Haberman'sSurvivalExercise

March 21, 2018

1 Exercise

1.0.1 Haberman's Survival

Survival of patients who had undergone surgery for breast cancer

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

```
In [2]: patients = pd.read_csv('haberman.csv')

        patients.shape
```

```
Out[2]: (306, 4)
```

Observation: There are total 305 data points There are 3 Features/dimensions
Columns Information:
1)Age of patient at time of operation (numerical) 2)Patient's year of operation (year - 1900, numerical) 3)Number of positive axillary nodes detected (numerical) 4)Survival status (class attribute) 1 = the patient survived 5 years or longer 2 = the patient died within 5 year

```
In [3]: patients.head()
```

```
Out[3]:    Age  Year  No.of Pos Axillary nodes  Survival Status
        0   30    64                         1                1
        1   30    62                         3                1
        2   30    65                         0                1
        3   31    59                         2                1
        4   31    65                         4                1
```

```
In [4]: patients.describe()
```

```
Out[4]:               Age        Year  No.of Pos Axillary nodes  Survival Status
        count  306.000000  306.000000                306.000000       306.000000
        mean    52.457516   62.852941                  4.026144         1.264706
        std     10.803452    3.249405                  7.189654         0.441899
        min     30.000000   58.000000                  0.000000         1.000000
```

25%	44.000000	60.000000	0.000000	1.000000
50%	52.000000	63.000000	1.000000	1.000000
75%	60.750000	65.750000	4.000000	2.000000
max	83.000000	69.000000	52.000000	2.000000

Observation: The Average age is 30

In [5]:
```
# getting survival status count of 2 groups

patients.get('Survival Status').value_counts()
```

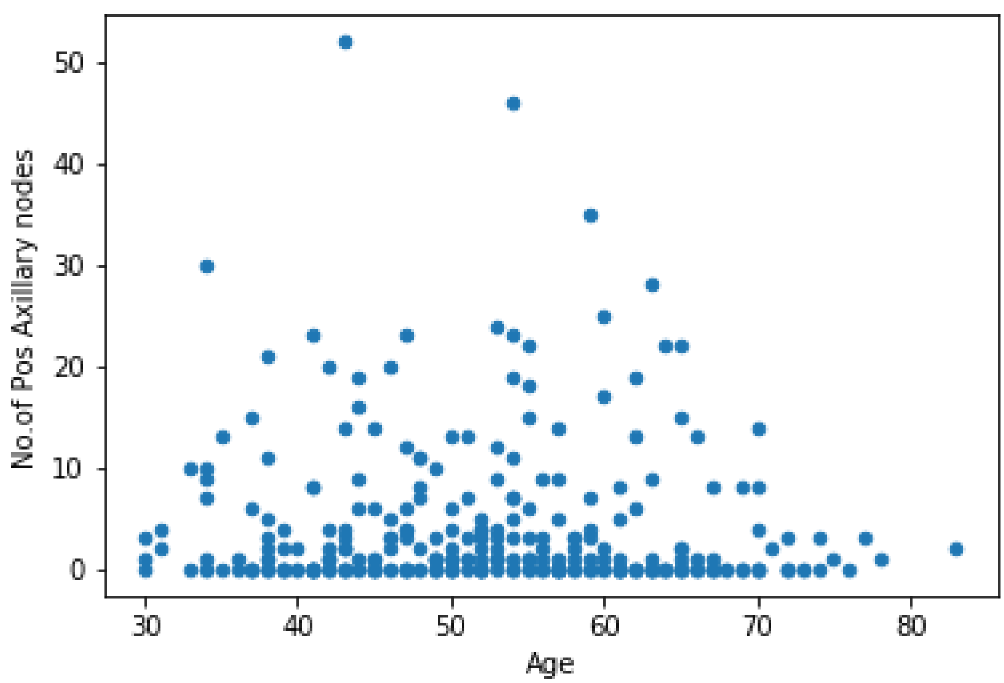
Out[5]:
```
1    225
2     81
Name: Survival Status, dtype: int64
```

Observation: Survived: 225 out of 305 Dead with in 5 years: 81 out of 305
Its Imbalanced Data Set.

1.1 BiVariant Analysis

1.1.1 2D Scatter Plot

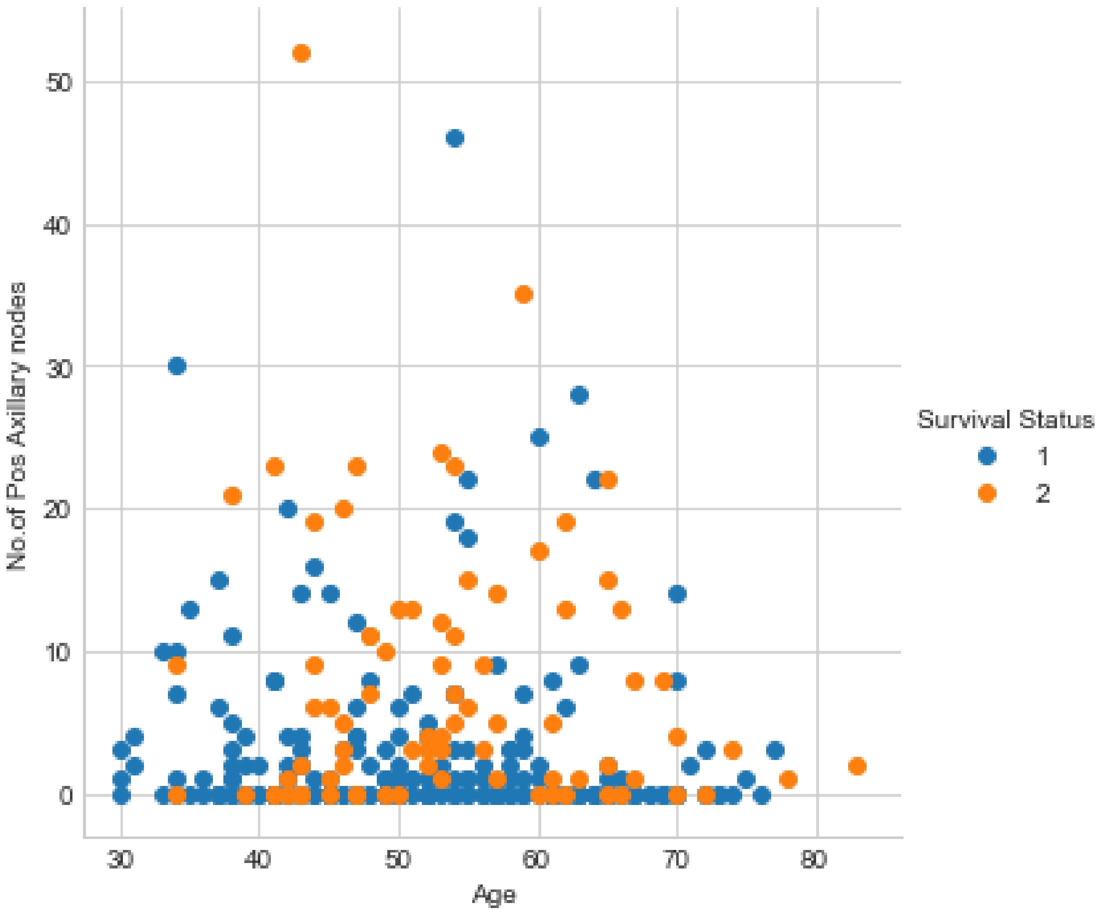
In [6]:
```
patients.plot(y='No.of Pos Axillary nodes', x='Age',kind='scatter');
plt.show()
```



Observation:
For Most of the Patients The No.of axillary nodes is '0'

```
In [7]: sns.set_style("whitegrid")

        sns.FacetGrid(patients,hue='Survival Status',size=5) \
            .map(plt.scatter,'Age','No.of Pos Axillary nodes') \
            .add_legend()
        plt.show()
```

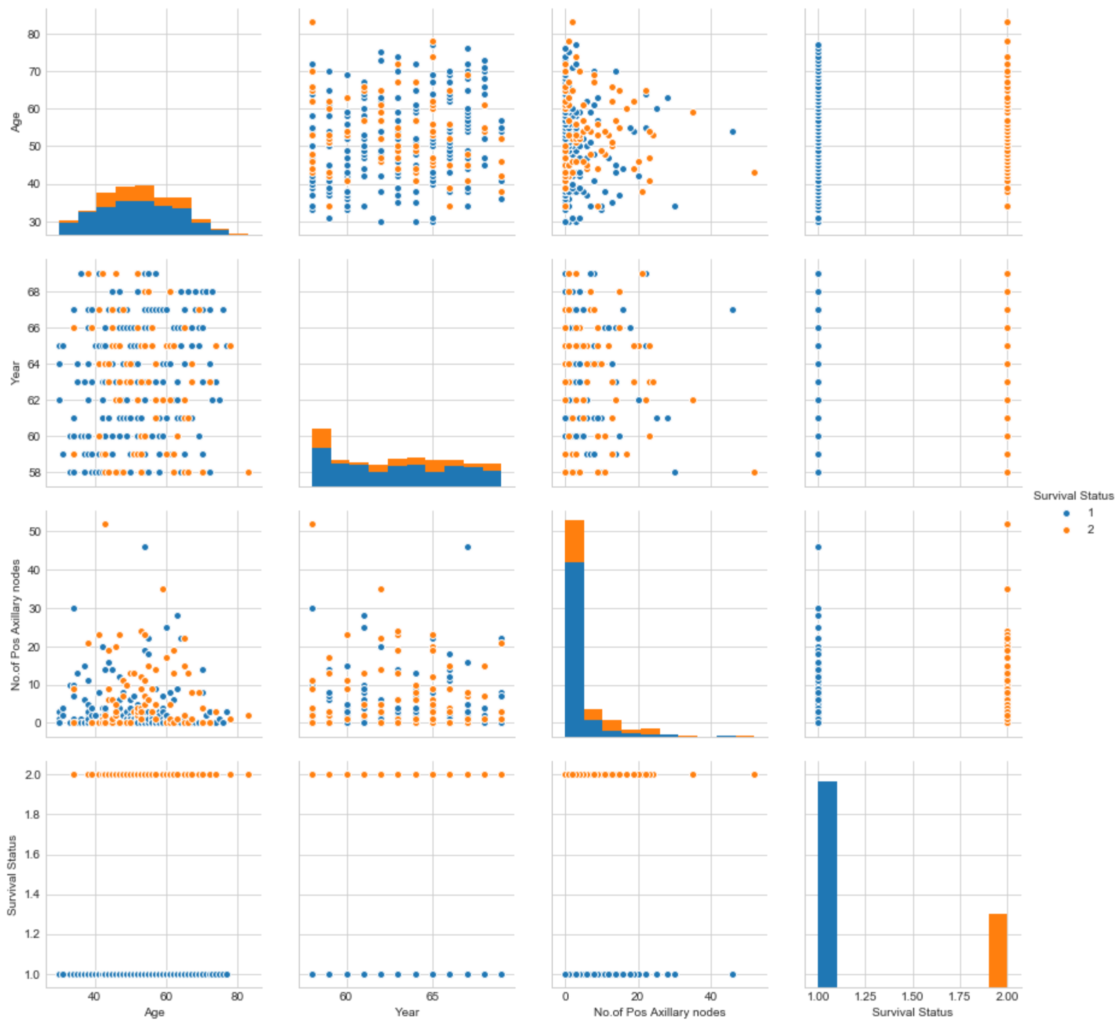


Observation: We cant classify through this features with this type of plot.

1.1.2 PairPlot

```
In [12]: sns.set_style("whitegrid");

         sns.pairplot(patients,hue='Survival Status',size=3,vars=["Age", "Year","No.of Pos Axi
         plt.show()
```

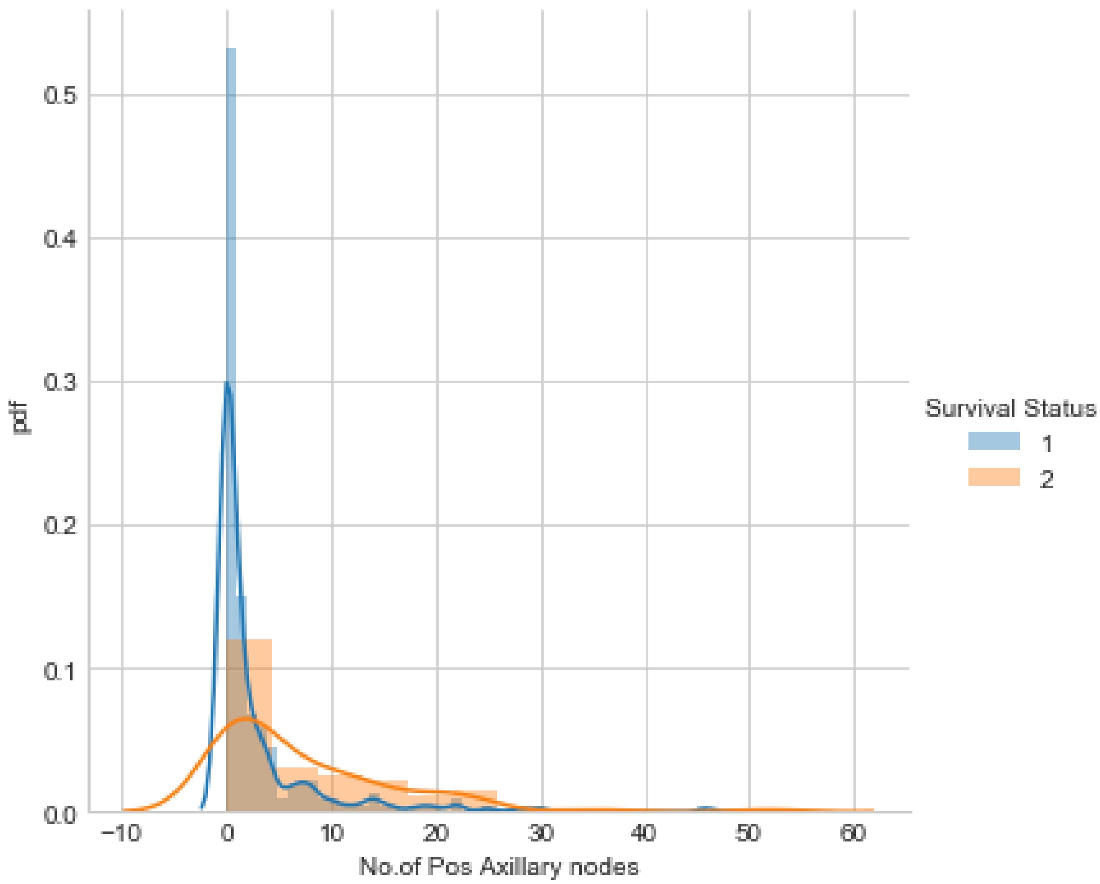


Note: Without Considering Survival statues column there are 3 cols-> 3C2 plots ->3 plots
With this 3 plots its difficult to classify the survival status.

1.2 Univariant Analysis

1.2.1 PDF

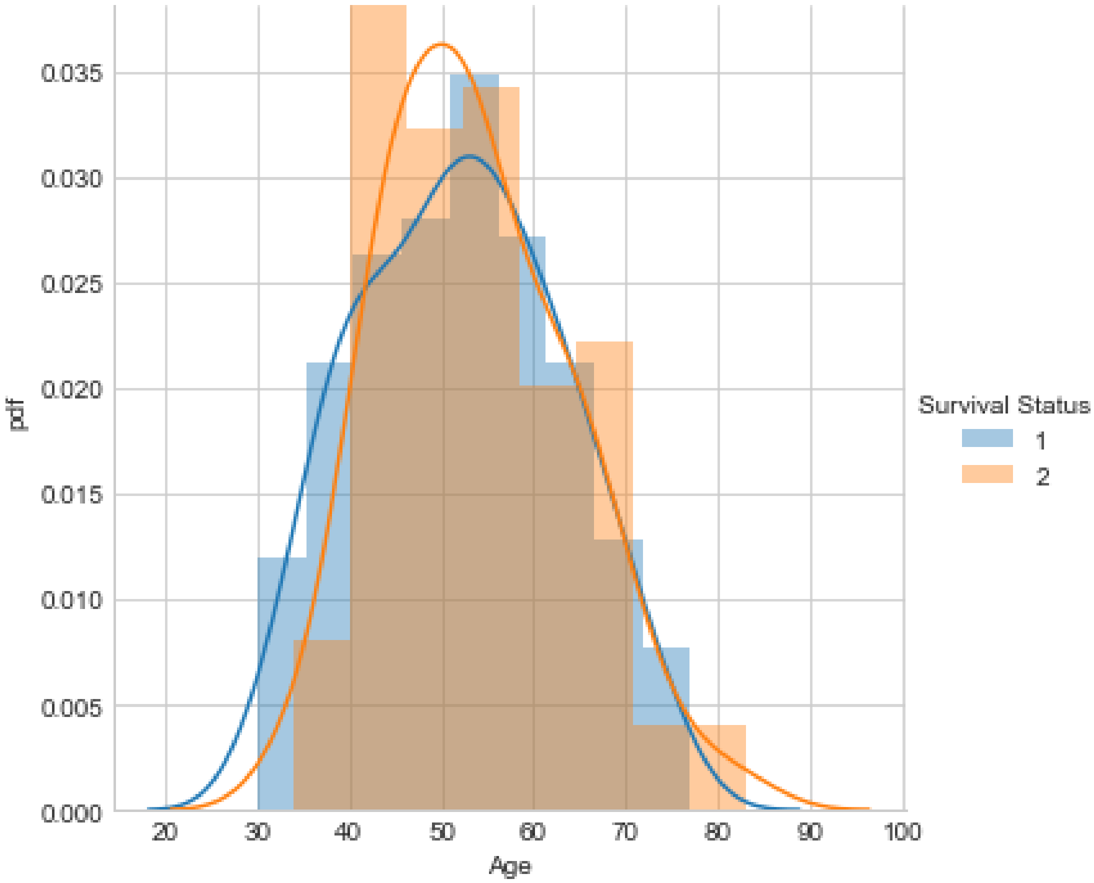
In [10]:
```
sns.FacetGrid(patients, hue="Survival Status", size=5) \
    .map(sns.distplot, "No.of Pos Axillary nodes") \
    .add_legend();
plt.ylabel('pdf')
plt.show();
```



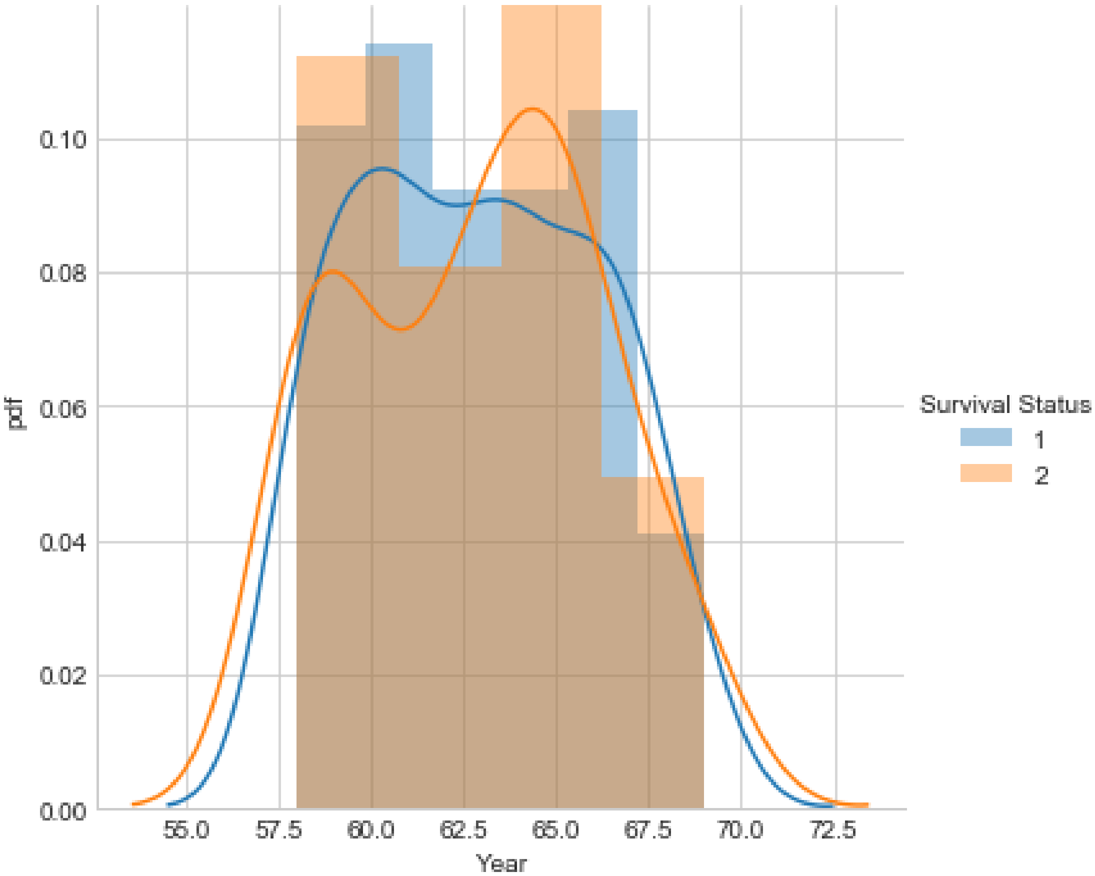
Observation: Spread is more for status 1 than status 2

More no.of patients of status 1 has less no.of Axillary Nodes That may indicate a inverse relation between Axillary nodes and Survival Status

```
In [11]: sns.FacetGrid(patients, hue="Survival Status", size=5) \
            .map(sns.distplot, "Age") \
            .add_legend();
         plt.ylabel('pdf')
         plt.show();
```




```
In [12]: sns.FacetGrid(patients, hue="Survival Status", size=5) \
            .map(sns.distplot, "Year") \
            .add_legend();
         plt.ylabel('pdf')
         plt.show();
```



In [13]:
```
status_1= patients[patients['Survival Status']==1]
status_1.head()
```

Out[13]:

	Age	Year	No.of Pos Axillary nodes	Survival Status
0	30	64	1	1
1	30	62	3	1
2	30	65	0	1
3	31	59	2	1
4	31	65	4	1

In [14]:
```
status_2= patients[patients['Survival Status']==2]
status_2.head()
```

Out[14]:

	Age	Year	No.of Pos Axillary nodes	Survival Status
7	34	59	0	2
8	34	66	9	2
24	38	69	21	2
34	39	66	0	2
43	41	60	23	2

```
In [15]: status_1.describe()
```

```
Out[15]:               Age        Year  No.of Pos Axillary nodes  Survival Status
         count  225.000000  225.000000                225.000000            225.0
         mean    52.017778   62.862222                  2.791111              1.0
         std     11.012154    3.222915                  5.870318              0.0
         min     30.000000   58.000000                  0.000000              1.0
         25%     43.000000   60.000000                  0.000000              1.0
         50%     52.000000   63.000000                  0.000000              1.0
         75%     60.000000   66.000000                  3.000000              1.0
         max     77.000000   69.000000                 46.000000              1.0
```

```
In [16]: status_2.describe()
```

```
Out[16]:              Age       Year  No.of Pos Axillary nodes  Survival Status
         count  81.000000  81.000000                 81.000000             81.0
         mean   53.679012  62.827160                  7.456790              2.0
         std    10.167137   3.342118                  9.185654              0.0
         min    34.000000  58.000000                  0.000000              2.0
         25%    46.000000  59.000000                  1.000000              2.0
         50%    53.000000  63.000000                  4.000000              2.0
         75%    61.000000  65.000000                 11.000000              2.0
         max    83.000000  69.000000                 52.000000              2.0
```

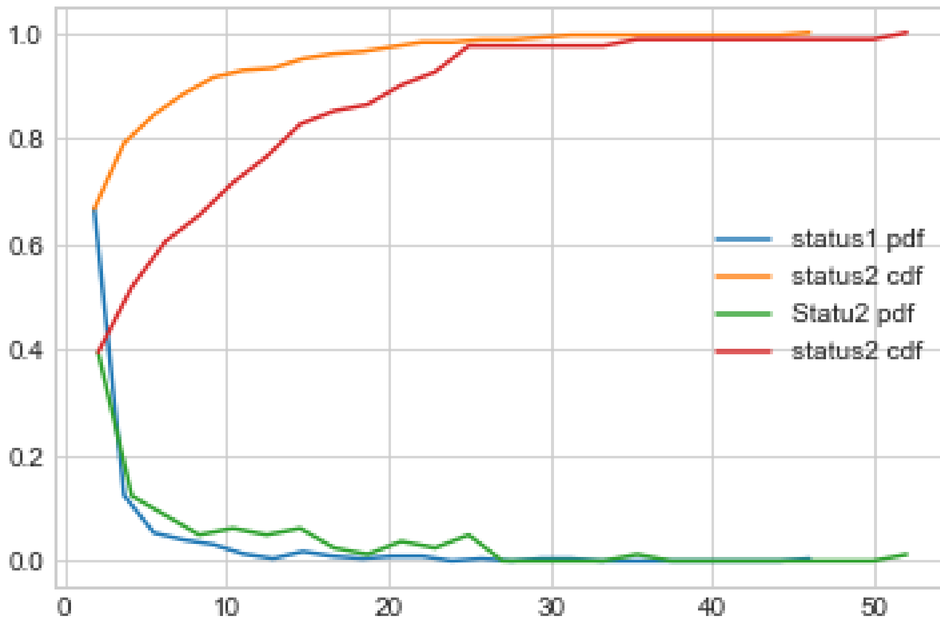
Observation: Status 1: Mean of no.of axillary nodes -> 2.8~ std -> 5.9~ Status 2: Mean of no.of axillary nodes -> 7.5~ std -> 9.1~

That Implies More no.of Axillary nodes patients may tend to die with in 5 years of operation

1.2.2 PDF CDF

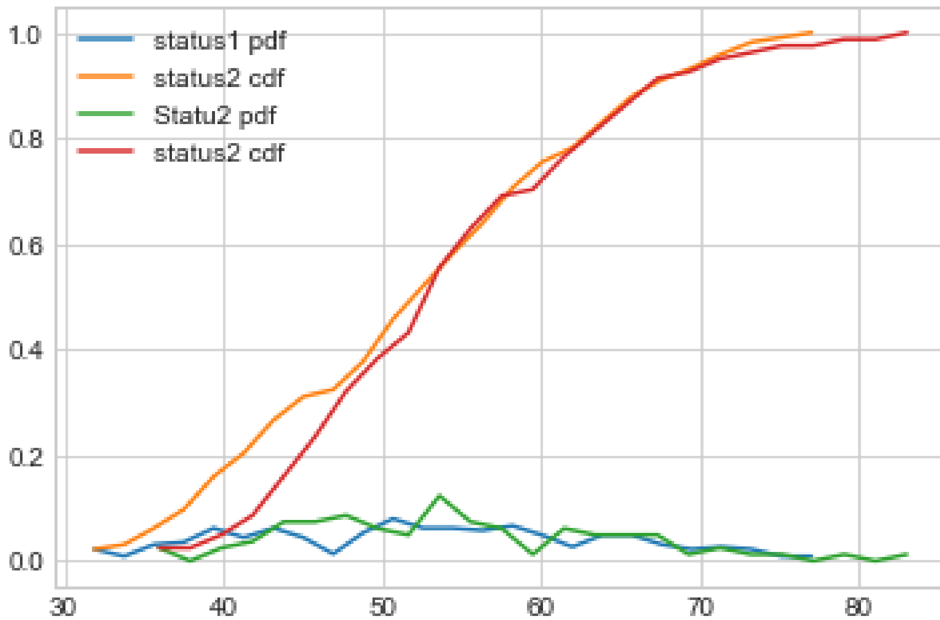
```
In [17]: counts, bin_edges = np.histogram(status_1['No.of Pos Axillary nodes'], bins=25,
                                          density = True)
         pdf = counts/(sum(counts))
         cdf = np.cumsum(pdf)
         plt.plot(bin_edges[1:],pdf,label='status1 pdf');
         plt.plot(bin_edges[1:], cdf,label='status2 cdf')


         counts, bin_edges = np.histogram(status_2['No.of Pos Axillary nodes'], bins=25,
                                          density = True)
         pdf = counts/(sum(counts))
         cdf = np.cumsum(pdf)
         plt.plot(bin_edges[1:],pdf,label='Statu2 pdf');
         plt.plot(bin_edges[1:], cdf,label='status2 cdf')
         plt.legend()
         plt.show()
```



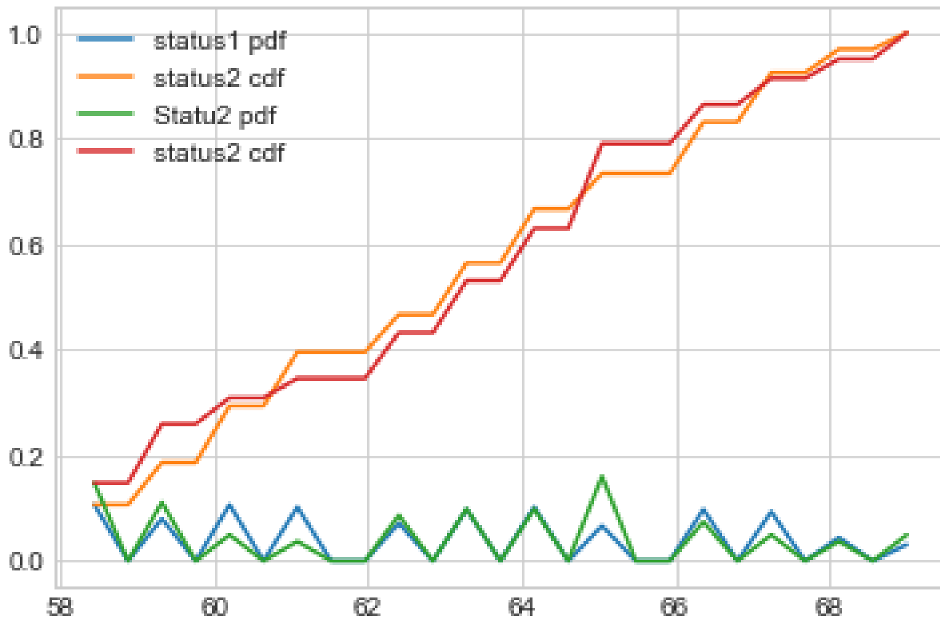

```
In [18]: counts, bin_edges = np.histogram(status_1['Age'], bins=25,
                                          density = True)
         pdf = counts/(sum(counts))
         cdf = np.cumsum(pdf)
         plt.plot(bin_edges[1:],pdf,label='status1 pdf');
         plt.plot(bin_edges[1:], cdf,label='status2 cdf')


         counts, bin_edges = np.histogram(status_2['Age'], bins=25,
                                          density = True)
         pdf = counts/(sum(counts))
         cdf = np.cumsum(pdf)
         plt.plot(bin_edges[1:],pdf,label='Statu2 pdf');
         plt.plot(bin_edges[1:], cdf,label='status2 cdf')
         plt.legend()
         plt.show()
```



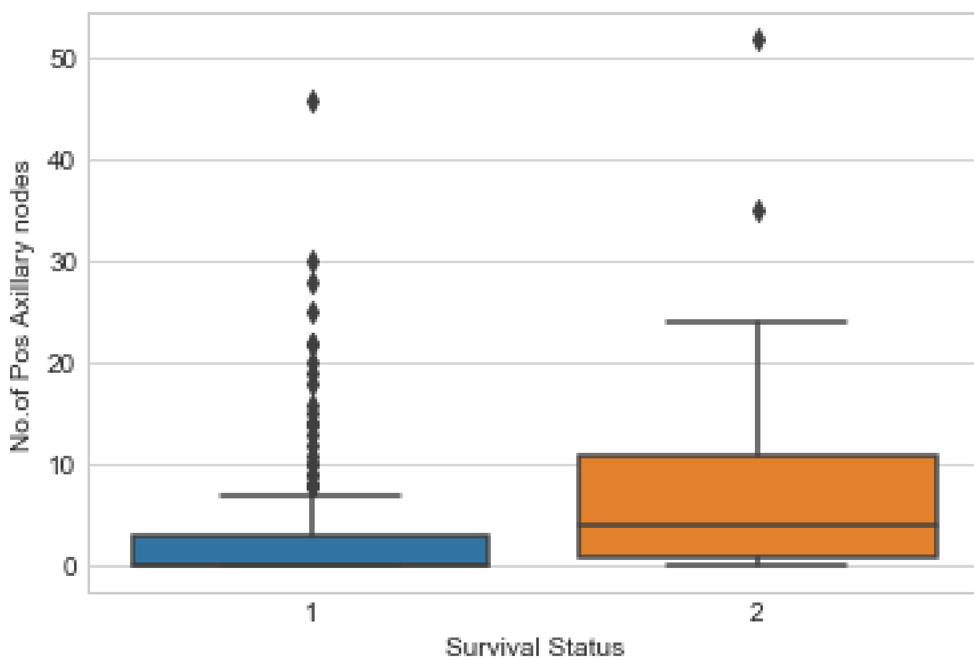
In [19]:
```
counts, bin_edges = np.histogram(status_1['Year'], bins=25,
                                 density = True)
pdf = counts/(sum(counts))
cdf = np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf,label='status1 pdf');
plt.plot(bin_edges[1:], cdf,label='status2 cdf')


counts, bin_edges = np.histogram(status_2['Year'], bins=25,
                                 density = True)
pdf = counts/(sum(counts))
cdf = np.cumsum(pdf)
plt.plot(bin_edges[1:],pdf,label='Statu2 pdf');
plt.plot(bin_edges[1:], cdf,label='status2 cdf')
plt.legend()
plt.show()
```



1.2.3 Box Plot

```
In [20]: sns.boxplot(x='Survival Status',y='No.of Pos Axillary nodes', data=patients)
         plt.show()
```

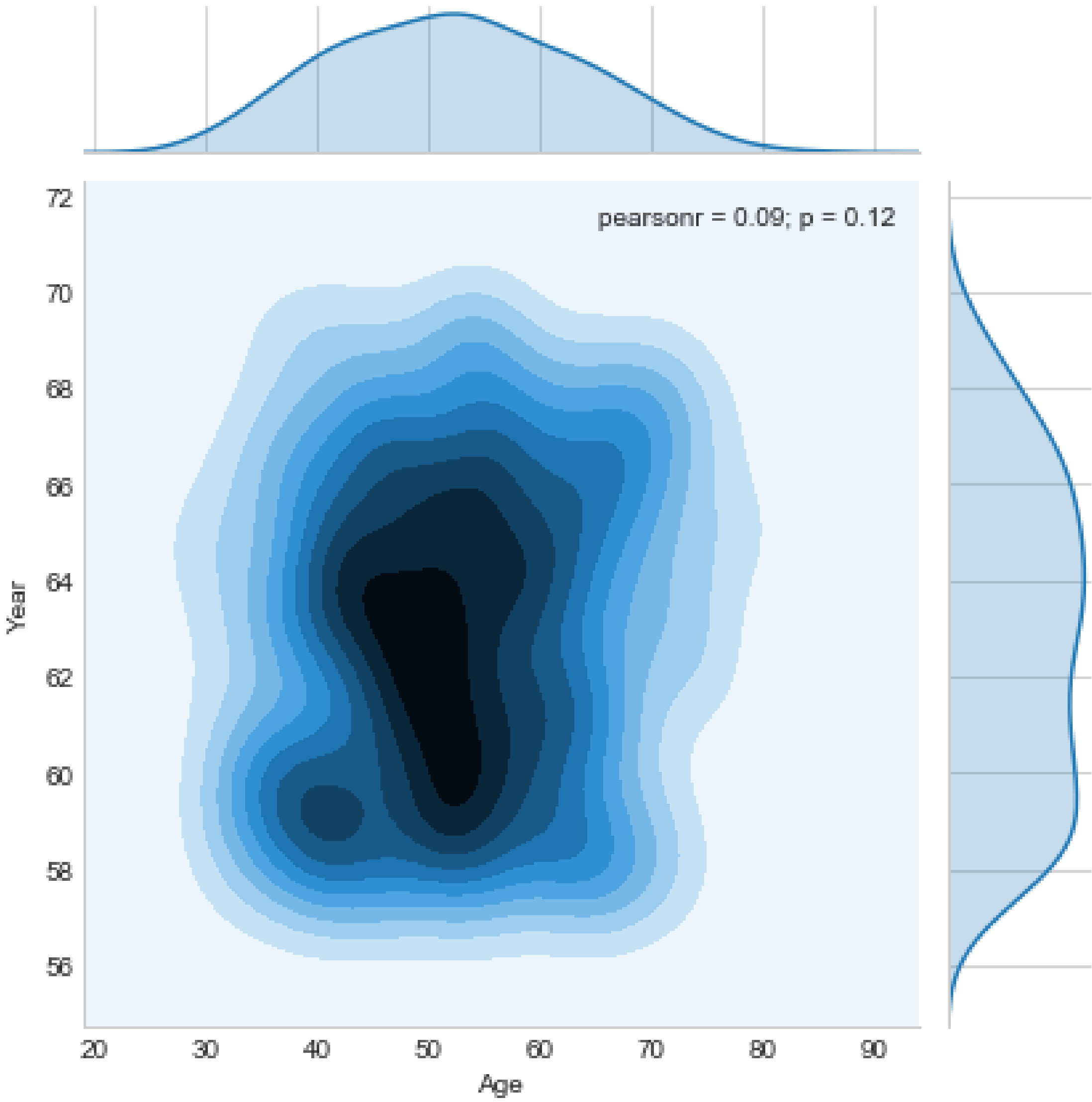


Observation:

Status1 -> About 50 percentile people has Axillary nodes 0 and 75 percentile have about 3~ axillary nodes. status2 -> About 50 percentile people has Axillary nodes more than 4~ and 25percentile patients have 1-3 nodes.

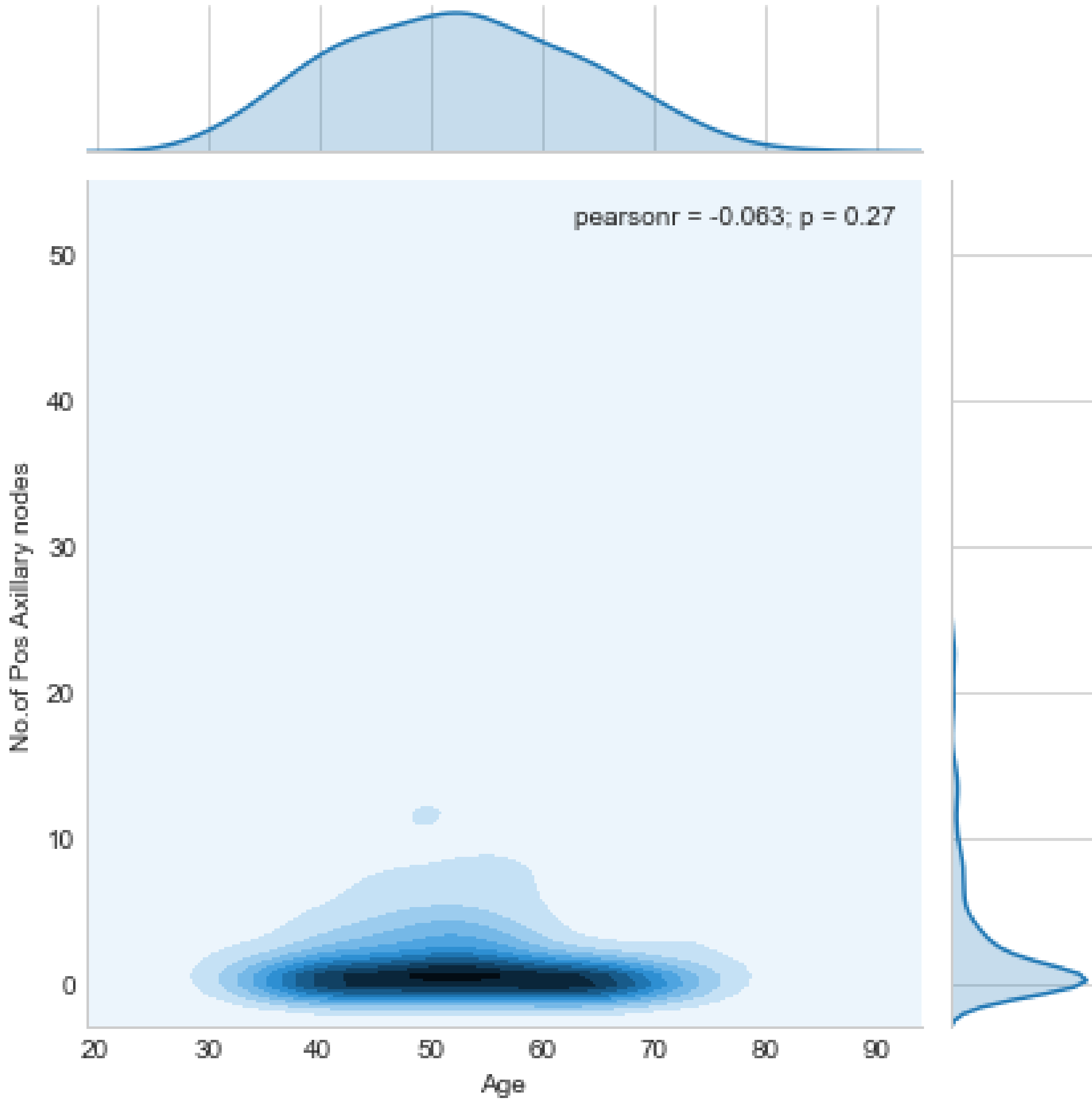
1.2.4 Violin Plot

```
In [21]: sns.violinplot(x='Survival Status',y='No.of Pos Axillary nodes', data=patients,size=8)
         plt.show()
```



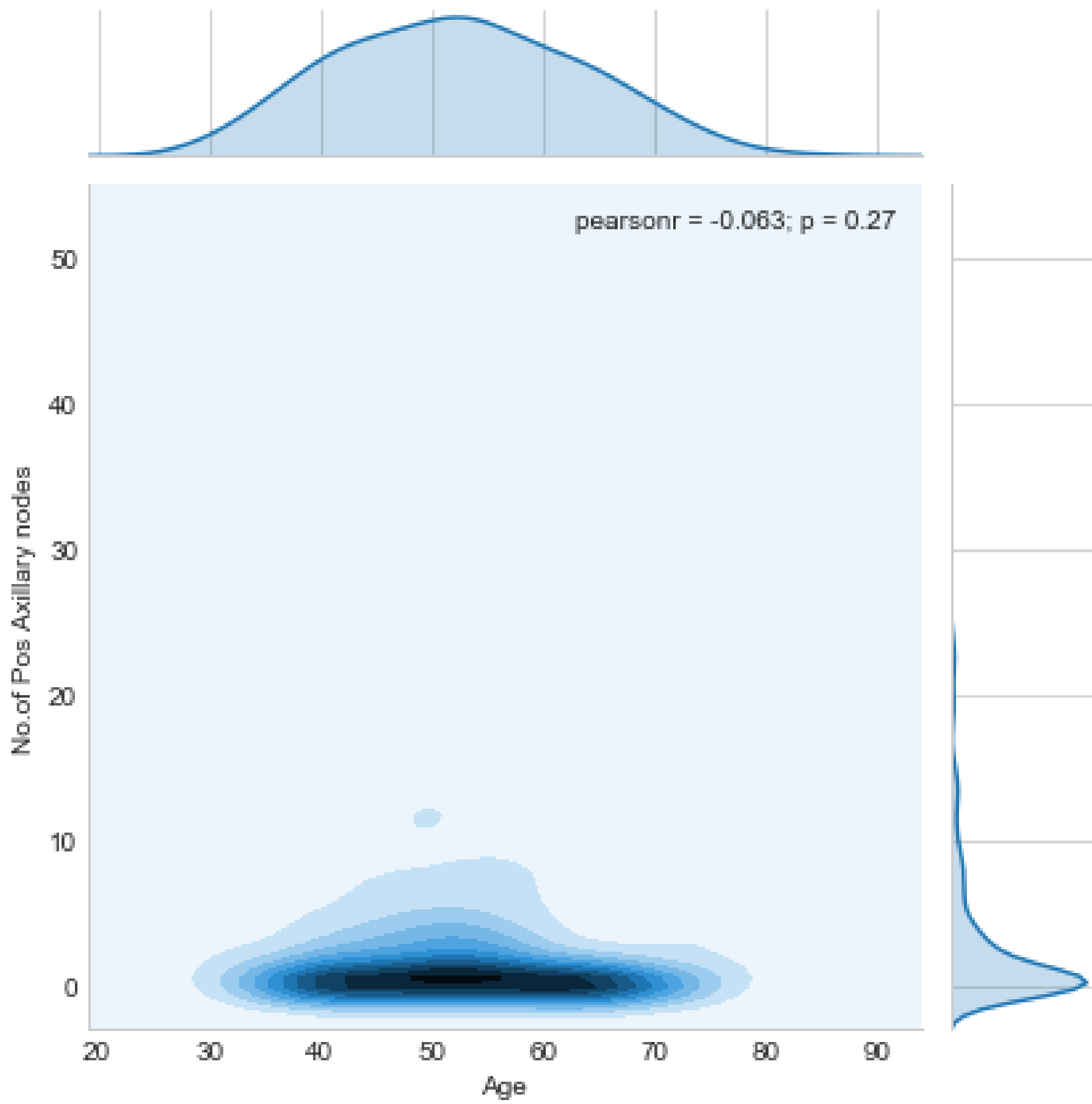
1.3 MultiVariant Analysis

```
In [22]: sns.jointplot(x= 'Age',kind = 'kde', y='Year', data = patients)
         plt.show()
```



There are more number of patients undergone operation during the year 1960 - 1964 period and between ages 45 - 55

```
In [13]: sns.jointplot(x= 'Age',kind = 'kde', y='No.of Pos Axillary nodes', data = patients)
         plt.show()
```



Conclusion: From PDF,Box plot and Means of no.of axillary nodes, It is evident that if there are more no.of axillary nodes the patient may tend to die with in 5 years of operation.