyplot as plt
```

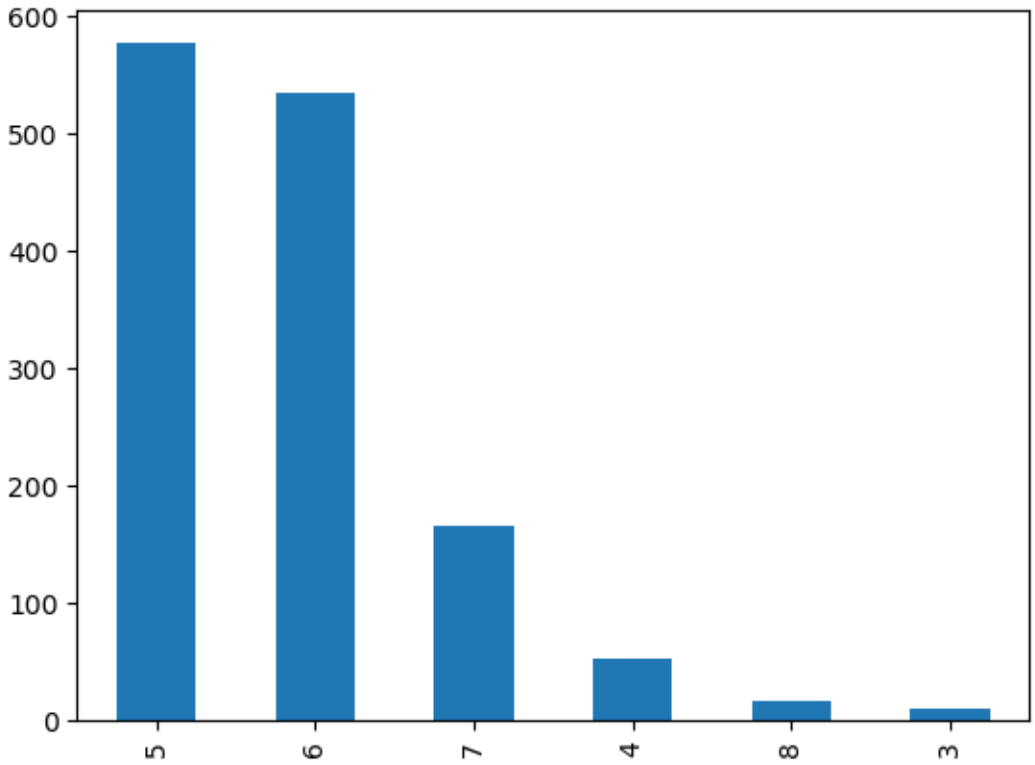
[25]:
```
import seaborn as sns
plt.figure(figsize=(10,6))
sns.heatmap(df.corr(),annot=True)
```

[25]:
```
<AxesSubplot: >
```



[28]:
```
df.quality.value_counts().plot(kind='bar')
```

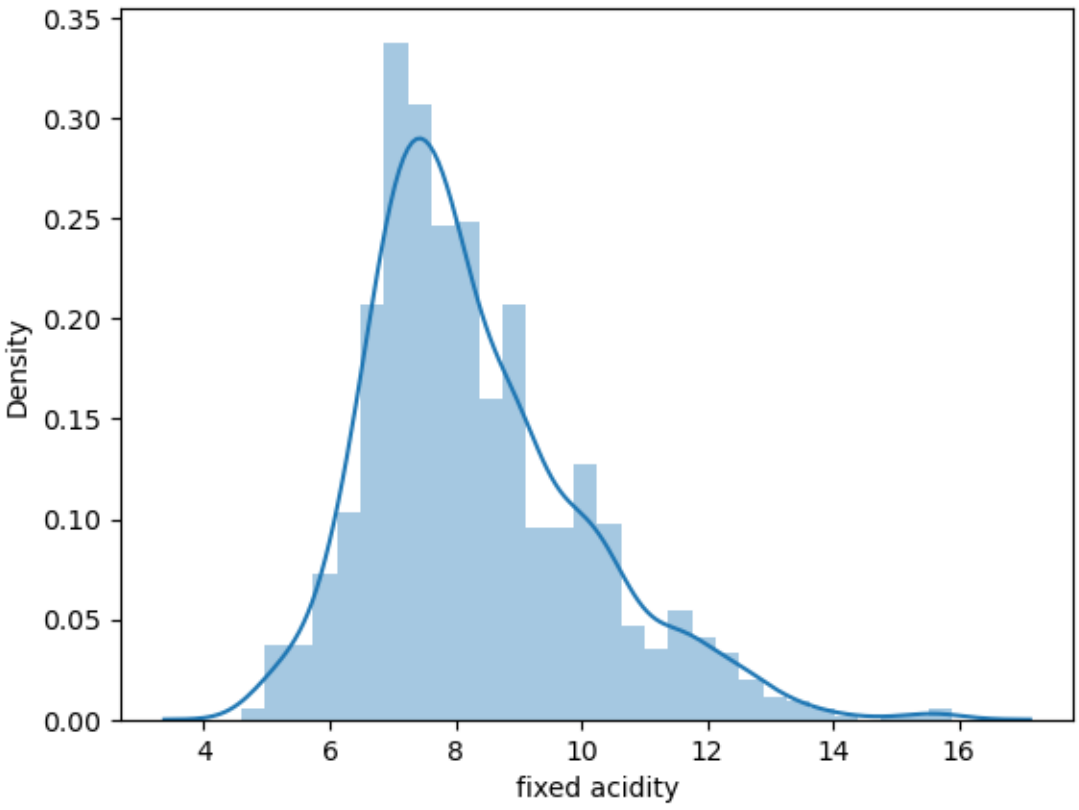
[28]: <AxesSubplot: >



[29]:
```
sns.distplot(df['fixed acidity'])
```

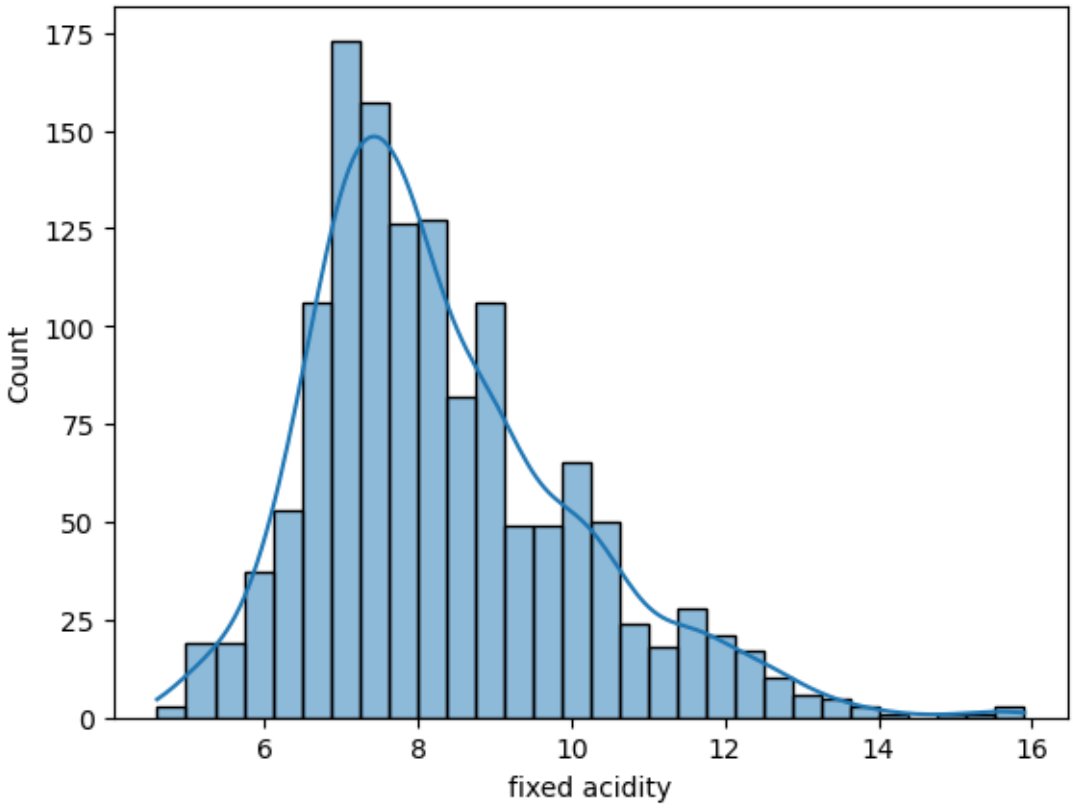
```
/tmp/ipykernel_77/1506967435.py:1: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(df['fixed acidity'])
```

[29]: <AxesSubplot: xlabel='fixed acidity', ylabel='Density'>

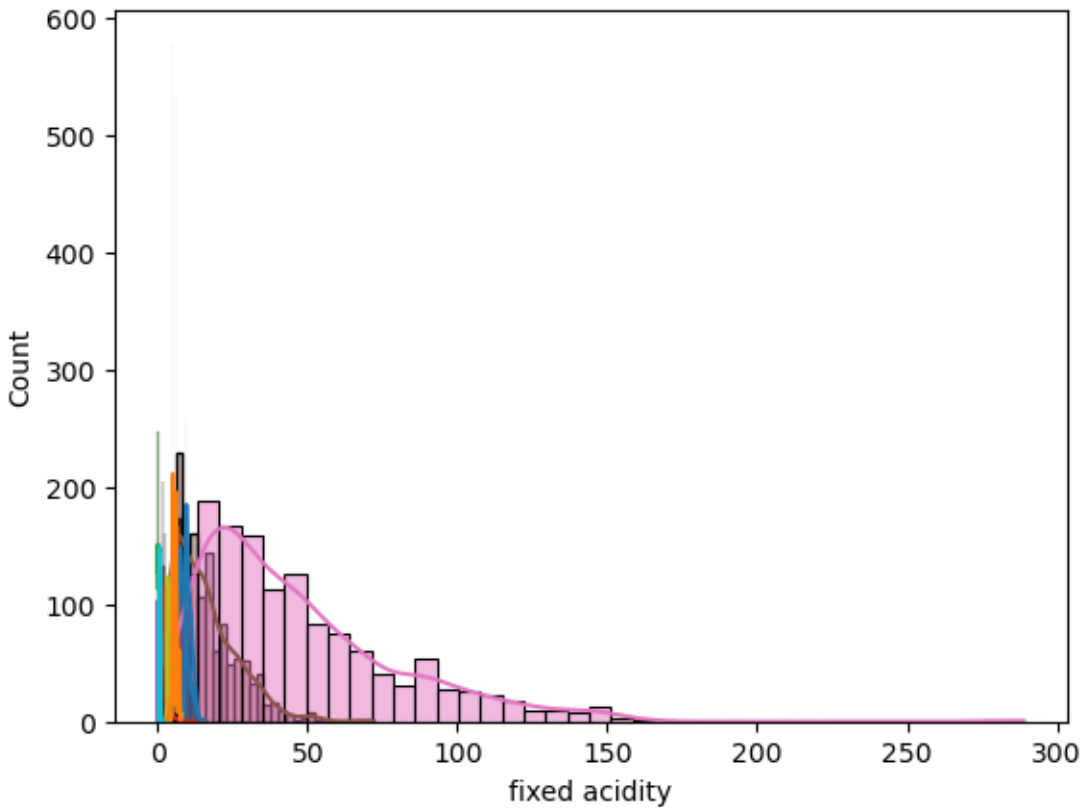


[31]:
```
sns.histplot(df['fixed acidity'],kde=True)
```

[31]:
```
<AxesSubplot: xlabel='fixed acidity', ylabel='Count'>
```

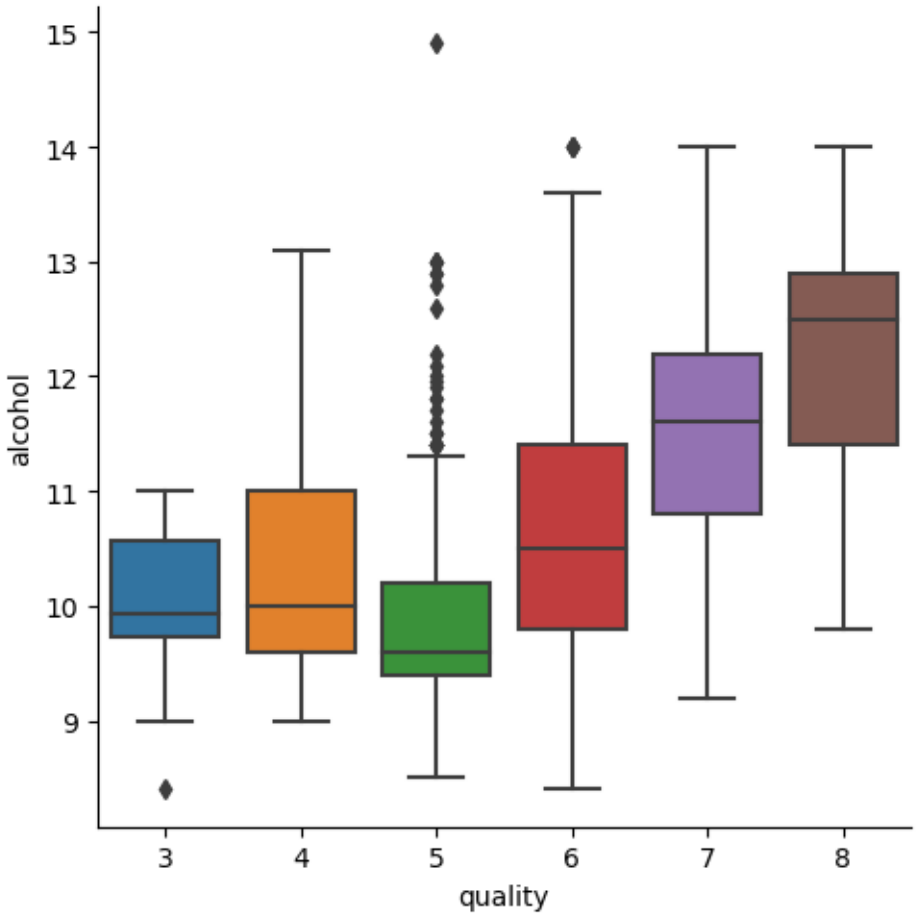


[33]:
```
for i in df.columns:
    sns.histplot(df[i],kde=True)
```



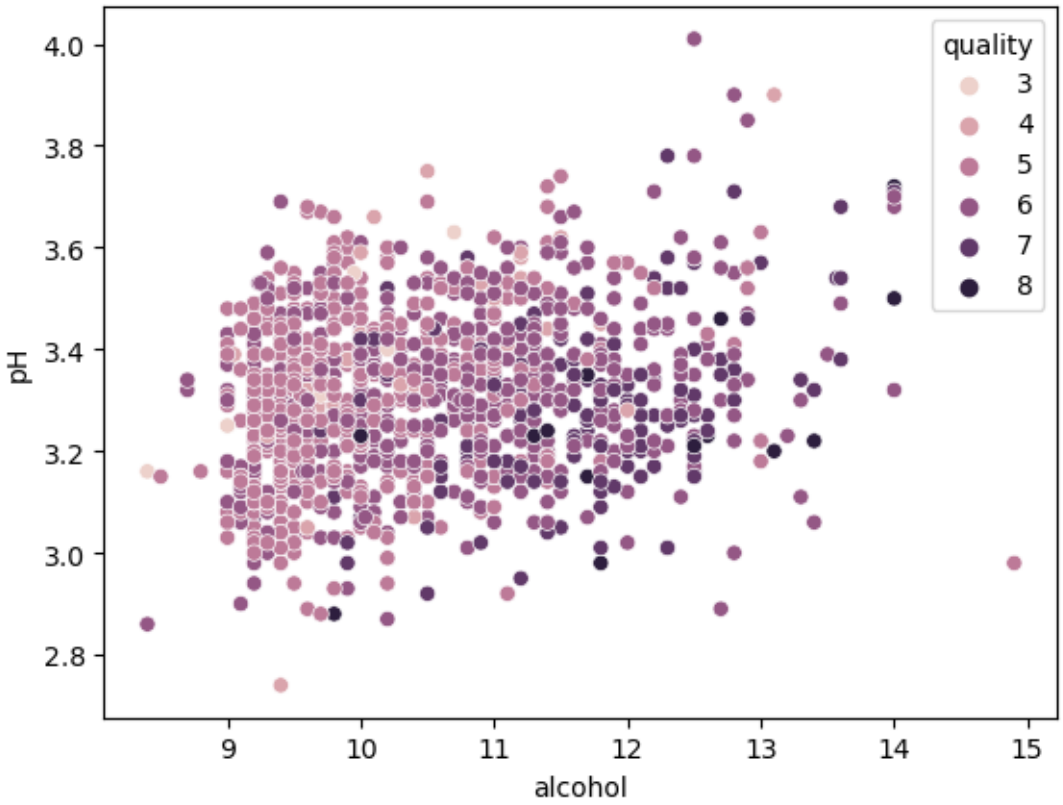
[38]:
```
## new type plot categorical plot

sns.catplot(x='quality',y='alcohol',data=df,kind='box')
```

[38]: <seaborn.axisgrid.FacetGrid at 0x7f14bb8872e0>



[43]:
```
sns.scatterplot(x='alcohol',y='pH',hue='quality',data=df)
```

[43]: <AxesSubplot: xlabel='alcohol', ylabel='pH'>


quality
3
4
5
6
7
8
pH
4.0
3.8
3.6
3.4
3.2
3.0
2.8
9
10
11
12
13
14
15
alcohol

[ ]: