

```
In [1]: import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\numpy\_distribu
tor_init.py:32: UserWarning: loaded more than 1 DLL from .libs:
c:\users\user\miniconda3\envs\bd\lib\site-packages\numpy\.libs\lib
openblas.NOIJJG62EMASZI6NYURL6JBKM4EVBGM7.gfortran-win_amd64.dll
c:\users\user\miniconda3\envs\bd\lib\site-packages\numpy\.libs\lib
openblas.PYQHXLVVQ7VESDPUVUADXEVJ0BGHJPAY.gfortran-win_amd64.dll
stacklevel=1)
```

prepare data

```
In [2]: df_train=pd.read_csv('./data/train.csv')
```

```
In [3]: #check null Age,Cabin,Embarked
df_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
#   Column          Non-Null Count  Dtype
---  -
0   PassengerId     891 non-null    int64
1   Survived        891 non-null    int64
2   Pclass          891 non-null    int64
3   Name            891 non-null    object
4   Sex             891 non-null    object
5   Age             714 non-null    float64
6   SibSp           891 non-null    int64
7   Parch           891 non-null    int64
8   Ticket          891 non-null    object
9   Fare            891 non-null    float64
10  Cabin           204 non-null    object
11  Embarked        889 non-null    object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
```

```
In [4]: #df_train=df_train.drop(['Cabin','Name','Ticket','PassengerId'],
axis=1,inplace=False)
```

```
In [5]: df_train.head()
```

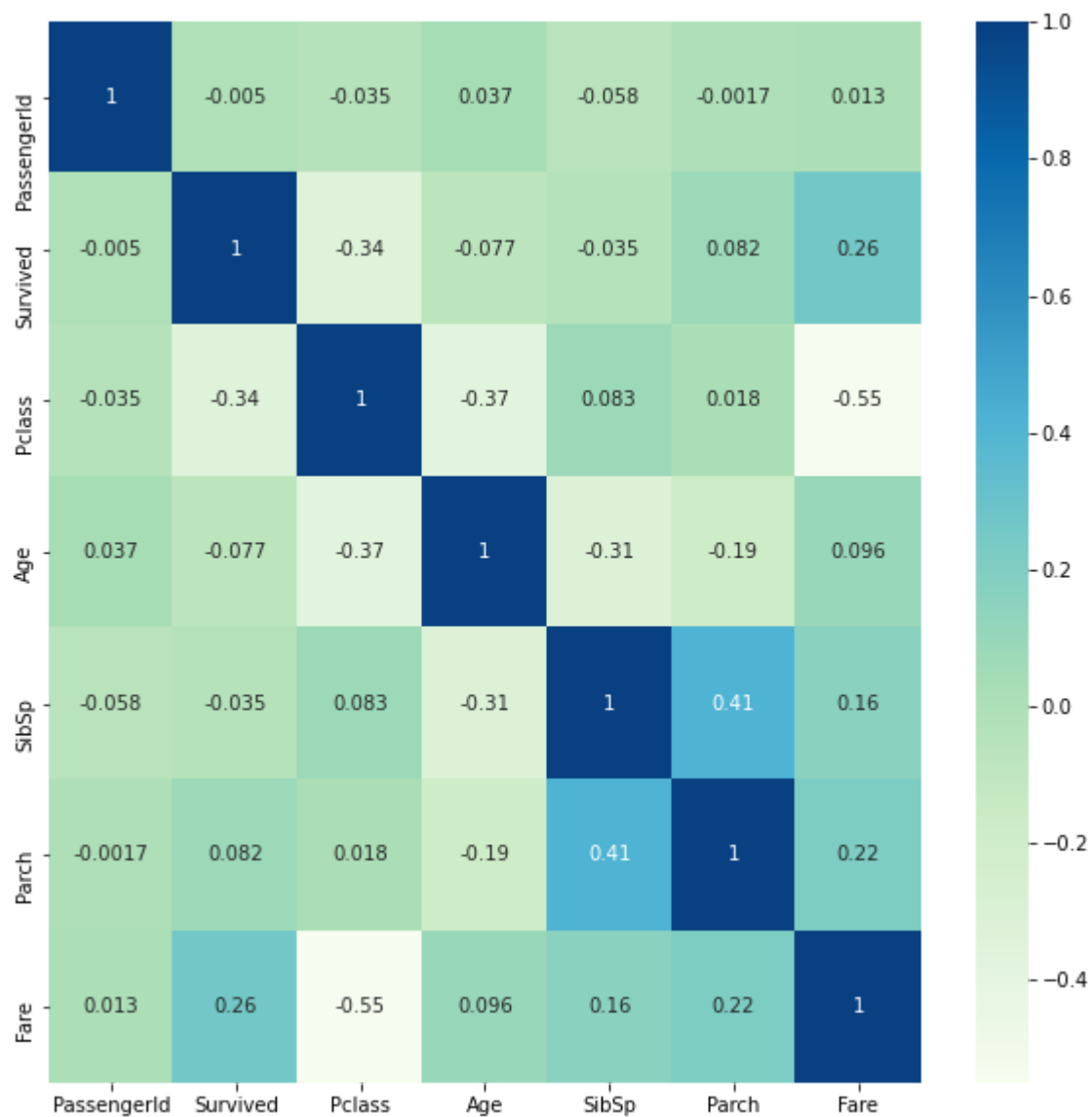
Out[5]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0

EDA

In [6]: *#correlation*

```
plt.figure(figsize=(10,10))
sns.heatmap(df_train.corr(),cmap = 'GnBu',annot=True)
plt.show()
```



In [7]: *#count number*

```
fig,ax = plt.subplots(2,4,figsize=(16,10))
sns.countplot('Survived',data=df_train,ax=ax[0][0])
sns.countplot('Pclass',data=df_train,ax=ax[0][1])
sns.countplot('Sex',data=df_train,ax=ax[0][2])
sns.countplot('SibSp',data=df_train,ax=ax[0][3])
sns.countplot('Parch',data=df_train,ax=ax[1][0])
sns.countplot('Embarked',data=df_train,ax=ax[1][1])
sns.distplot(df_train['Fare'],kde=True,ax=ax[1][2])

plt.show()
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
```

```
FutureWarning
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
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c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
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c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
```

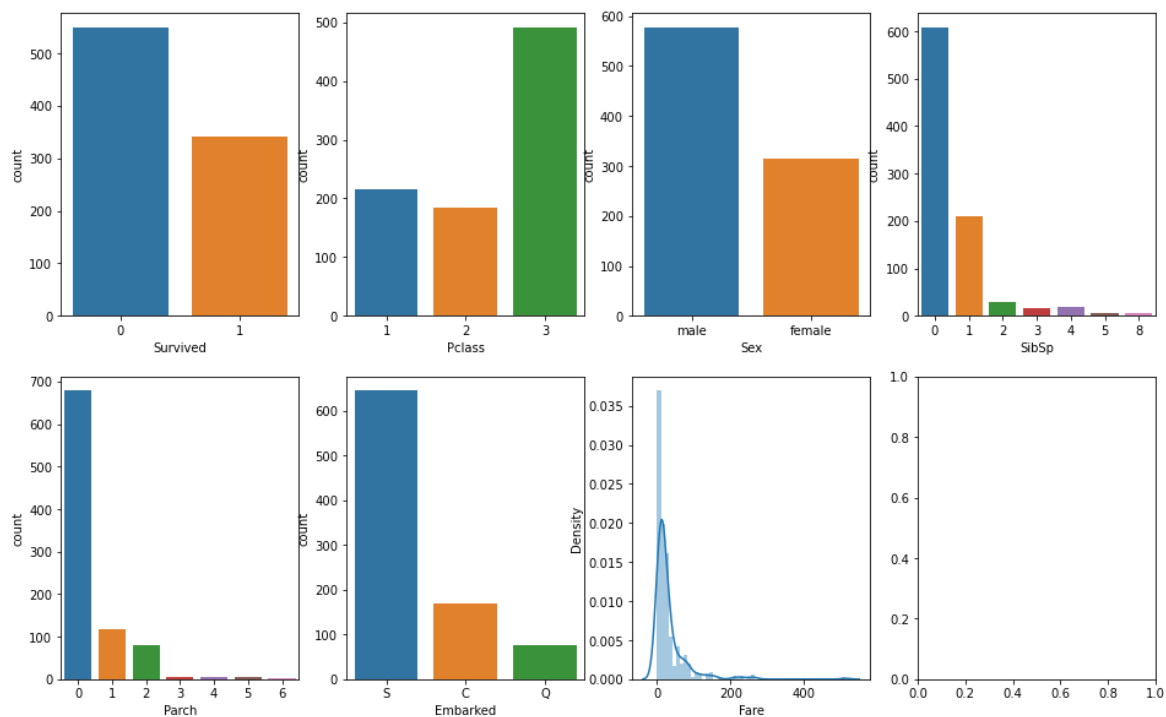
```
FutureWarning
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
```

```
FutureWarning
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\distributions.py:2551: FutureWarning: `distplot` is a deprecated function and will be removed in a future version. Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).
```

```
warnings.warn(msg, FutureWarning)
```



```
In [8]: '''
implies:
1. death more than lives
2. most people live in third class
3. male more than female
4. most people don't have siblings and spouse
5. most people don't have parch
6. most people embark at S
7. most people pay 0~100 fare
'''
print()
```

In [9]: *# survived Sex Age pclass Embarked*

```
fig,ax = plt.subplots(2,4,figsize=(16,10))
sns.countplot('Survived',hue='Sex',linewidth=2.5,edgecolor=".2",
data=df_train,ax=ax[0][0])
sns.countplot('Pclass',hue='Sex',linewidth=2.5,edgecolor=".2",da
ta=df_train,ax=ax[0][1])
sns.countplot('Survived',hue='Pclass',linewidth=2.5,edgecolor=".
2",data=df_train,ax=ax[0][2])
sns.stripplot(x="Survived", y="Age", data=df_train,jitter=True,a
x=ax[0][3])
sns.stripplot(x="Pclass", y="Age", data=df_train,jitter=True,ax=
ax[1][0])
sns.stripplot(x="Sex", y="Age", data=df_train,jitter=True,ax=ax[
1][1])
sns.countplot('Embarked',hue='Pclass',linewidth=2.5,edgecolor=".
2",data=df_train,ax=ax[1][2])
sns.countplot('Embarked',hue='Sex',linewidth=2.5,edgecolor=".2",
data=df_train,ax=ax[1][3])
plt.show()
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decora
tors.py:43: FutureWarning: Pass the following variable as a keywor
d arg: x. From version 0.12, the only valid positional argument wi
ll be `data`, and passing other arguments without an explicit keyw
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```

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FutureWarning
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ll be `data`, and passing other arguments without an explicit keyw
ord will result in an error or misinterpretation.
```

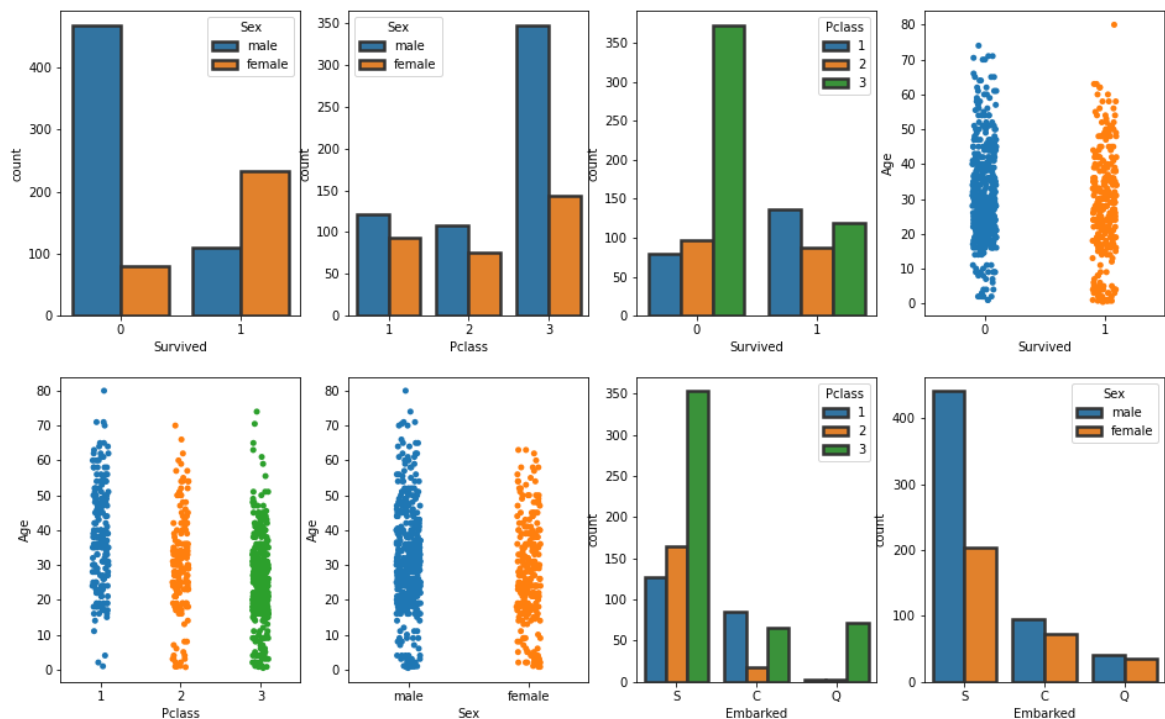
```
FutureWarning
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decora
tors.py:43: FutureWarning: Pass the following variable as a keywor
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ll be `data`, and passing other arguments without an explicit keyw
ord will result in an error or misinterpretation.
```

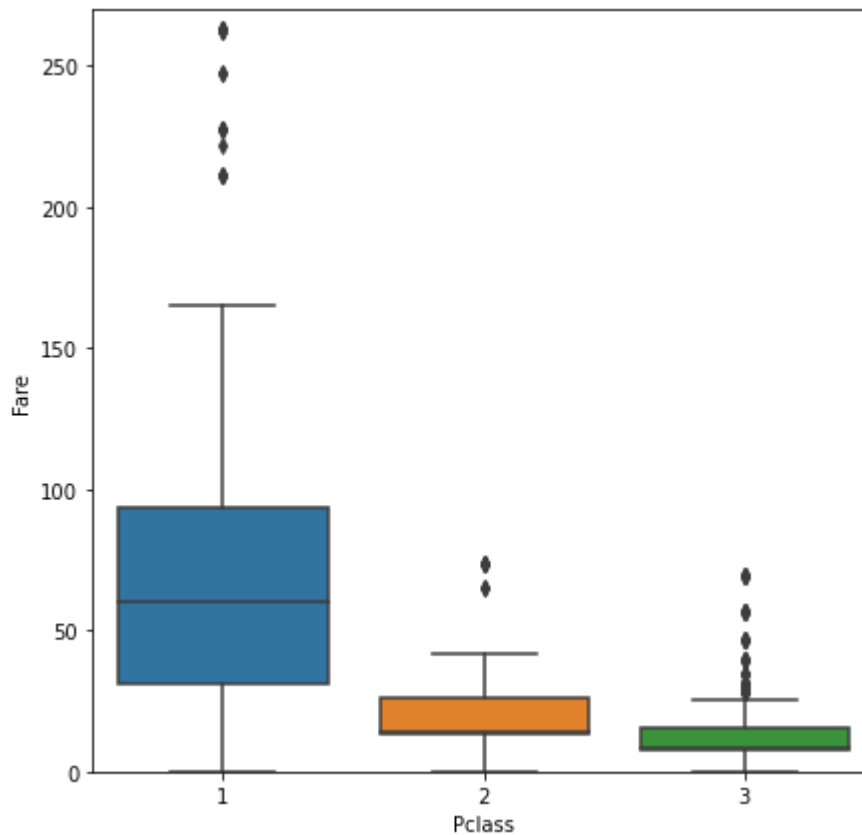
```
FutureWarning
```

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c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decora
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ll be `data`, and passing other arguments without an explicit keyw
ord will result in an error or misinterpretation.
```

```
FutureWarning
```




```
In [10]: #pclass 3 is the cheapest
plt.figure(figsize=(7,7))
sns.boxplot(x='Pclass',y='Fare',data=df_train)
plt.ylim([0,270])
plt.show()
```



```
In [11]: '''
implies:

1.male die the most
2.most male live in pclass 3
3.pclass 3 die the most
4.Age 20~40 die the most
5.most people in pclass 3 are in age 20~40
6.most male are in age 20~40
7.most people live in pclass 3 embarked at S
8.most male embarked at S

--> those who are male in age 20~40 live in pclass 3 embarked at S die the most

'''
print()
```

```
In [12]: fig,ax = plt.subplots(2,2,figsize=(16,10))
sns.countplot('Survived',hue='SibSp',linewidth=2.5,edgecolor=".2",data=df_train,ax=ax[0][0])
sns.countplot('Survived',hue='Parch',linewidth=2.5,edgecolor=".2",data=df_train,ax=ax[0][1])
sns.countplot('Pclass',hue='Parch',linewidth=2.5,edgecolor=".2",data=df_train,ax=ax[1][0])
sns.countplot('Pclass',hue='SibSp',linewidth=2.5,edgecolor=".2",data=df_train,ax=ax[1][1])

plt.show()
```

c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.

FutureWarning

c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.

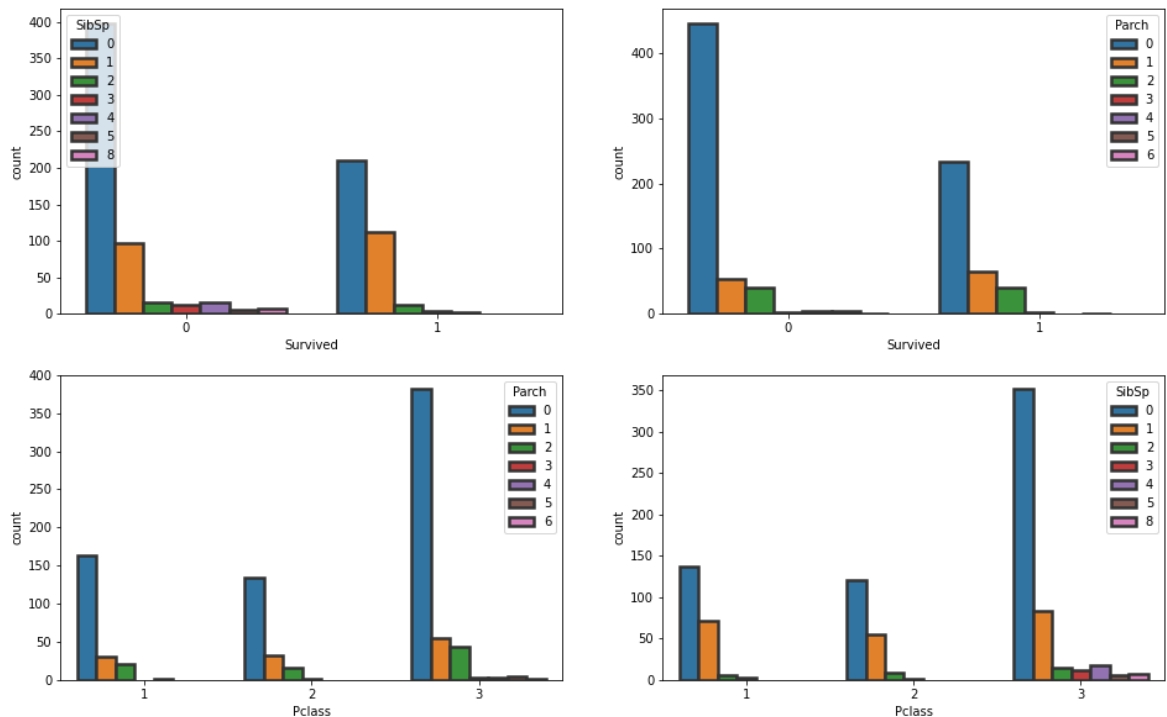
FutureWarning

c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.

FutureWarning

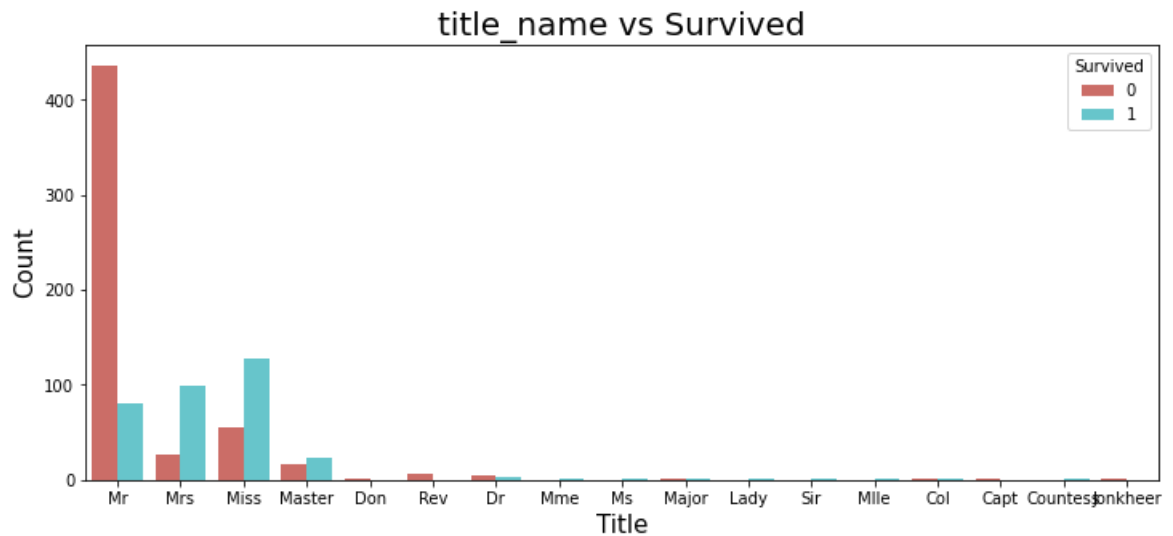
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.

FutureWarning



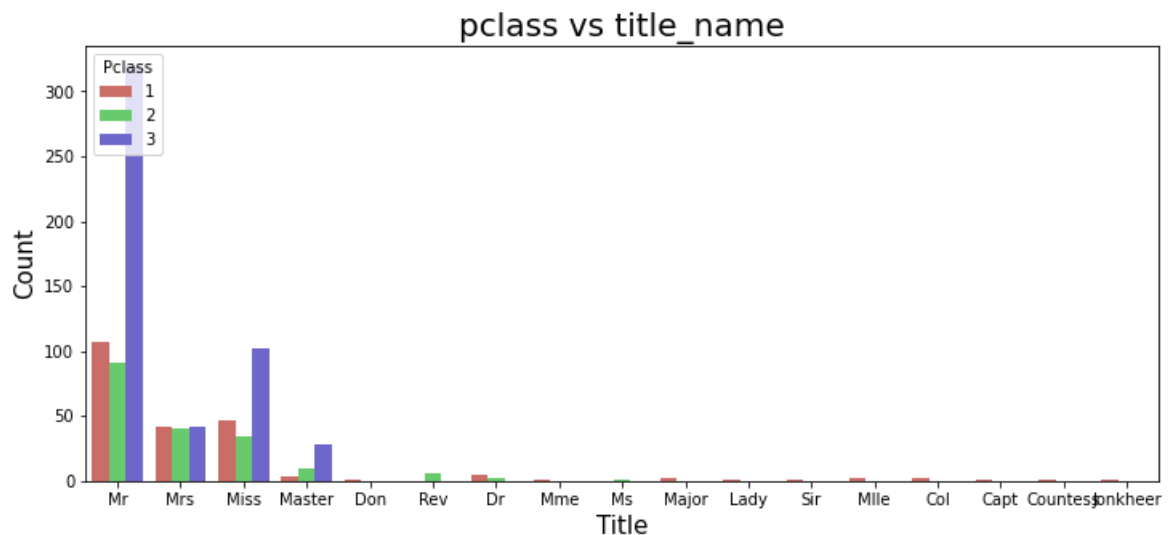
```
In [13]: import re
#add name
df_train['Title'] = df_train.Name.apply(lambda x: re.search(
    '[A-Z][a-z]+\.', x).group(1))
```

```
In [14]: plt.figure(figsize=(12,5))
sns.countplot(x='Title',data=df_train,palette='hls',hue='Survived')
plt.xlabel('Title',fontsize=15)
plt.ylabel('Count',fontsize=15)
plt.title('title_name vs Survived',fontsize=20)
plt.show()
```



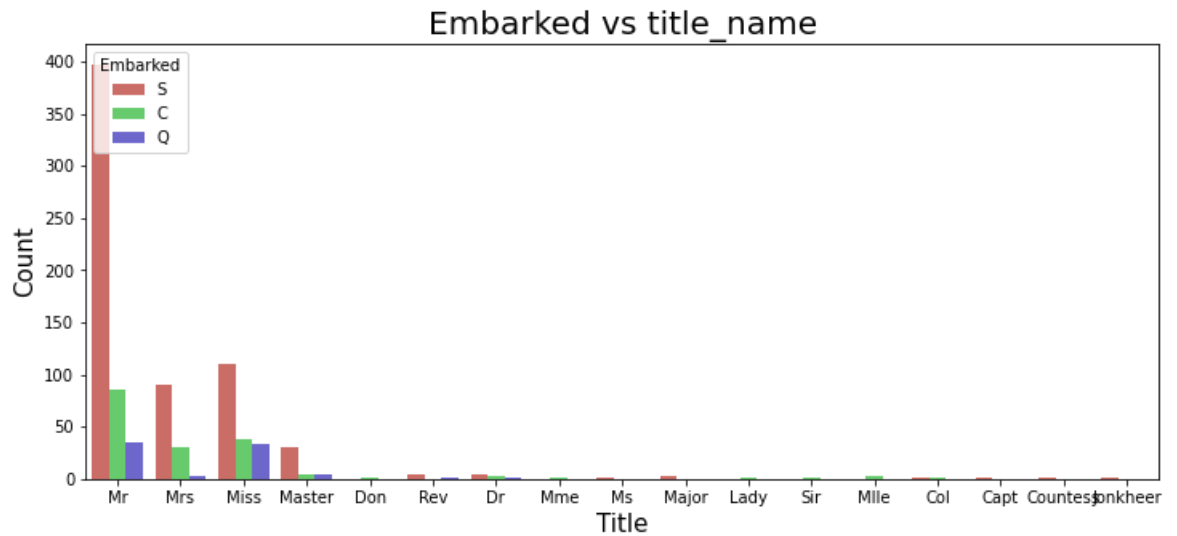
```
In [15]: plt.figure(figsize=(12,5))
sns.countplot(x='Title',data=df_train,palette='hls',hue='Pclass')
plt.xlabel('Title',fontsize=15)
plt.ylabel('Count',fontsize=15)
plt.title('pclass vs title_name',fontsize=20)
```

Out[15]: Text(0.5, 1.0, 'pclass vs title_name')



```
In [16]: plt.figure(figsize=(12,5))
sns.countplot(x='Title',data=df_train,palette='hls',hue='Embarked')
plt.xlabel('Title',fontsize=15)
plt.ylabel('Count',fontsize=15)
plt.title('Embarked vs title_name',fontsize=20)
```

Out[16]: Text(0.5, 1.0, 'Embarked vs title_name')



```
In [20]: # Pclass 3 -----embarked at some place ,show Title vs Survived count

df=df_train[df_train.Title.str.contains('M')]
df_S=df[df.Embarked.str[0]=='S']
df_S=df_S[df_S.Pclass==3]
df_Q=df[df.Embarked.str[0]=='Q']
df_Q=df_Q[df_Q.Pclass==3]
df_C=df[df.Embarked.str[0]=='C']
df_C=df_C[df_C.Pclass==3]

fig,ax = plt.subplots(1,3,figsize=(16,10))
sns.countplot('Title',hue='Survived',linewidth=2.5,edgecolor=".2",data=df_S,ax=ax[0])
sns.countplot('Title',hue='Survived',linewidth=2.5,edgecolor=".2",data=df_Q,ax=ax[1])
sns.countplot('Title',hue='Survived',linewidth=2.5,edgecolor=".2",data=df_C,ax=ax[2])

ax[0].title.set_text('Embarked_S')
ax[0].set(ylim=(0, 250))
ax[1].title.set_text('Embarked_Q')
ax[1].set(ylim=(0, 250))
ax[2].title.set_text('Embarked_C')
ax[2].set(ylim=(0, 250))
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decora
tors.py:43: FutureWarning: Pass the following variable as a keywor
d arg: x. From version 0.12, the only valid positional argument wi
ll be `data`, and passing other arguments without an explicit keyw
ord will result in an error or misinterpretation.
```

```
FutureWarning
```

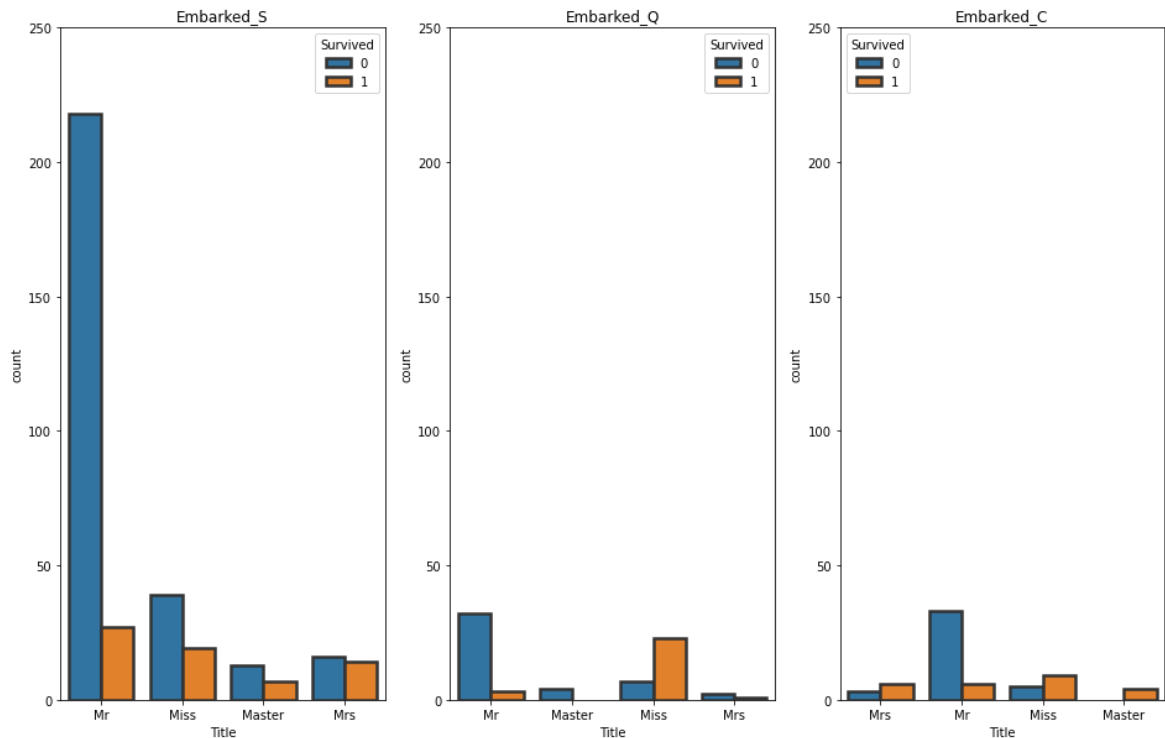
```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decora
tors.py:43: FutureWarning: Pass the following variable as a keywor
d arg: x. From version 0.12, the only valid positional argument wi
ll be `data`, and passing other arguments without an explicit keyw
ord will result in an error or misinterpretation.
```

```
FutureWarning
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decora
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d arg: x. From version 0.12, the only valid positional argument wi
ll be `data`, and passing other arguments without an explicit keyw
ord will result in an error or misinterpretation.
```

```
FutureWarning
```

```
Out[20]: [(0.0, 250.0)]
```



data process

```
In [18]: from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split as tts
from sklearn.preprocessing import StandardScaler
```

```
In [19]: #drop useless data
df_train_label=pd.DataFrame(df_train['Survived'])
df_train=df_train.drop(['Name','PassengerId','Cabin','Ticket','Survived'],axis=1,inplace=False)
df_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 8 columns):
 #   Column      Non-Null Count  Dtype
---  -
 0   Pclass      891 non-null    int64
 1   Sex         891 non-null    object
 2   Age         714 non-null    float64
 3   SibSp       891 non-null    int64
 4   Parch       891 non-null    int64
 5   Fare        891 non-null    float64
 6   Embarked    889 non-null    object
 7   Title       891 non-null    object
dtypes: float64(2), int64(3), object(3)
memory usage: 55.8+ KB
```

```
In [20]: df_train.Age.fillna(df_train.Age.mean(),inplace=True)
df_train.Embarked.fillna('S',inplace=True)
```

```
In [21]: #replace number to label
#sex: male, female ---0,1
#embarked: S,C,Q----0,1,2
#title
replace = LabelEncoder()

#sex
replace.fit(df_train.Sex)
Sex_label = replace.transform(df_train.Sex)
df_train['Sex_label'] = Sex_label
df_train.drop(['Sex'],axis=1,inplace=True)

#embarked
replace.fit(df_train.Embarked)
Embarked_label = replace.transform(df_train.Embarked)
df_train['Embarked_label'] = Embarked_label
df_train.drop(['Embarked'],axis=1,inplace=True)

#title
replace.fit(df_train.Title)
Title_label = replace.transform(df_train.Title)
df_train['Title_label'] = Title_label
df_train.drop(['Title'],axis=1,inplace=True)
```


In [22]: df_train.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 8 columns):
#   Column                Non-Null Count  Dtype
---  ---
0   Pclass                891 non-null   int64
1   Age                   891 non-null   float64
2   SibSp                 891 non-null   int64
3   Parch                 891 non-null   int64
4   Fare                  891 non-null   float64
5   Sex_label             891 non-null   int32
6   Embarked_label        891 non-null   int32
7   Title_label           891 non-null   int32
dtypes: float64(2), int32(3), int64(3)
memory usage: 45.4 KB
```

In [23]: df_train.head(9)

Out[23]:

	Pclass	Age	SibSp	Parch	Fare	Sex_label	Embarked_label	T
0	3	22.000000	1	0	7.2500	1		2
1	1	38.000000	1	0	71.2833	0		0
2	3	26.000000	0	0	7.9250	0		2
3	1	35.000000	1	0	53.1000	0		2
4	3	35.000000	0	0	8.0500	1		2
5	3	29.699118	0	0	8.4583	1		1
6	1	54.000000	0	0	51.8625	1		2
7	3	2.000000	3	1	21.0750	1		2
8	3	27.000000	0	2	11.1333	0		2

In [164]: X=np.array(df_train)
y=np.array(df_train_label).astype(np.float32)
X.shape,y.shape

Out[164]: ((891, 8), (891, 1))

In [165]: *#normalize*
from sklearn.preprocessing *import* StandardScaler

normalize=StandardScaler()
X_=normalize.fit_transform(X)

```
In [166]: X_.mean(),X_.std()
```

```
Out[166]: (2.6353778867364827e-17, 1.0)
```

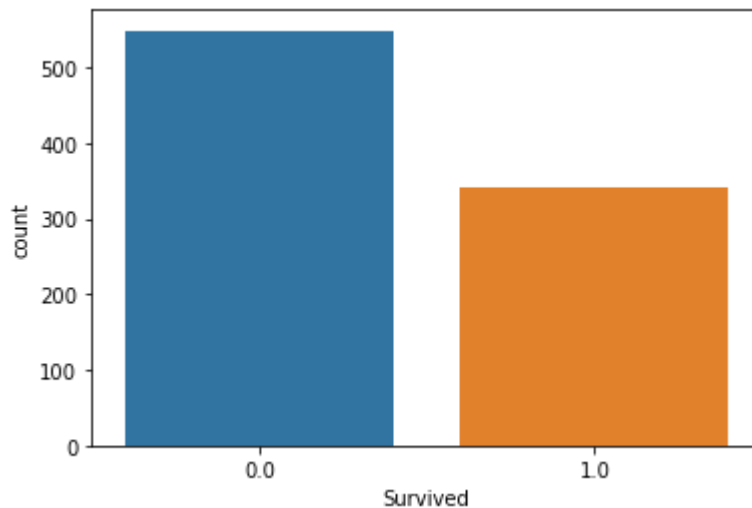
```
In [167]: #the distribution of negative and positive sample is not extreme, so we use accuracy as metrics
```

```
sns.countplot('Survived',data=pd.DataFrame(y,columns=df_train_label.columns))
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\seaborn\_decorators.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From version 0.12, the only valid positional argument will be `data`, and passing other arguments without an explicit keyword will result in an error or misinterpretation.
```

```
FutureWarning
```

```
Out[167]: <AxesSubplot:xlabel='Survived', ylabel='count'>
```



build model

we use K-fold to evaluate model

logistic regression

```
In [168]: from sklearn.linear_model import LogisticRegression  
          from sklearn.model_selection import GridSearchCV
```

```
In [169]: #tunning hyperparameters: C(lambda) , max_iter , random_state

reg=LogisticRegression()

params={
    'C':[0.5,1.0,1.2,1.5],
    'max_iter':[50,100,150],
    'random_state':[1,2,3,4]
}
grid=GridSearchCV(
    reg,
    params,
    cv=5,
    verbose=2,
    scoring='accuracy',
    refit=True
)
grid.fit(X_,y)
print("best score: {:.3f}, best params: {}".format(grid.best_score_, grid.best_params_))
```

```
Fitting 3 folds for each of 48 candidates, totalling 144 fits
[CV] C=0.5, max_iter=50, random_state=1
.....
[CV] ..... C=0.5, max_iter=50, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=1
.....
[CV] ..... C=0.5, max_iter=50, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=1
.....
[CV] ..... C=0.5, max_iter=50, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=2
.....
[CV] ..... C=0.5, max_iter=50, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=2
.....
[CV] ..... C=0.5, max_iter=50, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=2
.....
[CV] ..... C=0.5, max_iter=50, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=3
.....
[CV] ..... C=0.5, max_iter=50, random_state=3, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=3
.....
[CV] ..... C=0.5, max_iter=50, random_state=3, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=3
.....
[CV] ..... C=0.5, max_iter=50, random_state=3, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=4
.....
[CV] ..... C=0.5, max_iter=50, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=4
.....
[CV] ..... C=0.5, max_iter=50, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=50, random_state=4
.....
[CV] ..... C=0.5, max_iter=50, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=1
.....
[CV] ..... C=0.5, max_iter=100, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=1
.....
[CV] ..... C=0.5, max_iter=100, random_state=1, total=
0.0s
```

```
[CV] C=0.5, max_iter=100, random_state=1
.....
[CV] ..... C=0.5, max_iter=100, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=2
.....
[CV] ..... C=0.5, max_iter=100, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=2
.....
[CV] ..... C=0.5, max_iter=100, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=2
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[CV] ..... C=0.5, max_iter=100, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=3
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[CV] ..... C=0.5, max_iter=100, random_state=3, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=3
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[CV] ..... C=0.5, max_iter=100, random_state=3, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=3
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[CV] ..... C=0.5, max_iter=100, random_state=3, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=4
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[CV] ..... C=0.5, max_iter=100, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=4
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[CV] ..... C=0.5, max_iter=100, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=100, random_state=4
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[CV] ..... C=0.5, max_iter=100, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=1
.....
[CV] ..... C=0.5, max_iter=150, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=1
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[CV] ..... C=0.5, max_iter=150, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=1
.....
[CV] ..... C=0.5, max_iter=150, random_state=1, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=2
.....
[CV] ..... C=0.5, max_iter=150, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=2
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.....
[CV] ..... C=0.5, max_iter=150, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=2
.....
[CV] ..... C=0.5, max_iter=150, random_state=2, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=3
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[CV] ..... C=0.5, max_iter=150, random_state=3, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=3
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[CV] ..... C=0.5, max_iter=150, random_state=3, total=
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[CV] C=0.5, max_iter=150, random_state=3
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[CV] ..... C=0.5, max_iter=150, random_state=3, total=
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[CV] C=0.5, max_iter=150, random_state=4
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[CV] ..... C=0.5, max_iter=150, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=4
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[CV] ..... C=0.5, max_iter=150, random_state=4, total=
0.0s
[CV] C=0.5, max_iter=150, random_state=4
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[CV] ..... C=0.5, max_iter=150, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=1
.....
[CV] ..... C=1.0, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=1
.....
[CV] ..... C=1.0, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=1
.....
[CV] ..... C=1.0, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=2
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[CV] ..... C=1.0, max_iter=50, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=2
.....
[CV] ..... C=1.0, max_iter=50, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=2
.....
```

```
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.  
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().  
    return f(**kwargs)  
[Parallel(n_jobs=1)]: Done   1 out of   1 | elapsed:    0.0s remaining:    0.0s  
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().  
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```



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(n_samples, ), for example using ravel().
    return f(**kwargs)
```

```
[CV] ..... C=1.0, max_iter=50, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=3
.....
[CV] ..... C=1.0, max_iter=50, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=3
.....
[CV] ..... C=1.0, max_iter=50, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=3
.....
[CV] ..... C=1.0, max_iter=50, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=4
.....
[CV] ..... C=1.0, max_iter=50, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=4
.....
[CV] ..... C=1.0, max_iter=50, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=50, random_state=4
.....
[CV] ..... C=1.0, max_iter=50, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=1
.....
[CV] ..... C=1.0, max_iter=100, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=1
.....
[CV] ..... C=1.0, max_iter=100, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=1
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[CV] ..... C=1.0, max_iter=100, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=2
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[CV] ..... C=1.0, max_iter=100, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=2
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[CV] ..... C=1.0, max_iter=100, random_state=2, total=
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[CV] C=1.0, max_iter=100, random_state=2
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[CV] ..... C=1.0, max_iter=100, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=3
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[CV] ..... C=1.0, max_iter=100, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=3
.....
[CV] ..... C=1.0, max_iter=100, random_state=3, total=
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0.0s
[CV] C=1.0, max_iter=100, random_state=3
.....
[CV] ..... C=1.0, max_iter=100, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=4
.....
[CV] ..... C=1.0, max_iter=100, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=4
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[CV] ..... C=1.0, max_iter=100, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=100, random_state=4
.....
[CV] ..... C=1.0, max_iter=100, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=1
.....
[CV] ..... C=1.0, max_iter=150, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=1
.....
[CV] ..... C=1.0, max_iter=150, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=1
.....
[CV] ..... C=1.0, max_iter=150, random_state=1, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=2
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[CV] ..... C=1.0, max_iter=150, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=2
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[CV] ..... C=1.0, max_iter=150, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=2
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[CV] ..... C=1.0, max_iter=150, random_state=2, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=3
.....
[CV] ..... C=1.0, max_iter=150, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=3
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[CV] ..... C=1.0, max_iter=150, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=3
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[CV] ..... C=1.0, max_iter=150, random_state=3, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=4
.....
[CV] ..... C=1.0, max_iter=150, random_state=4, total=
0.0s
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[CV] C=1.0, max_iter=150, random_state=4
.....
[CV] ..... C=1.0, max_iter=150, random_state=4, total=
0.0s
[CV] C=1.0, max_iter=150, random_state=4
.....
[CV] ..... C=1.0, max_iter=150, random_state=4, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=1
.....
[CV] ..... C=1.2, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=1
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[CV] ..... C=1.2, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=1
.....
[CV] ..... C=1.2, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=2
.....
[CV] ..... C=1.2, max_iter=50, random_state=2, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=2
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[CV] ..... C=1.2, max_iter=50, random_state=2, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=2
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[CV] ..... C=1.2, max_iter=50, random_state=2, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=3
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[CV] ..... C=1.2, max_iter=50, random_state=3, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=3
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[CV] ..... C=1.2, max_iter=50, random_state=3, total=
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[CV] C=1.2, max_iter=50, random_state=3
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[CV] ..... C=1.2, max_iter=50, random_state=3, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=4
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[CV] ..... C=1.2, max_iter=50, random_state=4, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=4
.....
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().  
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[CV] ..... C=1.2, max_iter=50, random_state=4, total=
0.0s
[CV] C=1.2, max_iter=50, random_state=4
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[CV] ..... C=1.2, max_iter=50, random_state=4, total=
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[CV] C=1.2, max_iter=100, random_state=1
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[CV] C=1.2, max_iter=100, random_state=2
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[CV] ..... C=1.2, max_iter=100, random_state=2, total=
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[CV] ..... C=1.2, max_iter=100, random_state=4, total=
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[CV] C=1.2, max_iter=150, random_state=1
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[CV] ..... C=1.2, max_iter=150, random_state=1, total=
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0.0s
[CV] C=1.2, max_iter=150, random_state=1
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[CV] C=1.2, max_iter=150, random_state=2
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[CV] C=1.2, max_iter=150, random_state=2
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[CV] ..... C=1.2, max_iter=150, random_state=2, total=
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[CV] C=1.2, max_iter=150, random_state=3
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[CV] ..... C=1.2, max_iter=150, random_state=3, total=
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[CV] C=1.2, max_iter=150, random_state=3
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[CV] C=1.2, max_iter=150, random_state=4
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[CV] ..... C=1.2, max_iter=150, random_state=4, total=
0.0s
[CV] C=1.2, max_iter=150, random_state=4
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[CV] ..... C=1.2, max_iter=150, random_state=4, total=
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[CV] ..... C=1.2, max_iter=150, random_state=4, total=
0.0s
[CV] C=1.5, max_iter=50, random_state=1
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[CV] ..... C=1.5, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.5, max_iter=50, random_state=1
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[CV] ..... C=1.5, max_iter=50, random_state=1, total=
0.0s
[CV] C=1.5, max_iter=50, random_state=1
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[CV] ..... C=1.5, max_iter=50, random_state=1, total=
0.0s

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[CV] C=1.5, max_iter=50, random_state=2
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[CV] ..... C=1.5, max_iter=50, random_state=2, total=
0.0s
[CV] C=1.5, max_iter=50, random_state=2
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[CV] ..... C=1.5, max_iter=50, random_state=2, total=
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0.0s
[CV] C=1.5, max_iter=100, random_state=2
.....

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c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().  
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[CV] ..... C=1.5, max_iter=150, random_state=1, total=
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0.0s
[CV] C=1.5, max_iter=150, random_state=2
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[CV] ..... C=1.5, max_iter=150, random_state=2, total=
0.0s
[CV] C=1.5, max_iter=150, random_state=2
.....
[CV] ..... C=1.5, max_iter=150, random_state=2, total=
```

```
0.0s
[CV] C=1.5, max_iter=150, random_state=3
.....
[CV] ..... C=1.5, max_iter=150, random_state=3, total=
0.0s
[CV] C=1.5, max_iter=150, random_state=3
.....
[CV] ..... C=1.5, max_iter=150, random_state=3, total=
0.0s
[CV] C=1.5, max_iter=150, random_state=3
.....
[CV] ..... C=1.5, max_iter=150, random_state=3, total=
0.0s
[CV] C=1.5, max_iter=150, random_state=4
.....
[CV] ..... C=1.5, max_iter=150, random_state=4, total=
0.0s
[CV] C=1.5, max_iter=150, random_state=4
.....
[CV] ..... C=1.5, max_iter=150, random_state=4, total=
0.0s
[CV] C=1.5, max_iter=150, random_state=4
.....
[CV] ..... C=1.5, max_iter=150, random_state=4, total=
0.0s
best score: 0.793, best params: {'C': 1.2, 'max_iter': 50, 'random
_state': 1}
```

```
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_samples, ), for example using ravel().
    return f(**kwargs)
```

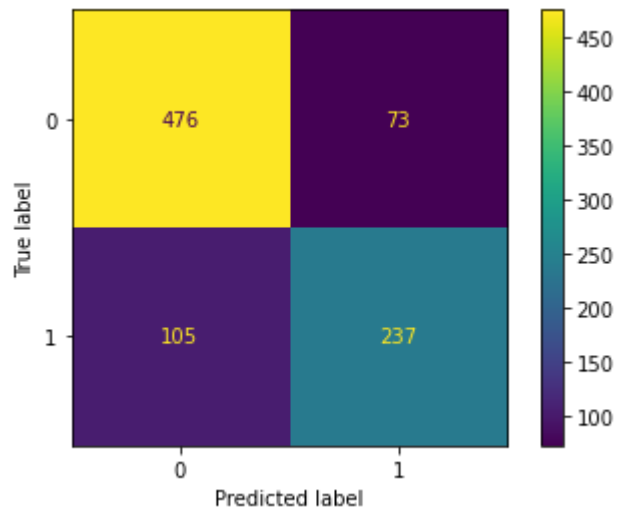
```

ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)
[Parallel(n_jobs=1)]: Done 144 out of 144 | elapsed:    0.6s finis
hed
c:\users\user\miniconda3\envs\bd\lib\site-packages\sklearn\utils\val
idation.py:72: DataConversionWarning: A column-vector y was pass
ed when a 1d array was expected. Please change the shape of y to
(n_samples, ), for example using ravel().
    return f(**kwargs)

```

```
In [170]: from sklearn.metrics import plot_confusion_matrix  
plot_confusion_matrix(grid.best_estimator_,X_,y,labels=[0,1])
```

```
Out[170]: <sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at  
0x28aa1c28b70>
```



deep learning

```
In [171]: #skorch method  
from skorch import NeuralNetBinaryClassifier  
from sklearn.model_selection import RandomizedSearchCV  
  
#pytorch  
import torch  
import torch.nn as nn  
import torch.optim as optim  
import torch.nn.functional as F
```

In [172]: *#model**#0-0-0-0-0*

```

class logistic_network(nn.Module):
    def __init__(self, prob=0.5, num_units=8, n_f=8):
        super(logistic_network, self).__init__()
        self.input=nn.Linear(n_f, num_units)
        self.hidden=nn.Sequential(

            nn.Dropout(prob),

            nn.Linear(num_units, num_units),
            nn.BatchNorm1d(num_units),
            nn.ReLU(),

            nn.Dropout(prob),

            nn.Linear(num_units, num_units),
            nn.BatchNorm1d(num_units),
            nn.ReLU()
        )
        self.output=nn.Linear(num_units, 1)
        self.initialize()

    def initialize(self):
        n=self.input.weight.shape[1]
        torch.nn.init.normal_(self.input.weight, mean=0, std=torch.sqrt(torch.tensor(2/n)))
        for layer in self.hidden:
            try:
                n=layer.weight.shape[1]
                torch.nn.init.normal_(layer.weight, mean=0, std=torch.sqrt(torch.tensor(2/n)))
            except:
                pass

    def forward(self, X):
        input_=F.relu(self.input(X))
        hidden=self.hidden(input_)
        out=self.output(hidden) #eat BCELogicLoss directly
        return out

```

```
In [173]: #setting model

#threshold default:0.5
model = NeuralNetBinaryClassifier(
    logistic_network,
    max_epochs=100,
    lr=0.001,
    optimizer=optim.Adam, #optimizer
    # Shuffle training data on each epoch
    iterator_train__shuffle=True,
    criterion=nn.BCEWithLogitsLoss,
    device=torch.device('cuda'),
)
```

```
In [174]: #tunning hyperparameters: lr , num_unis , dropout prob , optimizer , max_epochs
X_=X_.astype('float32')
y_=y_.squeeze().astype('float32')

# deactivate skorch-internal train-valid split and verbose logging
model.set_params(train_split=False, verbose=0)

params = {
    'lr': [10**(-4*np.random.rand()) for i in range(10)],
    'max_epochs': [50,100],
    'module__num_units': [12,16],
    #'module__prob':[0.5],
    'optimizer__weight_decay':[0,0.001],
    #'optimizer':[optim.Adam,optim.SGD,optim.RMSprop]
}

#cvint, cross-validation generator or an iterable
#cv=kfold(3),default 5
#metric:accuracy
gs =RandomizedSearchCV(model, params, refit=True, cv=5, scoring=
'accuracy', verbose=2)

gs.fit(X_, y_)
print("best score: {:.3f}, best params: {}".format(gs.best_score_, gs.best_params_))
```



```
Fitting 5 folds for each of 10 candidates, totalling 50 fits  
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993
```

```
[Parallel(n_jobs=1)]: Using backend SequentialBackend with 1 concurrent workers.
```

```
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993, total= 1.5s
```

```
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993
```

```
[Parallel(n_jobs=1)]: Done 1 out of 1 | elapsed: 1.4s remaining: 0.0s
```

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993, total= 1.5s

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993, total= 1.5s

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993, total= 1.4s

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00012848378793001993, total= 1.4s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484, total= 2.9s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484, total= 3.1s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484, total= 3.1s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484, total= 3.1s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.20879103361611484, total= 3.3s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646, total= 1.6s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646, total= 1.5s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646, total= 1.7s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646, total= 1.6s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=50, lr=0.00023757659375594646, total= 1.5s

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.11717152150513566

[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epochs=100, lr=0.11717152150513566

```
chs=100, lr=0.11717152150513566, total= 3.3s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=100, lr=0.11717152150513566, total= 3.2s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=100, lr=0.11717152150513566, total= 3.2s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=100, lr=0.11717152150513566, total= 3.2s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=100, lr=0.11717152150513566, total= 3.3s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
hs=50, lr=0.17939137622795764
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
chs=50, lr=0.17939137622795764, total= 1.7s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
hs=50, lr=0.17939137622795764
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
chs=50, lr=0.17939137622795764, total= 1.6s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
hs=50, lr=0.17939137622795764
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
chs=50, lr=0.17939137622795764, total= 1.6s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
hs=50, lr=0.17939137622795764
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epoc
chs=50, lr=0.17939137622795764, total= 1.8s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=50, lr=0.043022837429703066
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=50, lr=0.043022837429703066, total= 1.6s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=50, lr=0.043022837429703066
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=50, lr=0.043022837429703066, total= 1.6s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=50, lr=0.043022837429703066
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=50, lr=0.043022837429703066, total= 1.6s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=50, lr=0.043022837429703066
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=50, lr=0.043022837429703066, total= 1.7s
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
hs=50, lr=0.043022837429703066
[CV] optimizer__weight_decay=0.001, module__num_units=16, max_epoc
chs=50, lr=0.043022837429703066, total= 1.6s
```

[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646, total= 1.6s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646, total= 1.5s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646, total= 1.5s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646, total= 1.5s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=50, lr=0.00023757659375594646, total= 1.6s
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993, total= 1.6s
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993, total= 1.5s
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[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993, total= 1.5s
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993, total= 1.5s
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993
[CV] optimizer__weight_decay=0, module__num_units=16, max_epochs=50, lr=0.009364075620568993, total= 1.9s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544, total= 4.1s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544, total= 3.6s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544, total= 3.3s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544, total= 3.3s
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544

```

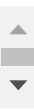
hs=100, lr=0.07781710719306544
[CV] optimizer__weight_decay=0.001, module__num_units=12, max_epochs=100, lr=0.07781710719306544, total= 3.3s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566, total= 3.2s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566, total= 3.1s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566, total= 3.1s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566, total= 3.1s
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566
[CV] optimizer__weight_decay=0, module__num_units=12, max_epochs=100, lr=0.11717152150513566, total= 3.3s

```

[Parallel(n_jobs=1)]: Done 50 out of 50 | elapsed: 1.9min finished

best score: 0.819, best params: {'optimizer__weight_decay': 0, 'module__num_units': 16, 'max_epochs': 50, 'lr': 0.009364075620568993}

In [175]: final_model=gs.best_estimator_ 

In [176]: *#compare logistic regression and network*
 print('logistic regression--',grid.best_estimator_.score(X_,y_))
 print('logistic network--',final_model.score(X_,y)) 

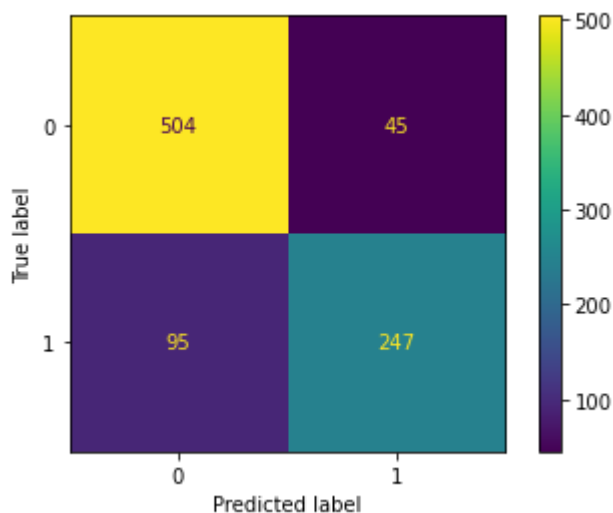
```

logistic regression-- 0.8002244668911336
logistic network-- 0.8428731762065096

```

```
In [177]: from sklearn.metrics import plot_confusion_matrix
plot_confusion_matrix(final_model,X_,y_,labels=[0,1])
```

```
Out[177]: <sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay at
0x28aa1bb1ef0>
```



```
In [178]: #save model
torch.save(final_model.module_, 'titanic_model.pkl')
```

```
In [179]: model_titanic=torch.load('titanic_model.pkl').cpu()
```

submit

```
In [180]: df_test=pd.read_csv('./data/test.csv')
df_test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 11 columns):
#   Column             Non-Null Count  Dtype
---  ---
0   PassengerId         418 non-null    int64
1   Pclass              418 non-null    int64
2   Name                418 non-null    object
3   Sex                 418 non-null    object
4   Age                 332 non-null    float64
5   SibSp               418 non-null    int64
6   Parch              418 non-null    int64
7   Ticket              418 non-null    object
8   Fare                417 non-null    float64
9   Cabin              91 non-null     object
10  Embarked            418 non-null    object
dtypes: float64(2), int64(4), object(5)
memory usage: 36.0+ KB
```

```
In [181]: # process
df_test['Title'] = df_test.Name.apply(lambda x: re.search(' ([A-Z][a-z]+)\.', x).group(1))
```

```
In [182]: df_test.Age.fillna(df_test.Age.mean(),inplace=True)
df_test.Embarked.fillna('S',inplace=True)
df_test.Fare.fillna(df_test.Fare.mean(),inplace=True)
```

```
In [183]: df_test.drop(['PassengerId', 'Name', 'Ticket', 'Cabin'],axis=1,inplace=True)
```

```
In [184]: df_test
```

Out[184]:

	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	Title
0	3	male	34.50000	0	0	7.8292	Q	Mr
1	3	female	47.00000	1	0	7.0000	S	Mrs
2	2	male	62.00000	0	0	9.6875	Q	Mr
3	3	male	27.00000	0	0	8.6625	S	Mr
4	3	female	22.00000	1	1	12.2875	S	Mrs
...
413	3	male	30.27259	0	0	8.0500	S	Mr
414	1	female	39.00000	0	0	108.9000	C	Dona
415	3	male	38.50000	0	0	7.2500	S	Mr
416	3	male	30.27259	0	0	8.0500	S	Mr
417	3	male	30.27259	1	1	22.3583	C	Master

418 rows × 8 columns

```
In [185]: df_test.Title[df_test.Title=='Dona']='Don'
```

c:\users\user\miniconda3\envs\bd\lib\site-packages\ipykernel_launcher.py:1: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy

"""Entry point for launching an IPython kernel.

```
In [186]: #replace number to label
#sex:male,female ---0,1
#embarked:S,C,Q---0,1,2
#title
replace_ = LabelEncoder()

#sex
replace_.fit(df_test.Sex)
Sex_label = replace_.transform(df_test.Sex)
df_test['Sex_label'] = Sex_label

#embarked
replace_.fit(df_test.Embarked)
Embarked_label = replace_.transform(df_test.Embarked)
df_test['Embarked_label'] = Embarked_label

#title
Title_label = replace_.transform(df_test.Title)
df_test['Title_label'] = Title_label
```

```
In [187]: df_test.drop(['Title', 'Sex', 'Embarked'], axis=1, inplace=True)
```

```
In [188]: df_test
```

Out[188]:

	Pclass	Age	SibSp	Parch	Fare	Sex_label	Embarked_label
0	3	34.50000	0	0	7.8292	1	1
1	3	47.00000	1	0	7.0000	0	2
2	2	62.00000	0	0	9.6875	1	1
3	3	27.00000	0	0	8.6625	1	2
4	3	22.00000	1	1	12.2875	0	2
...
413	3	30.27259	0	0	8.0500	1	2
414	1	39.00000	0	0	108.9000	0	0
415	3	38.50000	0	0	7.2500	1	2
416	3	30.27259	0	0	8.0500	1	2
417	3	30.27259	1	1	22.3583	1	0

418 rows × 8 columns

In [189]: `df_test.info()`

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 418 entries, 0 to 417
Data columns (total 8 columns):
#   Column                Non-Null Count  Dtype
---  ---
0   Pclass                418 non-null    int64
1   Age                   418 non-null    float64
2   SibSp                 418 non-null    int64
3   Parch                 418 non-null    int64
4   Fare                  418 non-null    float64
5   Sex_label             418 non-null    int32
6   Embarked_label        418 non-null    int32
7   Title_label           418 non-null    int32
dtypes: float64(2), int32(3), int64(3)
memory usage: 21.4 KB
```

In [190]:

```
#normalize
normal= StandardScaler()

X_test=np.array(df_test)

normal.fit(X_test)
X_test_norm=normal.transform(X_test)
X_test_norm=X_test_norm.astype(np.float32)
```

In [191]:

```
Survived=final_model.predict(X_test_norm).squeeze().astype('int32')
```

In [192]:

```
#submit
PassengerId = np.arange(892,1310)

submit = pd.DataFrame(list(zip(PassengerId,Survived)),columns=[
    'PassengerId','Survived'])
```

In [193]: `submit.head(10)`

Out[193]:

	PassengerId	Survived
0	892	0
1	893	1
2	894	0
3	895	0
4	896	0
5	897	0
6	898	1
7	899	0
8	900	1
9	901	0

In [194]: `submit.to_csv("final_ans_new.csv", index=False)`

In []: