```
import pandas as pd
import numpy as np
from sklearn.feature_selection import SelectKBest
from sklearn.feature_selection import chi2
data=pd.read_csv(r"heart.csv")
x=data.iloc[:,0:20] #independent columns
y=data.iloc[:,-1] #target columns
```

```
data.head()
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	slope	ca	th
0	63	1	3	145	233	1	0	150	0	2.3	0	0	
1	37	1	2	130	250	0	1	187	0	3.5	0	0	
2	41	0	1	130	204	0	0	172	0	1.4	2	0	
3	56	1	1	120	236	0	1	178	0	0.8	2	0	
4	57	0	0	120	354	0	1	163	1	0.6	2	0	

```
print(data.describe())
```

```
              age         sex          cp  ...          ca        thal      target
count  303.000000  303.000000  303.000000  ...  303.000000  303.000000  303.000000
mean    54.366337    0.683168    0.966997  ...    0.729373    2.313531    0.544554
std      9.082101    0.466011    1.032052  ...    1.022606    0.612277    0.498835
min     29.000000    0.000000    0.000000  ...    0.000000    0.000000    0.000000
25%     47.500000    0.000000    0.000000  ...    0.000000    2.000000    0.000000
50%     55.000000    1.000000    1.000000  ...    0.000000    2.000000    1.000000
75%     61.000000    1.000000    2.000000  ...    1.000000    3.000000    1.000000
max     77.000000    1.000000    3.000000  ...    4.000000    3.000000    1.000000

[8 rows x 14 columns]
```

```
print(data.shape)
```

```
(303, 14)
```

```
#apply SelectKBest class to extract top 10 features
bestfeatures=SelectKBest(score_func=chi2,k=8)
fit=bestfeatures.fit(x,y)
```

```
dfscores=pd.DataFrame(fit.scores_)
dfcolumns=pd.DataFrame(x.columns)
```

```
#concat two dataframes for better visualization
featureScores=pd.concat([dfcolumns,dfscores],axis=1)
featureScores.columns=['values','Scores'] #naming the dataframe columns
```

```
featureScores
```

```
featureScores
```

	values	Scores
0	age	23.286624
1	sex	7.576835
2	cp	62.598098
3	trestbps	14.823925
4	chol	23.936394
5	fbs	0.202934
6	restecg	2.978271
7	thalach	188.320472
8	exang	38.914377
9	oldpeak	72.644253
10	slope	9.804095
11	ca	66.440765
12	thal	5.791853
13	target	138.000000

```
print(featureScores.nlargest(10,'Scores'))
```

```
      values      Scores
7    thalach  188.320472
13    target  138.000000
9    oldpeak   72.644253
11        ca   66.440765
2         cp   62.598098
8      exang   38.914377
4       chol   23.936394
0        age   23.286624
3   trestbps   14.823925
10     slope    9.804095
```

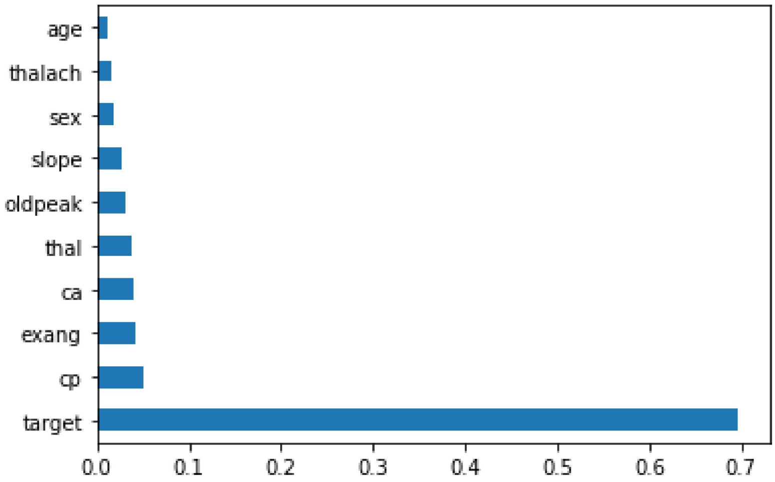
```
from sklearn.ensemble import ExtraTreesClassifier
import matplotlib.pyplot as plt
model=ExtraTreesClassifier()
model.fit(x,y)
```

```
ExtraTreesClassifier(bootstrap=False, ccp_alpha=0.0, class_weight=None,
                     criterion='gini', max_depth=None, max_features='auto',
                     max_leaf_nodes=None, max_samples=None,
                     min_impurity_decrease=0.0, min_impurity_split=None,
                     min_samples_leaf=1, min_samples_split=2,
                     min_weight_fraction_leaf=0.0, n_estimators=100,
                     n_jobs=None, oob_score=False, random_state=None, verbose=0,
                     warm_start=False)
```

```
print(model.feature_importances_)
```

```
[0.01128683 0.01909092 0.05162095 0.00732613 0.00913291 0.00415975
 0.00774644 0.01593183 0.0425676  0.03095078 0.02734842 0.04014682
 0.03753551 0.6951551 ]
```

```
feat_importances=pd.Series(model.feature_importances_,index=x.columns)
feat_importances.nlargest(10).plot(kind='barh')
plt.show()
```



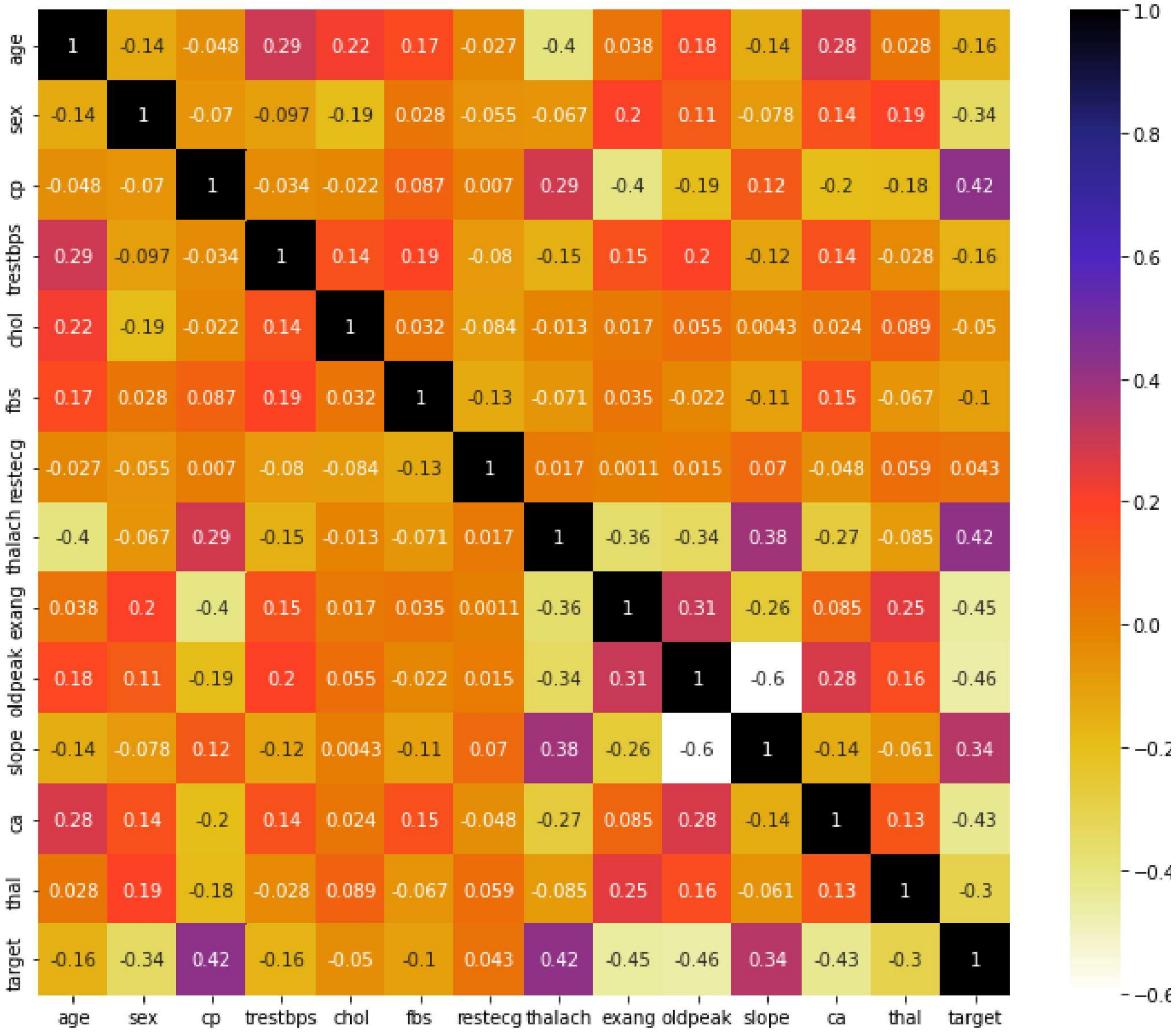
```
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test=train_test_split(
    x,
    y,
    test_size=0.3,
    random_state=0
)
x_train.shape,x_test.shape
```

```
((212, 14), (91, 14))
```

```
x_train.corr()
```

	age	sex	cp	trestbps	chol	fbs	restecg	th
age	1.000000	-0.137750	-0.047924	0.292784	0.218388	0.168401	-0.026793	-0.3
sex	-0.137750	1.000000	-0.070390	-0.097475	-0.192253	0.027645	-0.054692	-0.0
cp	-0.047924	-0.070390	1.000000	-0.034019	-0.022464	0.087377	0.006994	0.2
trestbps	0.292784	-0.097475	-0.034019	1.000000	0.144821	0.190868	-0.080388	-0.1
chol	0.218388	-0.192253	-0.022464	0.144821	1.000000	0.032476	-0.084454	-0.0

```
import seaborn as sns
#using pearson Correlation
plt.figure(figsize=(12,10))
cor=x_train.corr()
sns.heatmap(cor,annot=True,cmap=plt.cm.CMRmap_r)
plt.show()
```



```
def correlation(dataset,threshold):
  col_corr=set() #set of all names of correlated columns
  corr_matrix=dataset.corr()
  for i in range(len(corr_matrix.columns)):
      for j in range(i):
        if abs(corr_matrix.iloc[i,j])>threshold:
          colname=corr_matrix.columns[i]
          col_corr.add(colname)
  return col_corr
```

```
corr_features=correlation(x_train,0.6)
len(set(corr_features))
```

```
1
```

```
corr_features
```

```
{'slope'}
```

```
x_train.drop(corr_features,axis=1)
x_test.drop(corr_features,axis=1)
```

	age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	oldpeak	ca	thal	t
225	70	1	0	145	174	0	1	125	1	2.6	0	3	
152	64	1	3	170	227	0	0	155	0	0.6	0	3	
228	59	1	3	170	288	0	0	159	0	0.2	0	3	
201	60	1	0	125	258	0	0	141	1	2.8	1	3	
52	62	1	2	130	231	0	1	146	0	1.8	3	3	
...	...	...	...	...	...	...	...	...	...	...	...	...	
253	67	1	0	100	299	0	0	125	1	0.9	2	2	
293	67	1	2	152	212	0	0	150	0	0.8	0	3	
76	51	1	2	125	245	1	0	166	0	2.4	0	2	
272	67	1	0	120	237	0	1	71	0	1.0	0	2	
238	77	1	0	125	304	0	0	162	1	0.0	3	2	

91 rows × 13 columns

New Section