titanic-part1-v4

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1 Titanic Project ML - Part 1 - Work In Progress

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File: titanic-part1.ipynb

Description: A Reproduction work based on Cyrille Rossant's book.
Source: Rossant, Cyrille, IPython Interactive Computing and Visualization Cookbook, 2nd ed., Packt Publishing, 2018, ISBN 978-1-78588-863-2, Chp. 8 Machine Learning

Additional Source: Matplotlib.org Tutorials: https://matplotlib.org/tutorials/introductory/usage.html#sphx-glr-tutorials-introductory-usage-py

Additional Source: VanderPlas, Jake, Python Data Science Handbook, O'Reilly Media Inc., Copyright 2017, Chp. 4 Visualizing with Matplotlib.

"""

1.0.1 Package Imports

```
In [1]: import numpy as np
        import pandas as pd
        import sklearn
        import sklearn.linear_model as lm
        import sklearn.model_selection as ms
        import matplotlib.pyplot as plt
        %matplotlib inline
```

1.0.2 Data Step

```
In [2]: # Load training datasets using Pandas dataframe object.

        # Input parameters.
        param1 = ('https://github.com/ipython-books'
                  '/cookbook-2nd-data/blob/master/'
                  'titanic_train.csv?raw=true')
        # print("param1:\n", param1)

        param2 = ('https://github.com/ipython-books'
                  '/cookbook-2nd-data/blob/master/'
```

```
                'titanic_test.csv?raw=true')
        # print("param2:\n", param2)
```

```
In [3]: # Commands.
        train = pd.read_csv(param1)
        test = pd.read_csv(param2)
        train[train.columns[[2, 4, 5, 1]]].head()
```

```
Out[3]:    Pclass     Sex   Age  Survived
        0       3    male  22.0         0
        1       1  female  38.0         1
        2       3  female  26.0         1
        3       1  female  35.0         1
        4       3    male  35.0         0
```

```
In [4]: print(len(train.columns))
        print(len(train))
        print(type(train))
        # Dataframe has 12 columns, 891 rows, and is a DataFrame type.
```

```
12
891
<class 'pandas.core.frame.DataFrame'>
```

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

```
Out[5]:    PassengerId  Survived  Pclass  \
        0            1         0       3
        1            2         1       1
        2            3         1       3
        3            4         1       1
        4            5         0       3

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

           Parch            Ticket     Fare Cabin Embarked
        0      0         A/5 21171   7.2500   NaN        S
        1      0          PC 17599  71.2833   C85        C
        2      0  STON/O2. 3101282   7.9250   NaN        S
        3      0            113803  53.1000  C123        S
        4      0            373450   8.0500   NaN        S
```

```
In [6]: # Descriptive statistics on training data.
        # Average, stdev, min, max, count, nas.
        train.describe()
```

```
Out[6]:        PassengerId    Survived      Pclass         Age       SibSp  \
        count   891.000000  891.000000  891.000000  714.000000  891.000000
        mean    446.000000    0.383838    2.308642   29.699118    0.523008
        std     257.353842    0.486592    0.836071   14.526497    1.102743
        min       1.000000    0.000000    1.000000    0.420000    0.000000
        25%     223.500000    0.000000    2.000000   20.125000    0.000000
        50%     446.000000    0.000000    3.000000   28.000000    0.000000
        75%     668.500000    1.000000    3.000000   38.000000    1.000000
        max     891.000000    1.000000    3.000000   80.000000    8.000000

                    Parch        Fare
        count  891.000000  891.000000
        mean     0.381594   32.204208
        std      0.806057   49.693429
        min      0.000000    0.000000
        25%      0.000000    7.910400
        50%      0.000000   14.454200
        75%      0.000000   31.000000
        max      6.000000  512.329200
```

1.0.3 Analysis - Train Data

There were 891 observations for all columns except age, which has some missing data. The count for age is 714. Fare paid varies wildly from 0.0 to 512.3292 units, possibly pounds. The 50th percentile fare was 14.4542 units, and was still in Pclass 3. Most passengers were classified as Pclass 3. The 25th percentile passenger is still classified as Pclass 2, with a fare of 7.9 units. Let's graph the fare information.

```
In [7]: # Select fields for fare, pclass, survived, sex.
        data = train[['Survived', 'Fare', 'Pclass', 'Sex']]
        data.head()
```

```
Out[7]:    Survived     Fare  Pclass     Sex
        0         0   7.2500       3    male
        1         1  71.2833       1  female
        2         1   7.9250       3  female
        3         1  53.1000       1  female
        4         0   8.0500       3    male
```

```
In [8]: y = data[['Survived']]
        x1 = data[['Fare']]
        x2 = data[['Pclass']]
```

1.0.4 Do more plots

```
In [9]: # Matplotlib Subplots -- different source
```

```
In [10]: # Select fields, convert sex field to binary, remove rows with NaN values.
         data = train[['Age', 'Pclass', 'Survived']]
```

```
        print(data.head())
        # Add a female binary sex column.
        data = data.assign(Female = train['Sex'] == 'female')
        print(data.head())
        # Reorder the columns.
        data = data[['Female', 'Age', 'Pclass', 'Survived']]
        # Drop rows with NaN, missing values.
        data = data.dropna()
        print("\nRows remaining in training data:", len(data))
        data.head()
```

```
    Age  Pclass  Survived
0  22.0       3         0
1  38.0       1         1
2  26.0       3         1
3  35.0       1         1
4  35.0       3         0
    Age  Pclass  Survived  Female
0  22.0       3         0   False
1  38.0       1         1    True
2  26.0       3         1    True
3  35.0       1         1    True
4  35.0       3         0   False

Rows remaining in training data: 714
```

```
Out[10]:    Female   Age  Pclass  Survived
        0   False  22.0       3         0
        1    True  38.0       1         1
        2    True  26.0       3         1
        3    True  35.0       1         1
        4   False  35.0       3         0
```

```
In [11]: # Convert data object from Pandas DataFrame to NumPy array inorder to use it in Sciki
        datanp = data.astype(np.int32).values
        X = datanp[:, :-1]  # Selects all columns except last column. Capital X.
        Y = datanp[:, -1]   # Selects last column only. Capital Y.
        print("X 2d array, 'Female, Age, Pclass': \n", X[0:5])
        print("Y 1d array, 'Survived': \n", Y[0:5])
```

```
X 2d array, 'Female, Age, Pclass':
 [[ 0 22  3]
 [ 1 38  1]
 [ 1 26  3]
 [ 1 35  1]
 [ 0 35  3]]
Y 1d array, 'Survived':
 [0 1 1 1 0]
```

```
In [12]: # Check that the number of rows is unchanged from before conversion.
         len(datanp)
```

```
Out[12]: 714
```

1.0.5 Male & Female Survivors

```
In [13]: # We define a few boolean vectors.
         # The first column is 'Female'.
         female = X[:, 0] == 1

         # The last column is 'Survived'.
         survived = Y == 1

         # This vector contains the age of the passengers.
         age = X[:, 1]
```

```
In [14]: print(female[0:5])
         print(survived[0:5])
         print(age[0:5])
         len(survived)
```

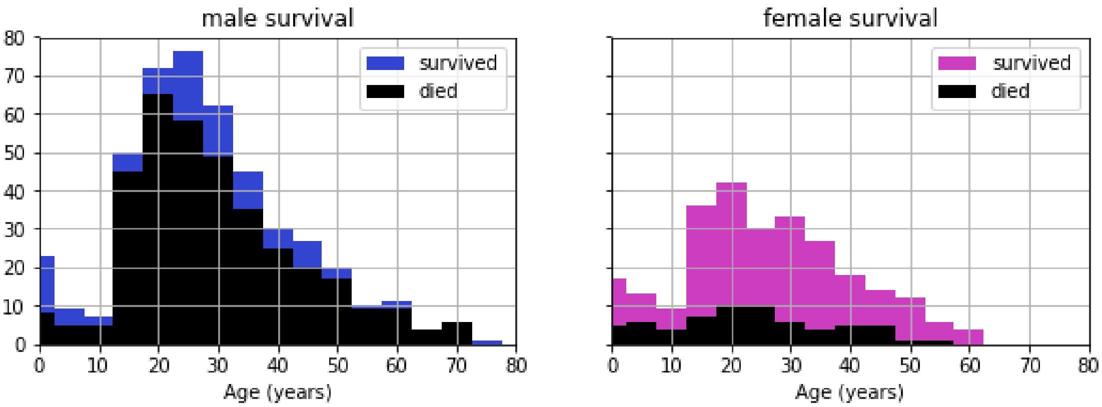
```
[False  True  True  True False]
[False  True  True  True False]
[22 38 26 35 35]
```

```
Out[14]: 714
```

```
In [15]: # We compute a few histograms.
         bins_ = np.arange(0, 81, 5)
         S = {'male': np.histogram(age[survived & ~female],
                                   bins=bins_)[0],
              'female': np.histogram(age[survived & female],
                                     bins=bins_)[0]}
         D = {'male': np.histogram(age[~survived & ~female],
                                   bins=bins_)[0],
              'female': np.histogram(age[~survived & female],
                                     bins=bins_)[0]}
```

```
In [16]: # We now plot the data.
         bins = bins_[:-1]
         fig, axes = plt.subplots(1, 2, figsize=(10, 3),
                                  sharey=True)
         for ax, sex, color in zip(axes, ('male', 'female'),
                                   ('#3345d0', '#cc3dc0')):
```

```
    ax.bar(bins, S[sex], bottom=D[sex], color=color,
           width=5, label='survived')
    ax.bar(bins, D[sex], color='k',
           width=5, label='died')
    ax.set_xlim(0, 80)
    ax.set_xlabel("Age (years)")
    ax.set_title(sex + " survival")
    ax.grid(None)
    ax.legend()
```



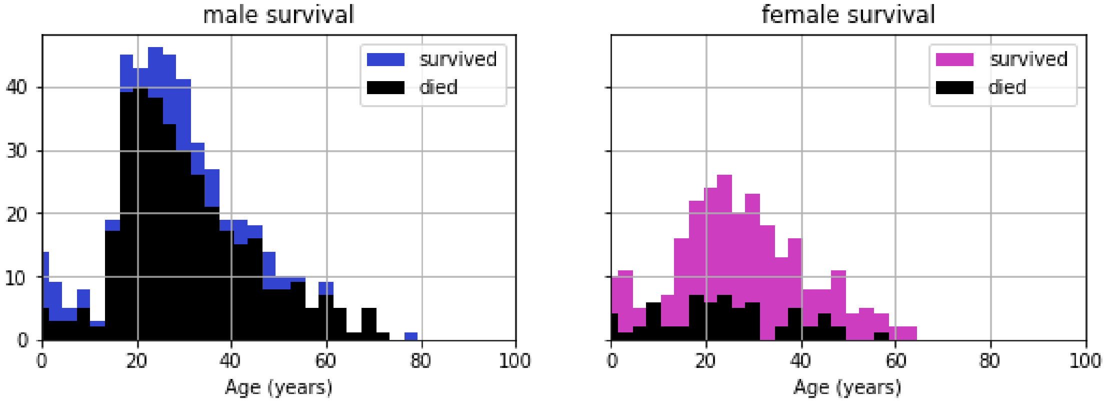
In [17]:

```
# Try different bins.
binsp = np.arange(0, 100, 3)
S = {'male': np.histogram(age[survived & ~female],
                          bins=binsp)[0],
     'female': np.histogram(age[survived & female],
                            bins=binsp)[0]}
D = {'male': np.histogram(age[~survived & ~female],
                          bins=binsp)[0],
     'female': np.histogram(age[~survived & female],
                            bins=binsp)[0]}
```

In [18]:

```
# We now plot the data.
bins = binsp[:-1]
fig, axes = plt.subplots(1, 2, figsize=(10, 3),
                         sharey=True)
for ax, sex, color in zip(axes, ('male', 'female'),
                          ('#3345d0', '#cc3dc0')):
    ax.bar(bins, S[sex], bottom=D[sex], color=color,
           width=3, label='survived')
    ax.bar(bins, D[sex], color='k',
           width=3, label='died')
```

```
ax.set_xlim(0, 100)
ax.set_xlabel("Age (years)")
ax.set_title(sex + " survival")
ax.grid(None)
ax.legend()
```



1.0.6 Analysis - Male and Female Histograms

These histograms seem to indicate that higher percentage of female passengers survived than male passengers. Also note that there were greater number of male passengers than female passengers on borad across most age groups. Also there were no female passengers past mid 60's, where as male passenger age went up to 81 years. Since it may be reasonable to assume that the ratio of female to male in the greater population was close to 1 to 1, the over representation of male passengers, almost 2 to 1 male to female, may indicate some non-randomness in the sex selection of passengers.

Titanic was a luxury, state-of-the-art ship and a cross-Atlantic voage at a time when these features were highly unusual. It would be interesting to study more common boating trips in local areas during the same time period, and see if those trips also exhibited higher female survival rates.

1.1 Continued in Part 2

```
In [19]: # Additional EDA, min/max, std.  Other features summary statistics.
```