Data Science @Bharat Intern

Done By Harsha Vardhan

```
import numpy as np

import pandas as pd

import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
from matplotlib import style
from sklearn import linear_model
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import Perceptron
from sklearn.linear_model import SGDClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from sklearn.naive_bayes import GaussianNB
```

```
train_df = pd.read_csv('train.csv')
test_df = pd.read_csv('test.csv')

train_df['train_test'] = 1
test_df['train_test'] = 0
# test_df['Survived'] = np.NaN
all_data = pd.concat([train_df,test_df])

%matplotlib inline
all_data.columns
```

```
Index(['PassengerId', 'Survived', 'Pclass', 'Name', 'Sex', 'Age', 'SibSp',
       'Parch', 'Ticket', 'Fare', 'Cabin', 'Embarked', 'train_test'],
      dtype='object')
```

```
train_df.head(10)
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.
1	2	1	1	Cumings, Mrs. John Bradley (Florence Briggs Th...	female	38.0	1	0	PC 17599	71.
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.
4	5	0	3	Allen, Mr. William	male	35.0	0	0	373450	8.

```
test_df.head(10)
```

	PassengerId	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
0	892	3	Kelly, Mr. James	male	34.5	0	0	330911	7.8292	NaN
1	893	3	Wilkes, Mrs. James (Ellen Needs)	female	47.0	1	0	363272	7.0000	NaN
2	894	2	Myles, Mr. Thomas	male	62.0	0	0	240276	9.6875	NaN

```
train_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 13 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 
 12  train_test   891 non-null    int64  
dtypes: float64(2), int64(6), object(5)
memory usage: 90.6+ KB
```

```
train_df.describe()
```

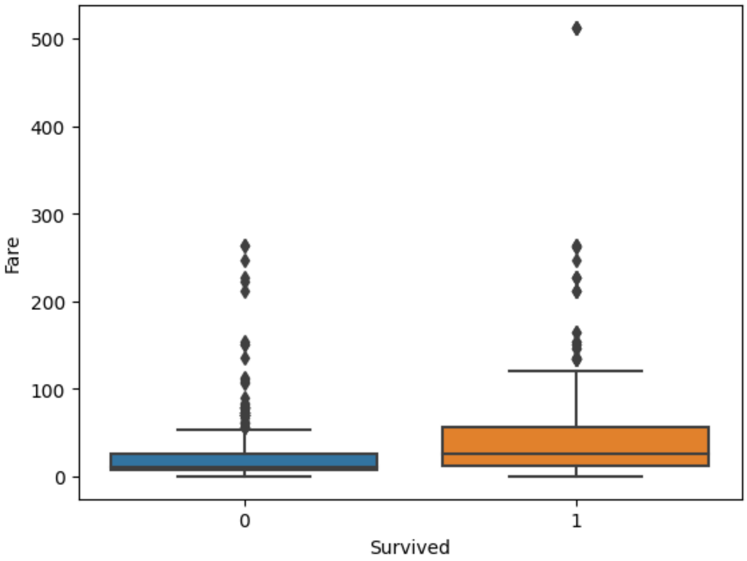
	PassengerId	Survived	Pclass	Age	SibSp	Parch	F
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204
std	257.353842	0.486592	0.836071	14.526497	1.102743	0.806057	49.693
min	1.000000	0.000000	1.000000	0.420000	0.000000	0.000000	0.000
25%	223.500000	0.000000	2.000000	20.125000	0.000000	0.000000	7.910
50%	446.000000	0.000000	3.000000	28.000000	0.000000	0.000000	14.454
75%	668.500000	1.000000	3.000000	38.000000	1.000000	0.000000	31.000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329

```
total = train_df.isnull().sum().sort_values(ascending=False)
percent_1 = train_df.isnull().sum()/train_df.isnull().count()*100
percent_2 = (round(percent_1, 1)).sort_values(ascending=False)
missing_data = pd.concat([total, percent_2], axis=1, keys=['Total', '%'])
missing_data.head(13)
```

```
train_df.columns.values
```

```
array(['PassengerId', 'Survived', 'Pclass', 'Name', 'Sex', 'Age', 'SibSp',
       'Parch', 'Ticket', 'Fare', 'Cabin', 'Embarked', 'train_test'],
      dtype=object)
```

```
sns.boxplot(x='Survived',y='Fare',data=train_df);
```



```
train_df[train_df['Fare']>300]
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	F
258	259	1	1	Ward, Miss. Anna	female	35.0	0	0	PC 17755	512.3
679	680	1	1	Cardeza, Mr. Thomas Drake Martinez	male	36.0	0	1	PC 17755	512.3

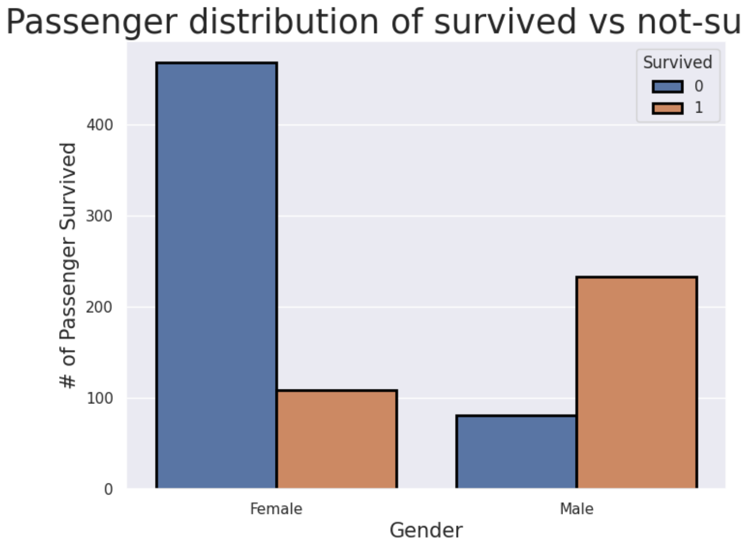
```
train_df[train_df['Name'].str.contains("Capt")]
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	C
				Crosby,							

```
FacetGrid = sns.FacetGrid(train_df, col='Embarked', height=4, aspect=1.2)
FacetGrid.map(sns.pointplot, 'Pclass', 'Survived', 'Sex', ci=95.0, palette='deep', order=None, hue_order=None)
FacetGrid.add_legend();
```

```
/usr/local/lib/python3.10/dist-packages/seaborn/axisgrid.py:848: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=('ci', 95.0)` for the same effect.

  func(*plot_args, **plot_kwargs)
/usr/local/lib/python3.10/dist-packages/seaborn/axisgrid.py:848: FutureWarning:

The `ci` parameter is deprecated. Use `errorbar=('ci', 95.0)` for the same effect.
```

```
sns.set(style='darkgrid')
plt.subplots(figsize = (8,6))
ax=sns.countplot(x='Sex', data = train_df, hue='Survived', edgecolor=(0,0,0), linewidth=2)

plt.title('Passenger distribution of survived vs not-survived', fontsize=25)
plt.xlabel('Gender', fontsize=15)
plt.ylabel("# of Passenger Survived", fontsize = 15)
labels = ['Female', 'Male']

plt.xticks(sorted(train_df.Survived.unique()),labels);
```



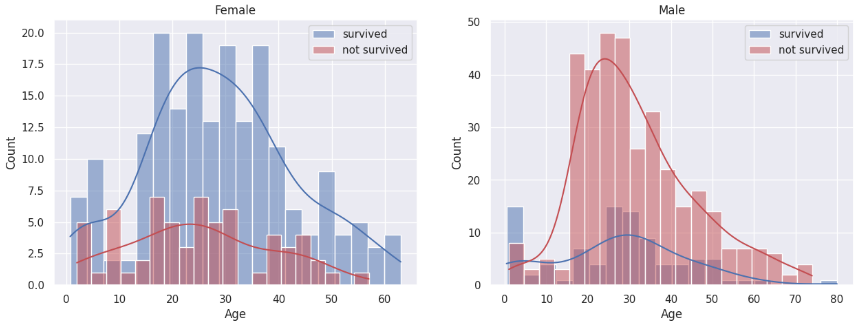
```
train_df.groupby(['Sex']).mean()
```

```
<ipython-input-16-0a4a460c27a0>:1: FutureWarning: The default value of numeric_only
  train_df.groupby(['Sex']).mean()
```

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare	trai
Sex								
female	431.028662	0.742038	2.159236	27.915709	0.694268	0.649682	44.479818	
male	454.147314	0.188908	2.389948	30.726645	0.429809	0.235702	25.523893	

```
train_df.groupby(['Sex','Pclass']).mean()
```

```
     <ipython-input-17-76053d666846>:1: FutureWarning: The default value of numeric_only
survived = 'survived'
not_survived = 'not survived'

fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(15, 5))

women = train_df[train_df['Sex']=='female']
men = train_df[train_df['Sex']=='male']

ax = sns.histplot(women[women['Survived']==1].Age.dropna(), bins=20, label = survived, ax = axes[0],color='b', kde=True)
ax = sns.histplot(women[women['Survived']==0].Age.dropna(), bins=20, label = not_survived, ax = axes[0],color='r', kde=True)
ax.legend()
ax.set_title('Female')

ax = sns.histplot(men[men['Survived']==1].Age.dropna(), bins=20, label = survived, ax = axes[1],color='b', kde=True)
ax = sns.histplot(men[men['Survived']==0].Age.dropna(), bins=20, label = not_survived, ax = axes[1],color='r', kde=True)
ax.legend()
ax.set_title('Male');
```

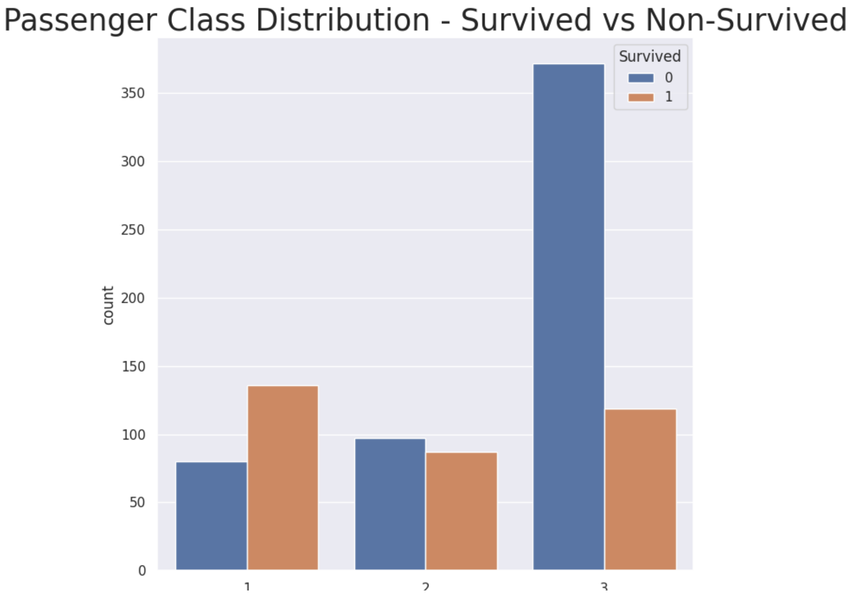


```
train_df[train_df['Age']<18].groupby(['Sex','Pclass']).mean()
```

```
     <ipython-input-20-828df17eba2f>:1: FutureWarning: The default value of numeric_only
       train_df[train_df['Age']<18].groupby(['Sex','Pclass']).mean()
```

		PassengerId	Survived	Age	SibSp	Parch	Fare	trai
Sex	Pclass							
female	1	525.375000	0.875000	14.125000	0.500000	0.875000	104.083337	
	2	369.250000	1.000000	8.333333	0.583333	1.083333	26.241667	
	3	374.942857	0.542857	8.428571	1.571429	1.057143	18.727977	
male	1	526.500000	1.000000	8.230000	0.500000	2.000000	116.072900	
	2	527.818182	0.818182	4.757273	0.727273	1.000000	25.659473	
	3	437.953488	0.232558	9.963256	2.069767	1.000000	22.752523	

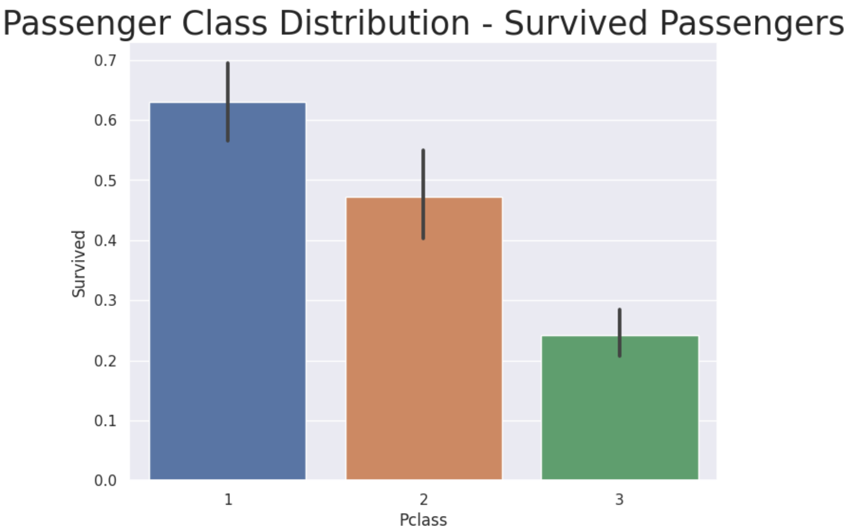
```
plt.subplots(figsize = (8,8))
ax=sns.countplot(x='Pclass',hue='Survived',data=train_df)
plt.title("Passenger Class Distribution - Survived vs Non-Survived", fontsize = 25);
```



```
plt.subplots(figsize=(10,8))
ax=sns.kdeplot(train_df.loc[(train_df['Survived'] == 0),'Pclass'],shade=True,color='r',label='Not Survived')
ax.legend()
ax=sns.kdeplot(train_df.loc[(train_df['Survived'] == 1),'Pclass'],shade=True,color='b',label='Survived')
ax.legend()

plt.title("Passenger Class Distribution - Survived vs Non-Survived", fontsize = 25)
labels = ['First', 'Second', 'Third']
plt.xticks(sorted(train_df.Pclass.unique()),labels);
```

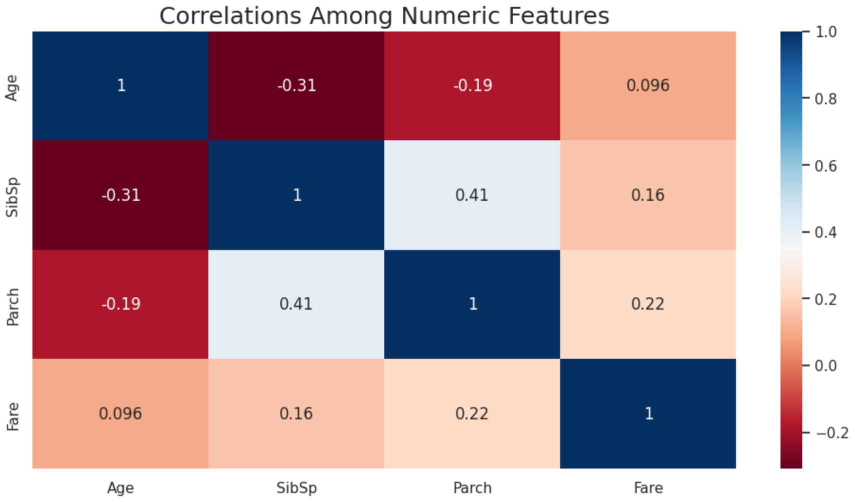
```
<ipython-input-22-89cb45b403e7>:2: FutureWarning:
```

```
plt.subplots(figsize = (8,6))
sns.barplot(x='Pclass', y='Survived', data=train_df);
plt.title("Passenger Class Distribution - Survived Passengers", fontsize = 25);
```



```
df_num = train_df[['Age','SibSp','Parch','Fare']]
df_cat = train_df[['Survived','Pclass','Sex','Ticket','Cabin','Embarked']]
```

```
plt.subplots(figsize = (12,6))
sns.heatmap(df_num.corr(), annot=True,cmap="RdBu")
plt.title("Correlations Among Numeric Features", fontsize = 18);
```



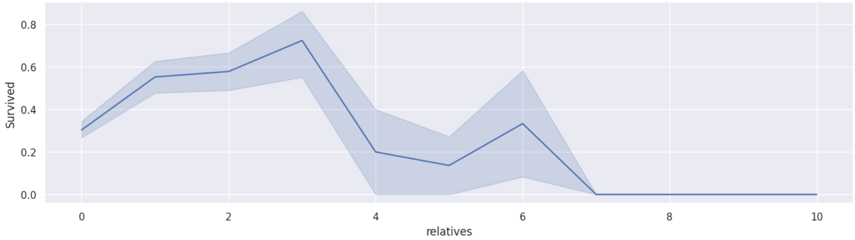
```
train_df = train_df.drop(['PassengerId'], axis=1)
train_df.head()
```

	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
0	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500	NaN
1	1	1	Cumings, Mrs. John Bradley (Florence	female	38.0	1	0	PC 17599	71.2833	C85

```
data = [train_df, test_df]
for dataset in data:
    dataset['relatives'] = dataset['SibSp'] + dataset['Parch']
    dataset.loc[dataset['relatives'] > 0, 'not_alone'] = 0
    dataset.loc[dataset['relatives'] == 0, 'not_alone'] = 1
    dataset['not_alone'] = dataset['not_alone'].astype(int)
train_df['not_alone'].value_counts()
```

```
1    537
0    354
Name: not_alone, dtype: int64
```

```
plt.subplots(figsize = (16,4))
ax = sns.lineplot(x='relatives',y='Survived', data=train_df)
```



```
import re
deck = {"A": 1, "B": 2, "C": 3, "D": 4, "E": 5, "F": 6, "G": 7, "U": 8}
data = [train_df, test_df]

for dataset in data:
    dataset['Cabin'] = dataset['Cabin'].fillna("U0")
    dataset['Deck'] = dataset['Cabin'].map(lambda x: re.compile("([a-zA-Z]+)").search(x).group())
    dataset['Deck'] = dataset['Deck'].map(deck)
    dataset['Deck'] = dataset['Deck'].fillna(0)
    dataset['Deck'] = dataset['Deck'].astype(int)
```

```
train_df = train_df.drop(['Cabin'], axis=1)
test_df = test_df.drop(['Cabin'], axis=1)
```

```
data = [train_df, test_df]

for dataset in data:
    mean = train_df["Age"].mean()
    std = test_df["Age"].std()
    is_null = dataset["Age"].isnull().sum()

    rand_age = np.random.randint(mean - std, mean + std, size = is_null)

    age_slice = dataset["Age"].copy()
    age_slice[np.isnan(age_slice)] = rand_age
    dataset["Age"] = age_slice
    dataset["Age"] = train_df["Age"].astype(int)
```

```
train_df["Age"].isnull().sum()
```

```
0
```

```
train_df['Embarked'].describe()
```

```
count     889
unique      3
```

```
top         S
freq      644
Name: Embarked, dtype: object
```

```
common_value = 'S'
data = [train_df, test_df]

for dataset in data:
    dataset['Embarked'] = dataset['Embarked'].fillna(common_value)
train_df['Embarked'].isnull().sum()
```

```
0
```

```
train_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 14 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   Survived    891 non-null    int64  
 1   Pclass      891 non-null    int64  
 2   Name        891 non-null    object 
 3   Sex         891 non-null    object 
 4   Age         891 non-null    int64  
 5   SibSp       891 non-null    int64  
 6   Parch       891 non-null    int64  
 7   Ticket      891 non-null    object 
 8   Fare        891 non-null    float64
 9   Embarked    891 non-null    object 
 10  train_test  891 non-null    int64  
 11  relatives   891 non-null    int64  
 12  not_alone   891 non-null    int64  
 13  Deck        891 non-null    int64  
dtypes: float64(1), int64(9), object(4)
memory usage: 97.6+ KB
```

```
data = [train_df, test_df]

for dataset in data:
    dataset['Fare'] = dataset['Fare'].fillna(0)
    dataset['Fare'] = dataset['Fare'].astype(int)
train_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 14 columns):
 #   Column      Non-Null Count  Dtype 
---  ------      --------------  ----- 
 0   Survived    891 non-null    int64 
 1   Pclass      891 non-null    int64 
 2   Name        891 non-null    object
 3   Sex         891 non-null    object
 4   Age         891 non-null    int64 
 5   SibSp       891 non-null    int64 
 6   Parch       891 non-null    int64 
 7   Ticket      891 non-null    object
 8   Fare        891 non-null    int64 
 9   Embarked    891 non-null    object
 10  train_test  891 non-null    int64 
 11  relatives   891 non-null    int64 
 12  not_alone   891 non-null    int64 
 13  Deck        891 non-null    int64 
dtypes: int64(10), object(4)
memory usage: 97.6+ KB
```

```
data = [train_df, test_df]
titles = {"Mr": 1, "Miss": 2, "Mrs": 3, "Master": 4, "Other": 5}

for dataset in data:

    dataset['Title'] = dataset.Name.str.extract('([A-Za-z]+)\.', expand=False)


    dataset['Title'] = dataset['Title'].replace(['Lady', 'Countess','Capt', 'Col','Don', 'Dr','Major', 'Rev', 'Sir', 'Jonkheer', 'Dona']
    dataset['Title'] = dataset['Title'].replace('Mlle', 'Miss')
    dataset['Title'] = dataset['Title'].replace('Ms', 'Miss')
    dataset['Title'] = dataset['Title'].replace('Mme', 'Mrs')


    dataset['Title'] = dataset['Title'].map(titles)
    dataset['Title'] = dataset['Title'].fillna(0)


train_df = train_df.drop(['Name'], axis=1)
test_df = test_df.drop(['Name'], axis=1)

train_df.head()
```

	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked	train_test
0	0	3	male	22	1	0	A/5 21171	7	S	1
1	1	1	female	38	1	0	PC 17599	71	C	1
2	1	3	female	26	0	0	STON/O2. 3101282	7	S	1
3	1	1	female	35	1	0	113803	53	S	1

```
genders = {"male": 0, "female": 1}
data = [train_df, test_df]

for dataset in data:
    dataset['Sex'] = dataset['Sex'].map(genders)


train_df.head()
```

	Survived	Pclass	Sex	Age	SibSp	Parch	Ticket	Fare	Embarked	train_test	re
0	0	3	0	22	1	0	A/5 21171	7	S	1	
1	1	1	1	38	1	0	PC 17599	71	C	1	
2	1	3	1	26	0	0	STON/O2. 3101282	7	S	1	
3	1	1	1	35	1	0	113803	53	S	1	

```
train_df['Ticket'].describe()
```

```
count        891
unique       681
top       347082
freq           7
Name: Ticket, dtype: object
```

```
train_df = train_df.drop(['Ticket'], axis=1)
test_df = test_df.drop(['Ticket'], axis=1)


train_df.head()
```

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	train_test	relatives	not_alone	Deck	Tit
0	0	3	0	22	1	0	7	S	1	1	0	8	
1	1	1	1	38	1	0	71	C	1	1	0	3	
2	1	3	1	26	0	0	7	S	1	0	1	8	
3	1	1	1	35	1	0	53	S	1	1	0	3	
4	0	3	0	35	0	0	8	S	1	0	1	8	

```
ports = {"S": 0, "C": 1, "Q": 2}
data = [train_df, test_df]

for dataset in data:
    dataset['Embarked'] = dataset['Embarked'].map(ports)


train_df.head()
```

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	train_test	relatives	not_alone	Deck	Tit
0	0	3	0	22	1	0	7	0	1	1	0	8	

```
data = [train_df, test_df]
for dataset in data:
    dataset['Age'] = dataset['Age'].astype(int)
    dataset.loc[ dataset['Age'] <= 11, 'Age'] = 0
    dataset.loc[(dataset['Age'] > 11) & (dataset['Age'] <= 18), 'Age'] = 1
    dataset.loc[(dataset['Age'] > 18) & (dataset['Age'] <= 22), 'Age'] = 2
    dataset.loc[(dataset['Age'] > 22) & (dataset['Age'] <= 27), 'Age'] = 3
    dataset.loc[(dataset['Age'] > 27) & (dataset['Age'] <= 33), 'Age'] = 4
    dataset.loc[(dataset['Age'] > 33) & (dataset['Age'] <= 40), 'Age'] = 5
    dataset.loc[(dataset['Age'] > 40) & (dataset['Age'] <= 66), 'Age'] = 6
    dataset.loc[ dataset['Age'] > 66, 'Age'] = 6
```

```
train_df['Age'].value_counts()
```

```
4    163
6    157
5    151
3    136
2    116
1    100
0     68
Name: Age, dtype: int64
```

```
train_df.head()
```

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	train_test	relatives	n
0	0	3	0	2	1	0	7	0	1	1	
1	1	1	1	5	1	0	71	1	1	1	
2	1	3	1	3	0	0	7	0	1	0	
3	1	1	1	5	1	0	53	0	1	1	
4	0	3	0	5	0	0	8	0	1	0	

```
pd.qcut(train_df['Fare'], q=6)
```

```
0      (-0.001, 7.0]
1      (52.0, 512.0]
2      (-0.001, 7.0]
3      (52.0, 512.0]
4         (7.0, 8.0]
            ...
886      (8.0, 14.0]
887     (26.0, 52.0]
888     (14.0, 26.0]
889     (26.0, 52.0]
890    (-0.001, 7.0]
Name: Fare, Length: 891, dtype: category
Categories (6, interval[float64, right]): [(-0.001, 7.0] < (7.0, 8.0] < (8.0, 14.0] < (14.0, 26.0] <
                                           (26.0, 52.0] < (52.0, 512.0]]
```

```
data = [train_df, test_df]

for dataset in data:
    dataset.loc[ dataset['Fare'] <= 7, 'Fare'] = 0
    dataset.loc[(dataset['Fare'] > 7) & (dataset['Fare'] <= 8), 'Fare'] = 1
    dataset.loc[(dataset['Fare'] > 8) & (dataset['Fare'] <= 14), 'Fare']   = 2
    dataset.loc[(dataset['Fare'] > 14) & (dataset['Fare'] <= 26), 'Fare']   = 3
    dataset.loc[(dataset['Fare'] > 26) & (dataset['Fare'] <= 52), 'Fare']   = 4
    dataset.loc[dataset['Fare'] > 52, 'Fare'] = 5
    dataset['Fare'] = dataset['Fare'].astype(int)
```

```
train_df.head(10)
```

	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	train_test	relatives	n
0	0	3	0	2	1	0	0	0	1	1	
1	1	1	1	5	1	0	5	1	1	1	
2	1	3	1	3	0	0	0	0	1	0	
3	1	1	1	5	1	0	5	0	1	1	

```
X_train = train_df.drop("Survived", axis=1)
Y_train = train_df["Survived"]
X_test  = test_df.drop("PassengerId", axis=1).copy()
```

SGD

```
sgd = linear_model.SGDClassifier(max_iter=5, tol=None)
sgd.fit(X_train, Y_train)

Y_pred = sgd.predict(X_test)

sgd.score(X_train, Y_train)
acc_sgd = round(sgd.score(X_train, Y_train) * 100, 2)

# Print score
print(round(acc_sgd,2,), "%")
```

```
75.98 %
```

Decision Tree

```
decision_tree = DecisionTreeClassifier()
decision_tree.fit(X_train, Y_train)

Y_pred = decision_tree.predict(X_test)

acc_decision_tree = round(decision_tree.score(X_train, Y_train) * 100, 2)

# Print score
print(round(acc_decision_tree,2,), "%")
```

```
92.82 %
```

Random Forest

```
random_forest = RandomForestClassifier(n_estimators=100)
random_forest.fit(X_train, Y_train)

Y_prediction = random_forest.predict(X_test)

random_forest.score(X_train, Y_train)
acc_random_forest = round(random_forest.score(X_train, Y_train) * 100, 2)

# Print score
print(round(acc_random_forest,2,), "%")
```

```
92.82 %
```

Logistic Regression

```
logreg = LogisticRegression()
logreg.fit(X_train, Y_train)

Y_pred = logreg.predict(X_test)

acc_log = round(logreg.score(X_train, Y_train) * 100, 2)

# Print score
print(round(acc_log,2,), "%")
```

```
81.14 %
```

KNN

```
knn = KNeighborsClassifier(n_neighbors = 3)
knn.fit(X_train, Y_train)

Y_pred = knn.predict(X_test)

acc_knn = round(knn.score(X_train, Y_train) * 100, 2)

# Print score
print(round(acc_knn,2,), "%")
```

```
85.19 %
```

Gaussian Naive Bayes

```
gaussian = GaussianNB()
gaussian.fit(X_train, Y_train)

Y_pred = gaussian.predict(X_test)

acc_gaussian = round(gaussian.score(X_train, Y_train) * 100, 2)

# Print score
print(round(acc_gaussian,2,), "%")
```

```
78.56 %
```

Perceptron

```
perceptron = Perceptron(max_iter=1000)
perceptron.fit(X_train, Y_train)

Y_pred = perceptron.predict(X_test)

acc_perceptron = round(perceptron.score(X_train, Y_train) * 100, 2)

# Print score
print(round(acc_perceptron,2,), "%")
```

```
64.09 %
```

Model evaluation

```
results = pd.DataFrame({
    'Model': ['KNN', 'Logistic Regression',
              'Random Forest', 'Naive Bayes', 'Perceptron',
              'Stochastic Gradient Decent',
              'Decision Tree'],
    'Score': [acc_knn, acc_log,
              acc_random_forest, acc_gaussian, acc_perceptron,
              acc_sgd, acc_decision_tree]})

result_df = results.sort_values(by='Score', ascending=False)
result_df = result_df.set_index('Score')
result_df.head(9)
```

	Model
Score	
85.19	KNN

K-Fold Cross Validation

```
from sklearn.model_selection import cross_val_score

rf = RandomForestClassifier(n_estimators=100)
scores = cross_val_score(rf, X_train, Y_train, cv=10, scoring = "accuracy")
print("Scores:", scores)
print("Mean:", scores.mean())
print("Standard Deviation:", scores.std())
```

```
Scores: [0.78888889 0.83146067 0.75280899 0.86516854 0.86516854 0.85393258
 0.82022472 0.7752809  0.86516854 0.80898876]
Mean: 0.8227091136079899
Standard Deviation: 0.0386440089058461
```

Random Forest

```
importances = pd.DataFrame({'feature':X_train.columns,'importance':np.round(random_forest.feature_importances_,3)})
importances = importances.sort_values('importance',ascending=False).set_index('feature')
importances.head(12)
```

	importance
feature	
Title	0.206
Sex	0.160
Age	0.157
Fare	0.113
Deck	0.089
Pclass	0.087
relatives	0.067
Embarked	0.047
SibSp	0.039
Parch	0.023
not_alone	0.012
train_test	0.000

```
importances.plot.bar();
```

```
train_df  = train_df.drop("not_alone", axis=1)
test_df  = test_df.drop("not_alone", axis=1)


train_df  = train_df.drop("Parch", axis=1)
test_df  = test_df.drop("Parch", axis=1)
```

```
X_train = train_df.drop("Survived", axis=1)
Y_train = train_df["Survived"]
X_test  = test_df.drop("PassengerId", axis=1).copy()
```

```
random_forest = RandomForestClassifier(n_estimators=100, oob_score = True)
random_forest.fit(X_train, Y_train)

Y_prediction = random_forest.predict(X_test)

random_forest.score(X_train, Y_train)
acc_random_forest = round(random_forest.score(X_train, Y_train) * 100, 2)

# Print scores
print(round(acc_random_forest,2,), "%")
```

```
92.82 %
```

```
importances = pd.DataFrame({'feature':X_train.columns,'importance':np.round(random_forest.feature_importances_,3)})
importances = importances.sort_values('importance',ascending=False).set_index('feature')
importances.head(12)
```

	importance
feature	
Title	0.193
Sex	0.185
Age	0.157
Fare	0.108
Pclass	0.092
Deck	0.087
relatives	0.082
SibSp	0.050
Embarked	0.046
train_test	0.000

```
print("oob score:", round(random_forest.oob_score_, 4)*100, "%")
```

```
oob score: 80.92 %
```

Hyperparameter Tuning

```
def clf_performance(classifier, model_name):
    print(model_name)
    print('Best Score: ' + str(classifier.best_score_))
    print('Best Parameters: ' + str(classifier.best_params_))
```

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