lung-cancer-prediction

September 26, 2024

[344]:
```
# Analysis by Prisca
```

[100]:
```
##### the effectiveness of cancer prediction system helps people to kknow their␣
 ↪cancer risk with low cost and it
##### also helps the people to take the appriopriate decision based on their␣
 ↪cancer risk status.
```

[101]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[102]:
```
df=pd.read_csv(r'C:\Users\USER\Documents\dataset\lung cancer survey.csv')
```

[103]:
```
df.head()
```

[103]:

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	PEER_PRESSURE	\
0	M	69	1	2	2	1	
1	M	74	2	1	1	1	
2	F	59	1	1	1	2	
3	M	63	2	2	2	1	
4	F	63	1	2	1	1	

	CHRONIC DISEASE	FATIGUE	ALLERGY	WHEEZING	ALCOHOL CONSUMING	COUGHING	\
0	1	2	1	2	2	2	
1	2	2	2	1	1	1	
2	1	2	1	2	1	2	
3	1	1	1	1	2	1	
4	1	1	1	2	1	2	

	SHORTNESS OF BREATH	SWALLOWING DIFFICULTY	CHEST PAIN	LUNG_CANCER
0	2	2	2	YES
1	2	2	2	YES
2	2	1	2	NO
3	1	2	2	NO
4	2	1	1	NO

[104]:
```
df.shape
```

[104]:
```
(309, 16)
```

[105]:
```
df.isnull().sum()
```

[105]:
```
GENDER                    0
AGE                       0
SMOKING                   0
YELLOW_FINGERS            0
ANXIETY                   0
PEER_PRESSURE             0
CHRONIC DISEASE           0
FATIGUE                   0
ALLERGY                   0
WHEEZING                  0
ALCOHOL CONSUMING         0
COUGHING                  0
SHORTNESS OF BREATH       0
SWALLOWING DIFFICULTY     0
CHEST PAIN                0
LUNG_CANCER               0
dtype: int64
```

[106]:
```
df.duplicated().sum()  # duplicates detected
```

[106]:
```
33
```

[107]:
```
df.drop_duplicates(inplace=True)
```

[108]:
```
# data structure
```

[109]:
```
lung_df=df[['GENDER', 'AGE', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY','FATIGUE ',␣
↪'ALLERGY ', 'WHEEZING', 'ALCOHOL CONSUMING', 'COUGHING',
           'SHORTNESS OF BREATH', 'SWALLOWING DIFFICULTY', 'CHEST PAIN',␣
↪'LUNG_CANCER']]
```

[110]:
```
lung_df.head()
```

[110]:

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	FATIGUE	ALLERGY	WHEEZING	\
0	M	69	1	2	2	2	1	2	
1	M	74	2	1	1	2	2	1	
2	F	59	1	1	1	2	1	2	
3	M	63	2	2	2	1	1	1	
4	F	63	1	2	1	1	1	2	

	ALCOHOL CONSUMING	COUGHING	SHORTNESS OF BREATH	SWALLOWING DIFFICULTY	\

```
0                  2         2                    2                     2
1                  1         1                    2                     2
2                  1         2                    2                     1
3                  2         1                    1                     2
4                  1         2                    2                     1

   CHEST PAIN LUNG_CANCER
0           2         YES
1           2         YES
2           2          NO
3           2          NO
4           1          NO
```

[111]:
```
lung_df.dtypes
```

[111]:
```
GENDER                    object
AGE                        int64
SMOKING                    int64
YELLOW_FINGERS             int64
ANXIETY                    int64
FATIGUE                    int64
ALLERGY                    int64
WHEEZING                   int64
ALCOHOL CONSUMING          int64
COUGHING                   int64
SHORTNESS OF BREATH        int64
SWALLOWING DIFFICULTY      int64
CHEST PAIN                 int64
LUNG_CANCER               object
dtype: object
```

[112]:
```
lung_df.shape # data size
```

[112]:
```
(276, 14)
```

[ ]:

[ ]:

[113]:
```
lung_df.describe()
```

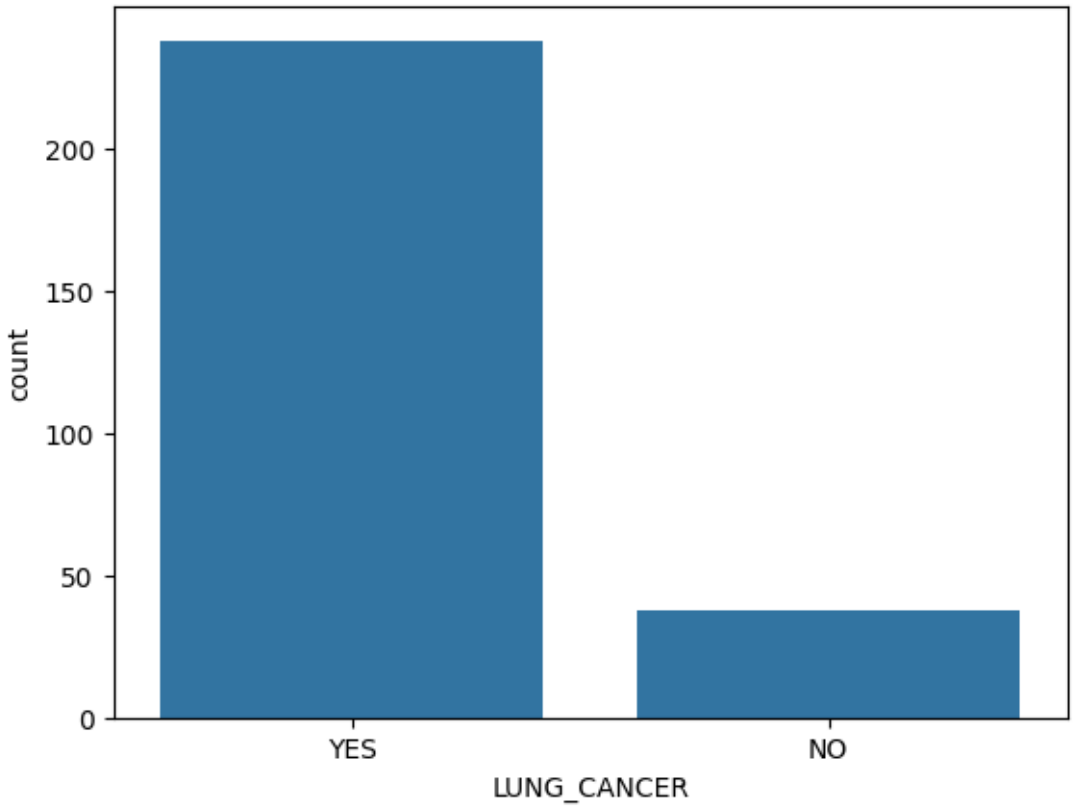
[113]:
```
              AGE     SMOKING  YELLOW_FINGERS     ANXIETY    FATIGUE   \
count  276.000000  276.000000      276.000000  276.000000  276.000000
mean    62.909420    1.543478        1.576087    1.496377    1.663043
std      8.379355    0.499011        0.495075    0.500895    0.473529
min     21.000000    1.000000        1.000000    1.000000    1.000000
25%     57.750000    1.000000        1.000000    1.000000    1.000000
```

```
50%     62.500000    2.000000        2.000000    1.000000    2.000000
75%     69.000000    2.000000        2.000000    2.000000    2.000000
max     87.000000    2.000000        2.000000    2.000000    2.000000

          ALLERGY     WHEEZING  ALCOHOL CONSUMING    COUGHING  \
count  276.000000  276.000000         276.000000  276.000000
mean     1.547101    1.547101           1.550725    1.576087
std      0.498681    0.498681           0.498324    0.495075
min      1.000000    1.000000           1.000000    1.000000
25%      1.000000    1.000000           1.000000    1.000000
50%      2.000000    2.000000           2.000000    2.000000
75%      2.000000    2.000000           2.000000    2.000000
max      2.000000    2.000000           2.000000    2.000000

       SHORTNESS OF BREATH  SWALLOWING DIFFICULTY  CHEST PAIN
count           276.000000             276.000000  276.000000
mean              1.630435               1.467391    1.557971
std               0.483564               0.499842    0.497530
min               1.000000               1.000000    1.000000
25%               1.000000               1.000000    1.000000
50%               2.000000               1.000000    2.000000
75%               2.000000               2.000000    2.000000
max               2.000000               2.000000    2.000000
```

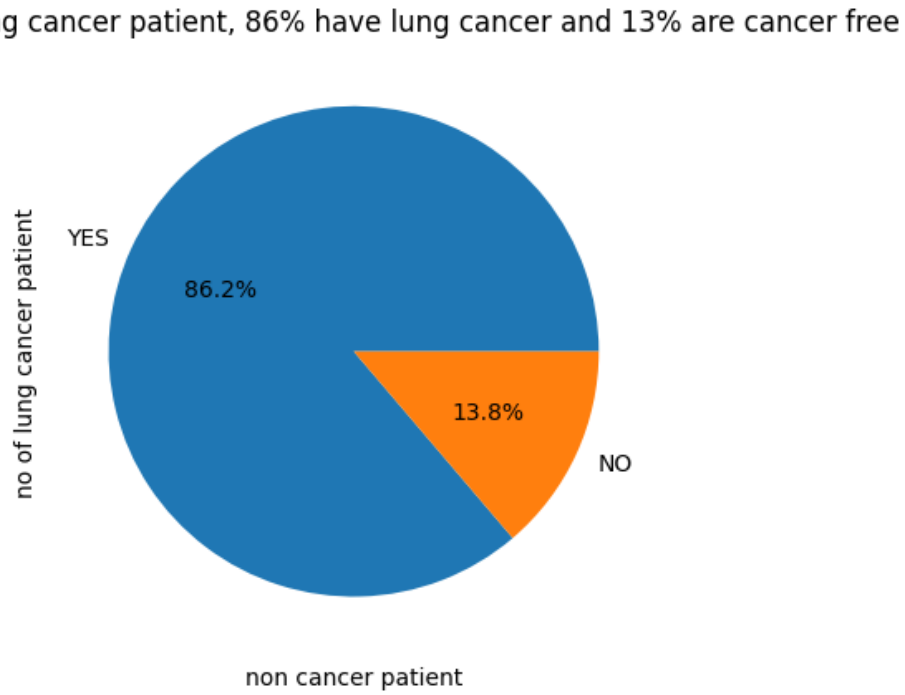
[114]:
```
# visualization
```

[115]:
```
sns.countplot(x='LUNG_CANCER', data=lung_df) ,
```

[115]:
```
(<Axes: xlabel='LUNG_CANCER', ylabel='count'>,)
```



[116]:
```
lung_df['LUNG_CANCER'].value_counts().plot(kind='pie',autopct='%1.1f%%')
plt.title('number of lung cancer patient, 86% have lung cancer and 13% are␣
 ↪cancer free')
plt.xlabel('non cancer patient')
plt.ylabel('no of lung cancer patient')
plt.savefig('cancer patient 2',pad_inches=0.7,bbox_inches='tight')
# 86.2% of the hospital patient has lung cancer, only 13% are cancer free
```

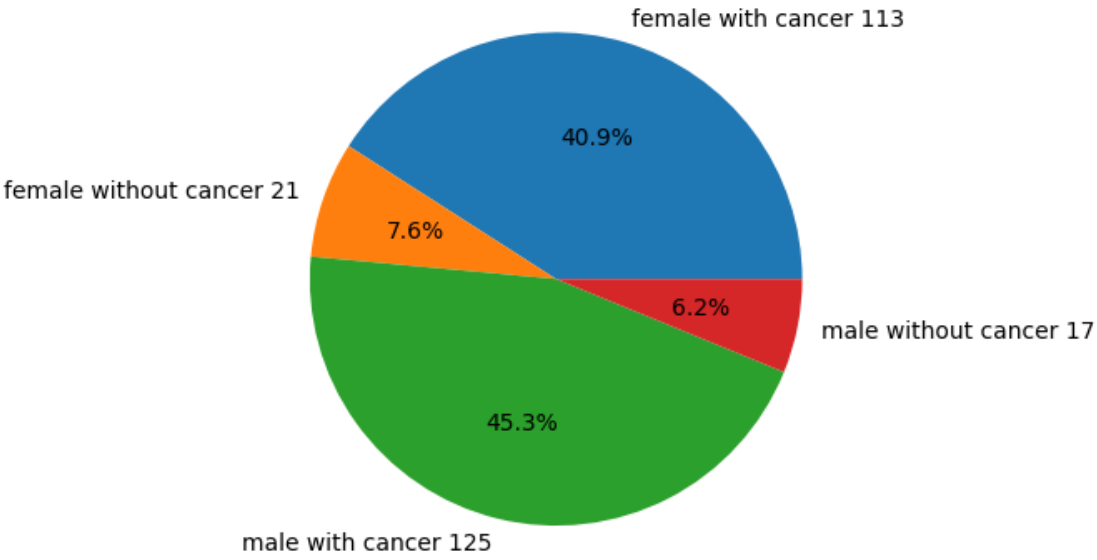


[117]:
```
dfr=lung_df.groupby(['GENDER'])['LUNG_CANCER'].value_counts()
```

[118]:
```
dfr
```

[118]:
```
GENDER  LUNG_CANCER
F       YES            113
        NO              21
M       YES            125
        NO              17
Name: count, dtype: int64
```

[119]:
```
plt.pie(dfr,labels=['female with cancer 113','female without cancer 21','male␣
 ↪with cancer 125','male without cancer 17'],autopct='%1.1f%%')
# this chart shows the number of female and male with and without lung cancer
plt.savefig('cancer patient', pad_inches=0.7,bbox_inches='tight')
```

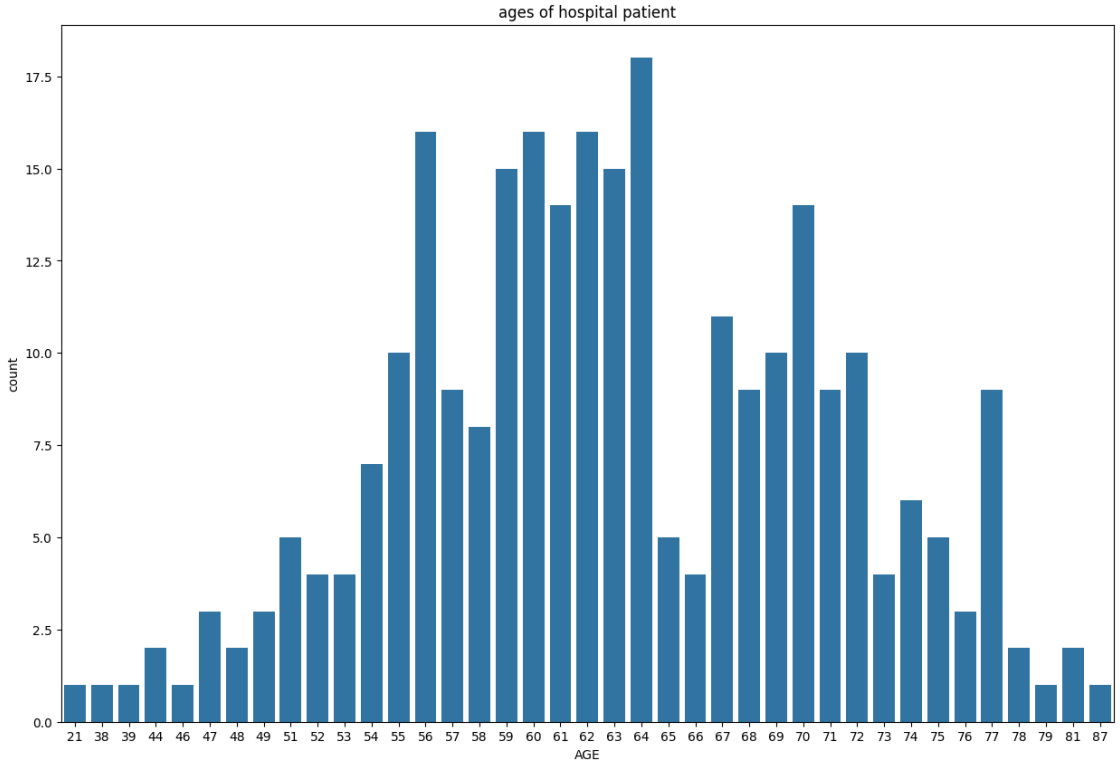


[120]:
```
dfr1=lung_df.groupby('AGE')['LUNG_CANCER'].value_counts()
dfr1
```

[120]:
```
AGE  LUNG_CANCER
21   NO             1
38   YES            1
39   YES            1
44   YES            2
46   NO             1
47   YES            2
     NO             1
48   YES            2
49   YES            3
51   YES            5
52   YES            4
53   YES            4
54   YES            7
55   YES            7
     NO             3
56   YES           14
     NO             2
57   YES            6
     NO             3
58   YES            7
     NO             1
59   YES           11
```

```
     NO              4
60   YES            13
     NO              3
61   YES            12
     NO              2
62   YES            15
     NO              1
63   YES            11
     NO              4
64   YES            16
     NO              2
65   YES             5
66   YES             4
67   YES            10
     NO              1
68   YES             6
     NO              3
69   YES             7
     NO              3
70   YES            13
     NO              1
71   YES             8
     NO              1
72   YES            10
73   YES             4
74   YES             6
75   YES             5
76   YES             3
77   YES             9
78   YES             2
79   YES             1
81   YES             2
87   NO              1
Name: count, dtype: int64
```

[343]:
```
ax=plt.subplots(figsize=(15,10))
sns.countplot(x='AGE',data=lung_df)
plt.title('ages of hospital patient')
plt.savefig('age of patient',pad_inches=0.8,bbox_inches='tight')
```



[122]:
```
lung_df.head()
```

[122]:

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	FATIGUE	ALLERGY	WHEEZING	ALCOHOL CONSUMING	COUGHING	SHORTNESS OF BREATH	SWALLOWING DIFFICULTY	CHEST PAIN	LUNG_CANCER
0	M	69	1	2	2	2	1	2	2	2	2	2	2	YES
1	M	74	2	1	1	2	2	1	1	1	2	2	2	YES
2	F	59	1	1	1	2	1	2	1	2	2	1	2	NO
3	M	63	2	2	2	1	1	1	2	1	1	2	2	NO
4	F	63	1	2	1	1	1	2	1	2	2	1	1	NO

[123]:
```
dfr2=lung_df.groupby(['COUGHING','CHEST PAIN'])['LUNG_CANCER'].value_counts()
```

[124]:
```
dfr2
```

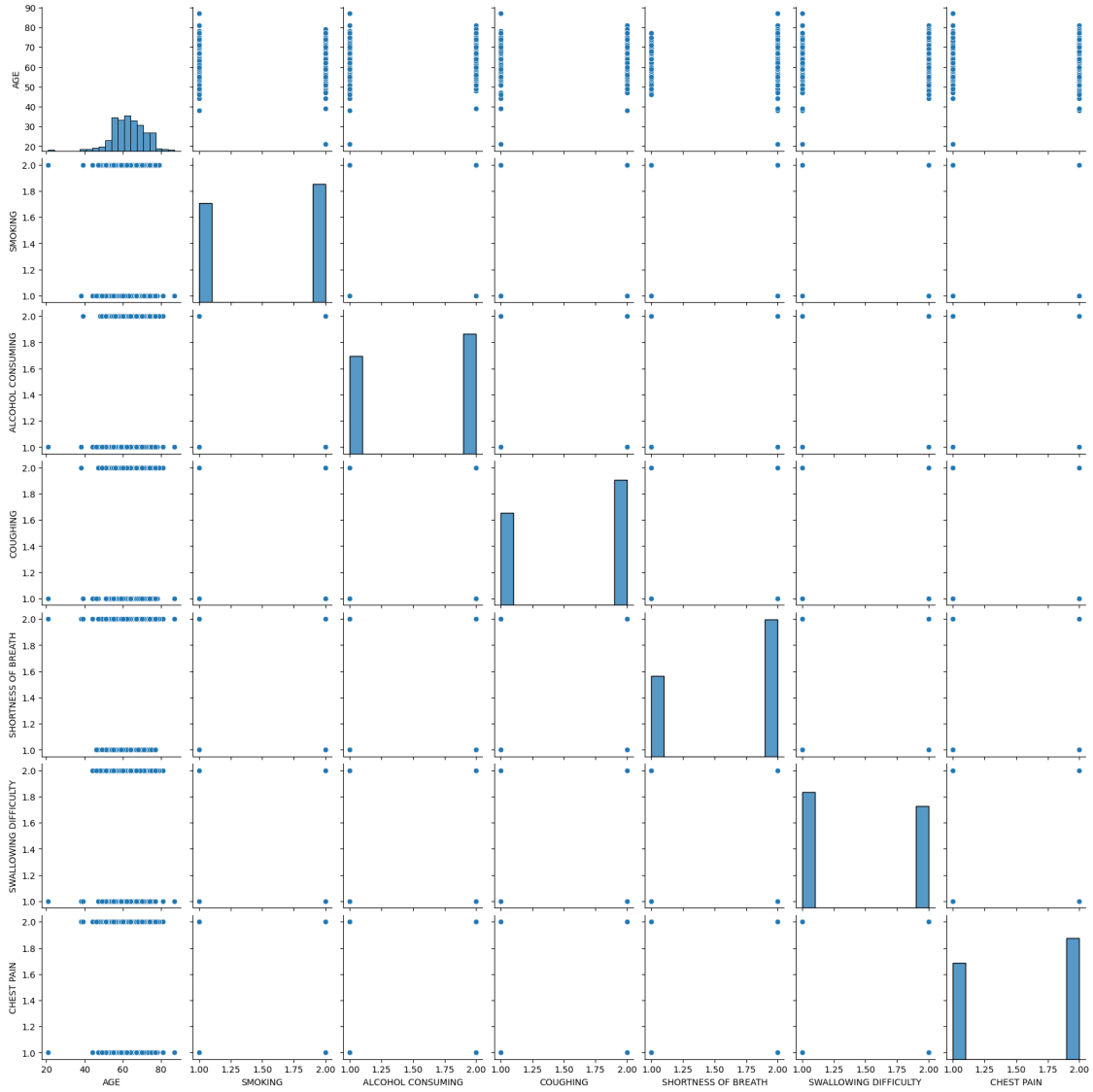
[124]:
```
COUGHING  CHEST PAIN  LUNG_CANCER
1         1           YES            37
                      NO             20
          2           YES            52
                      NO              8
2         1           YES            59
                      NO              6
          2           YES            90
                      NO              4
Name: count, dtype: int64
```

[131]:
```
lung_df.columns
```

[131]:
```
Index(['GENDER', 'AGE', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY', 'FATIGUE ',
       'ALLERGY ', 'WHEEZING', 'ALCOHOL CONSUMING', 'COUGHING',
       'SHORTNESS OF BREATH', 'SWALLOWING DIFFICULTY', 'CHEST PAIN',
       'LUNG_CANCER'],
      dtype='object')
```

[126]:
```
sns.pairplot(lung_df[['GENDER', 'AGE', 'SMOKING', 'ALCOHOL CONSUMING',␣
 ↪'COUGHING',
       'SHORTNESS OF BREATH', 'SWALLOWING DIFFICULTY', 'CHEST PAIN',
       'LUNG_CANCER']])
```

[126]:
```
<seaborn.axisgrid.PairGrid at 0x1db12c9e8b0>
```



changing object values to numerical

[156]:
```
from sklearn .preprocessing import LabelEncoder
```

[158]:
```
le=LabelEncoder()
```

[263]:
```
lung_df['LUNG_CANCER']=le.fit_transform(lung_df['LUNG_CANCER'])
```

```
C:\Users\USER\AppData\Local\Temp\ipykernel_10220\3610150796.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  lung_df['LUNG_CANCER']=le.fit_transform(lung_df['LUNG_CANCER'])
```

[264]:
```
lung_df['GENDER']=le.fit_transform(lung_df['GENDER'])
```

```
C:\Users\USER\AppData\Local\Temp\ipykernel_10220\685198304.py:1:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  lung_df['GENDER']=le.fit_transform(lung_df['GENDER'])
```

[265]:
```
lung_df.head(20)
```

[265]:

	GENDER	AGE	SMOKING	YELLOW_FINGERS	ANXIETY	FATIGUE	ALLERGY	\
0	1	69	1	2	2	2	1	
1	1	74	2	1	1	2	2	
2	0	59	1	1	1	2	1	
3	1	63	2	2	2	1	1	
4	0	63	1	2	1	1	1	
5	0	75	1	2	1	2	2	
6	1	52	2	1	1	2	1	
7	0	51	2	2	2	2	2	
8	0	68	2	1	2	2	1	
9	1	53	2	2	2	1	2	
10	0	61	2	2	2	2	1	
11	1	72	1	1	1	2	2	
12	0	60	2	1	1	2	1	
13	1	58	2	1	1	2	2	
14	1	69	2	1	1	1	2	
15	0	48	1	2	2	2	2	
16	1	75	2	1	1	1	2	
17	1	57	2	2	2	1	1	
18	0	68	2	2	2	2	1	
19	0	61	1	1	1	2	1	

	WHEEZING	ALCOHOL CONSUMING	COUGHING	SHORTNESS OF BREATH	\
0	2	2	2	2	
1	1	1	1	2	
2	2	1	2	2	
3	1	2	1	1	
4	2	1	2	2	
5	2	1	2	2	
6	2	2	2	2	

```
7          1                   1         1                   2
8          1                   1         1                   1
9          1                   2         1                   1
10         2                   1         2                   2
11         2                   2         2                   2
12         1                   1         1                   2
13         2                   2         2                   2
14         2                   2         2                   1
15         2                   1         2                   2
16         2                   2         2                   2
17         1                   2         1                   1
18         1                   1         2                   2
19         1                   1         1                   2
```

```
    SWALLOWING DIFFICULTY  CHEST PAIN  LUNG_CANCER
0                       2           2            1
1                       2           2            1
2                       1           2            0
3                       2           2            0
4                       1           1            0
5                       1           1            1
6                       1           2            1
7                       2           1            1
8                       1           1            0
9                       2           2            1
10                      2           1            1
11                      1           2            1
12                      1           1            0
13                      1           2            1
14                      1           2            0
15                      2           1            1
16                      1           2            1
17                      2           2            1
18                      1           1            1
19                      1           1            0
```

[266]:
```
from sklearn .preprocessing import MinMaxScaler
```

[267]:
```
lung_df.columns
```

[267]:
```
Index(['GENDER', 'AGE', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY', 'FATIGUE ',
       'ALLERGY ', 'WHEEZING', 'ALCOHOL CONSUMING', 'COUGHING',
       'SHORTNESS OF BREATH', 'SWALLOWING DIFFICULTY', 'CHEST PAIN',
       'LUNG_CANCER'],
      dtype='object')
```

[268]:
```
x=lung_df[['GENDER', 'AGE', 'SMOKING', 'YELLOW_FINGERS', 'ANXIETY', 'FATIGUE ',␣
 ↪'ALLERGY ', 'WHEEZING', 'ALCOHOL CONSUMING', 'COUGHING',
       'SHORTNESS OF BREATH', 'SWALLOWING DIFFICULTY', 'CHEST PAIN']]
y=lung_df['LUNG_CANCER']
```

[269]:
```
from sklearn.model_selection import train_test_split
```

[270]:
```
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,random_state=0)
```

[309]:
```
scaler=MinMaxScaler(feature_range=(0,1))
```

[310]:
```
x_train=scaler.fit_transform(x_train)
x_test=scaler.transform(x_test)
```

[311]:
```
x_train.shape,x_test.shape,y_train.shape,y_test.shape
```

[311]:
```
((220, 13), (56, 13), (220,), (56,))
```

0.0.1 model building

[312]:
```
from sklearn .ensemble import RandomForestClassifier
from sklearn.naive_bayes import MultinomialNB
```

[313]:
```
nb=MultinomialNB()
r_forest=RandomForestClassifier()
```

[314]:
```
nb.fit(x_train,y_train)
r_forest.fit(x_train,y_train)
```

[314]:
```
RandomForestClassifier()
```

[315]:
```
nb.score(x_train,y_train)
```

[315]:
```
0.8681818181818182
```

[316]:
```
r_forest.score(x_train,y_train)
```

[316]:
```
0.9954545454545455
```

[317]:
```
from sklearn .linear_model import LogisticRegression
```

[318]:
```
lo_model=LogisticRegression()
```

[319]:
```
lo_model.fit(x_train,y_train)
```

[319]:
```
LogisticRegression()
```

[320]:
```
lo_model.score(x_train,y_train)
```

[320]:
```
0.9181818181818182
```

[321]:
```
from sklearn.metrics import confusion_matrix,classification_report

from sklearn import metrics
```

[322]:
```
ypred=nb.predict(x_test)
metrics.accuracy_score(y_test,ypred)
```

[322]:
```
0.8392857142857143
```

[323]:
```
y_pred=r_forest.predict(x_test)
metrics.accuracy_score (y_test,y_pred)
```

[323]:
```
0.8571428571428571
```

[324]:
```
ypred_log=lo_model.predict(x_test)
metrics.accuracy_score(y_test,ypred_log)
```

[324]:
```
0.8392857142857143
```

0.0.2 from the above model , i chose logistic regression which shows better fiting and doing great on validation

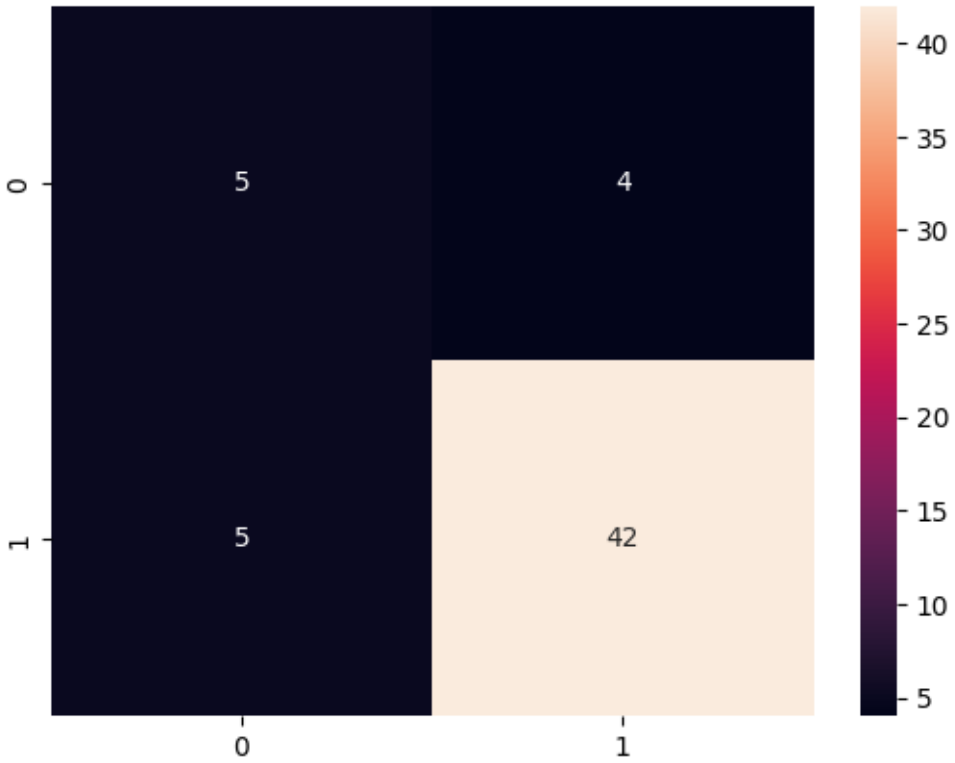
[325]:
```
cm=confusion_matrix(y_test,ypred_log)
```

[326]:
```
cm
```

[326]:
```
array([[ 5,  4],
       [ 5, 42]], dtype=int64)
```

[327]:
```
sns.heatmap(cm,annot=True) # model performace at prediction
```

[327]:
```
<Axes: >
```



1 validation of model performance

[328]:
```
from sklearn . model_selection import KFold,cross_val_score
```

[329]:
```
kf=KFold(n_splits=5)
score=cross_val_score(r_forest,x_train,y_train,cv=kf)
```

[330]:
```
score
```

[330]:
```
array([0.86363636, 0.88636364, 0.97727273, 0.90909091, 0.86363636])
```

[331]:
```
kf=KFold(n_splits=3)
score1=cross_val_score(lo_model,x_train,y_train,cv=kf)
```

[332]:
```
score1
```

[332]:
```
array([0.90540541, 0.90410959, 0.87671233])
```

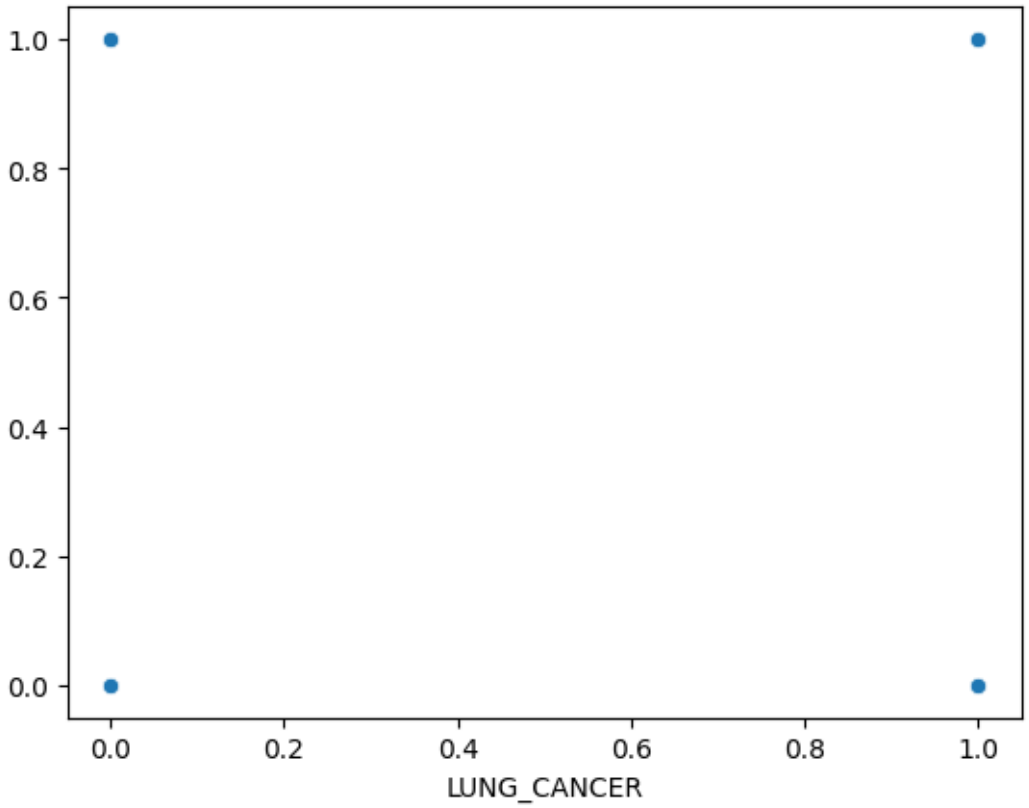
[333]:
```
kf=KFold(n_splits=3)
score2=cross_val_score(nb,x_train,y_train,cv=kf)
```

[334]:
```
score2
```

[334]:
```
array([0.89189189, 0.8630137 , 0.84931507])
```

[335]:
```
sns.scatterplot(x=y_test,y=ypred_log)
```

[335]:
```
<Axes: xlabel='LUNG_CANCER'>
```



[336]:
```
pd.DataFrame({'actual':y_test,
              'predicted': ypred_log}) # visulaizing actual values and␣
↪predicted values
```

[336]:

	actual	predicted
187	1	0
15	1	1
55	1	1
74	1	1
191	1	1
214	1	1
92	1	1
229	1	1

128	1	1
193	1	0
119	1	1
224	1	1
250	1	1
103	1	1
192	1	0
22	0	1
59	1	1
159	0	0
278	1	1
8	0	1
63	1	1
155	1	0
197	1	1
204	1	1
12	0	0
176	1	1
89	1	1
125	1	1
7	1	1
220	1	1
226	1	1
110	1	1
81	1	1
268	1	1
242	1	1
108	1	1
129	0	0
45	1	1
147	1	1
241	1	1
269	1	1
211	1	1
218	1	1
90	1	1
209	1	1
246	1	1
266	0	1
111	1	1
27	0	1
121	1	1
181	1	1
190	1	0
230	1	1
37	0	0
64	1	1

```
157       0           0
```

2 model testing

[337]:
```
lung_df.head()
```

[337]:
```
   GENDER  AGE  SMOKING  YELLOW_FINGERS  ANXIETY  FATIGUE   ALLERGY   \
0       1   69        1               2        2         2         1
1       1   74        2               1        1         2         2
2       0   59        1               1        1         2         1
3       1   63        2               2        2         1         1
4       0   63        1               2        1         1         1

   WHEEZING  ALCOHOL CONSUMING  COUGHING  SHORTNESS OF BREATH  \
0         2                  2         2                    2
1         1                  1         1                    2
2         2                  1         2                    2
3         1                  2         1                    1
4         2                  1         2                    2

   SWALLOWING DIFFICULTY  CHEST PAIN  LUNG_CANCER
0                      2           2            1
1                      2           2            1
2                      1           2            0
3                      2           2            0
4                      1           1            0
```

[338]:
```
lo_model.predict(scaler.
 ↪transform([[1        ,63,        2,        2,        2,        1,        1,        1,
```

[338]:
```
array([1])
```

[339]:
```
lo_model.predict(scaler.
 ↪transform([[0,        63,        1,        2,        1,        1,        1,        2,
```

[339]:
```
array([1])
```

[342]:
```
lo_model.predict(scaler.
 ↪transform([[0,        80,        1,        2,        1,        1,        1,        1,
```

[342]:
```
array([1])
```

3 conclusion

this model will help the hospital or individuals to detect early stage of cancer before it get worse

[ ]: