haberman

March 6, 2019

1 EDA on Haberman Cancer Survival DataSet

1.1 Dataset Description :

The dataset contains cases from a study that was conducted between 1958 and 1970 at the University of Chicago's Billings Hospital on the survival of patients who had undergone surgery for breast cancer.

- Number of Instances : 306
- Number of Attributes : 4 (including the class attribute)

1.1.1 Attribute Information :

- Age of patient at time of operation (numerical).
- Patient's year of operation (year - 1900, numerical).
- Number of positive auxiliary nodes detected (numerical).
- Survival status (class attribute) 1 = the patient survived 5 years or longer 2 = the patient died within 5 year
- Missing Attribute Values : None

In [1]:
```
# importing relevant packages
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import numpy as np
import warnings
warnings.filterwarnings("ignore")
```

In [2]:
```
#Loading haberman cancer survival dataset dataset
habe = pd.read_csv("haberman.csv", header=None, names=['age', 'year_of_treat', '+ve_aux_nodes', 'su
```

In [3]:
```
# since class attribute is numerical datatype, we'll have to convert it to categoery type

habe['survival_stat_after_5_years'] = habe['survival_stat_after_5_years'].astype('category')
```

In [4]:
```
habe.head()
```

Out[4]:

	age	year_of_treat	+ve_aux_nodes	survival_stat_after_5_years
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 [5]: habe.info()

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 306 entries, 0 to 305
Data columns (total 4 columns):
age                          306 non-null int64
year_of_treat                306 non-null int64
+ve_aux_nodes                306 non-null int64
survival_stat_after_5_years  306 non-null category
dtypes: category(1), int64(3)
memory usage: 7.6 KB
```

In [6]:
```
# mapping 'yes' to class attribute 1 and 'no' to class attribute 2.
# here class attribute is survival_stat_after_5_years.

habe['survival_stat_after_5_years'] = habe['survival_stat_after_5_years'].map({1:"yes", 2:"no"})
```

In [7]: habe.head()

Out[7]:

	age	year_of_treat	+ve_aux_nodes	survival_stat_after_5_years
0	30	64	1	yes
1	30	62	3	yes
2	30	65	0	yes
3	31	59	2	yes
4	31	65	4	yes

2 Observations of whole dataset (numerically) :

In [8]: habe.describe()

Out[8]:

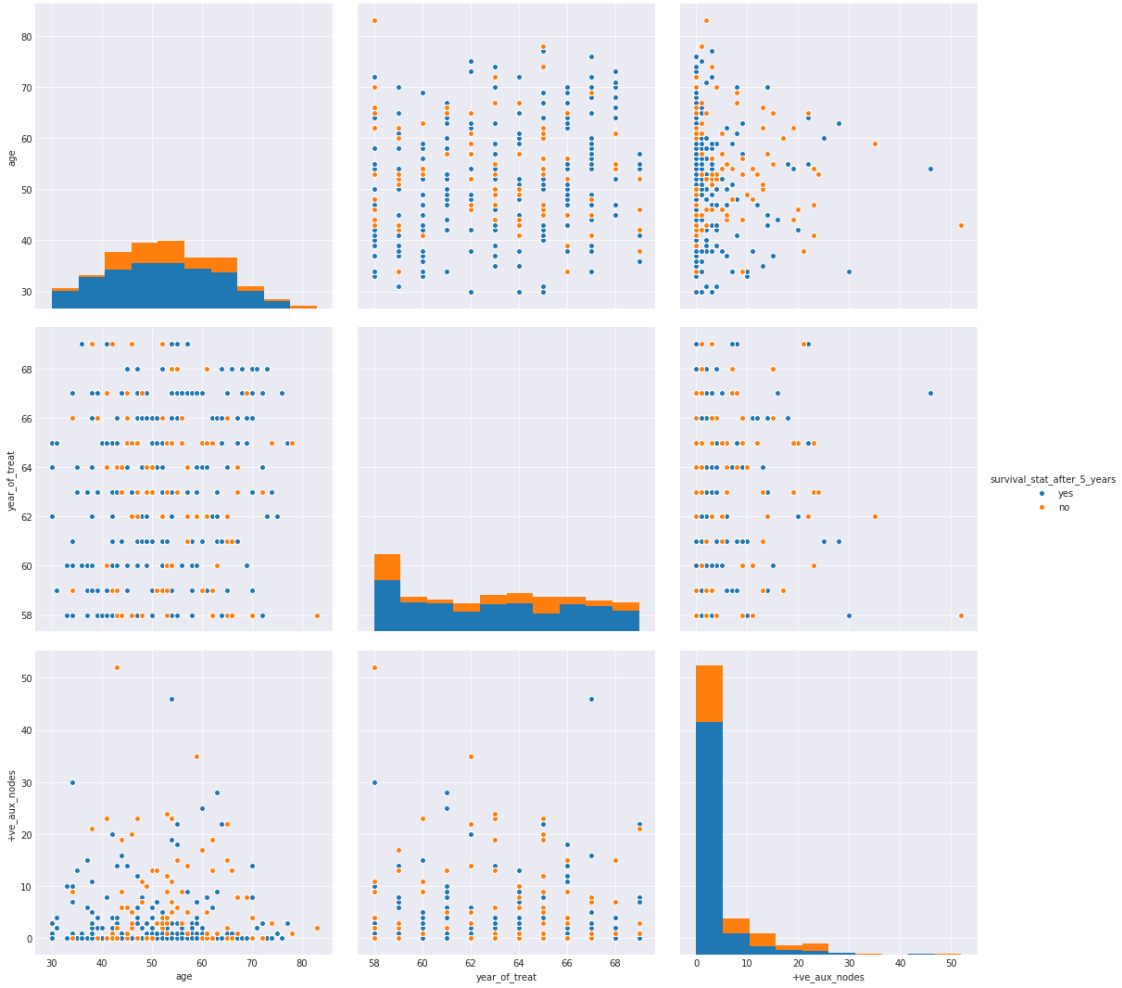
	age	year_of_treat	+ve_aux_nodes
count	306.000000	306.000000	306.000000
mean	52.457516	62.852941	4.026144
std	10.803452	3.249405	7.189654
min	30.000000	58.000000	0.000000
25%	44.000000	60.000000	0.000000
50%	52.000000	63.000000	1.000000
75%	60.750000	65.750000	4.000000
max	83.000000	69.000000	52.000000

3 Multivariate analysis :

3.1 Pair Plots

In [9]: #Plotting Pair Plots all at once

```
plt.close();
sns.set_style('darkgrid');
sns.pairplot(habe, hue = 'survival_stat_after_5_years', size = 5)
plt.show()
```



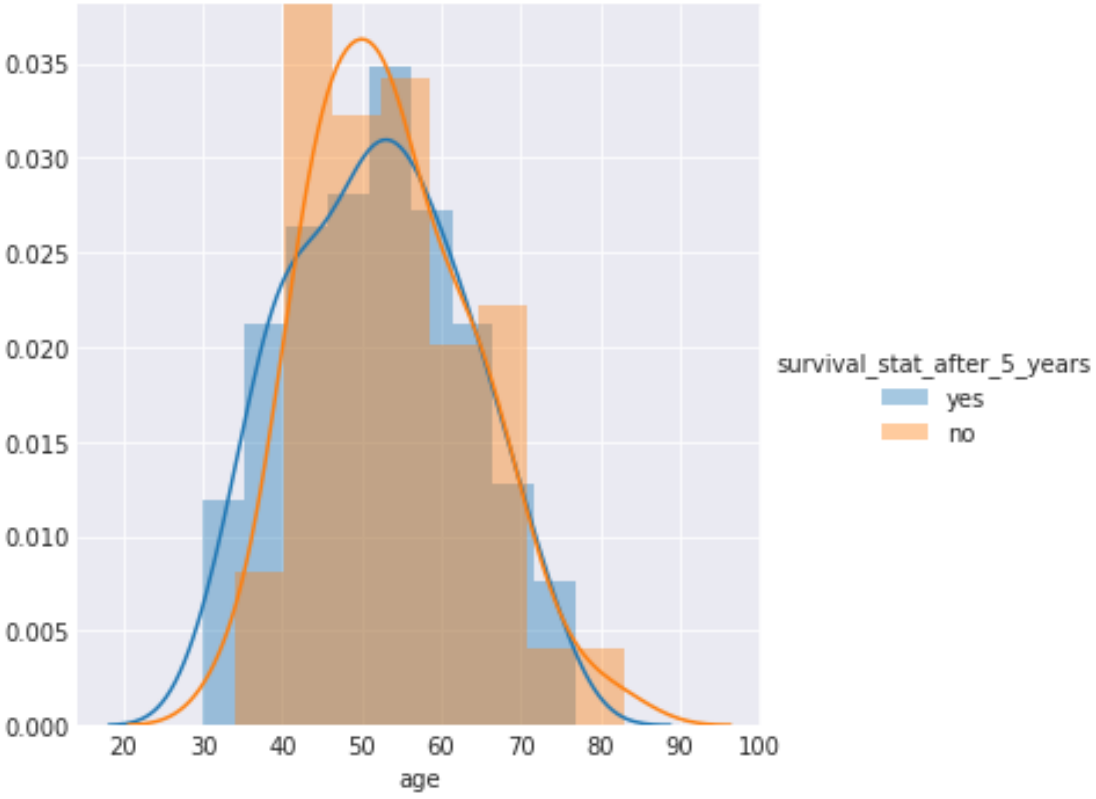
4 Observations

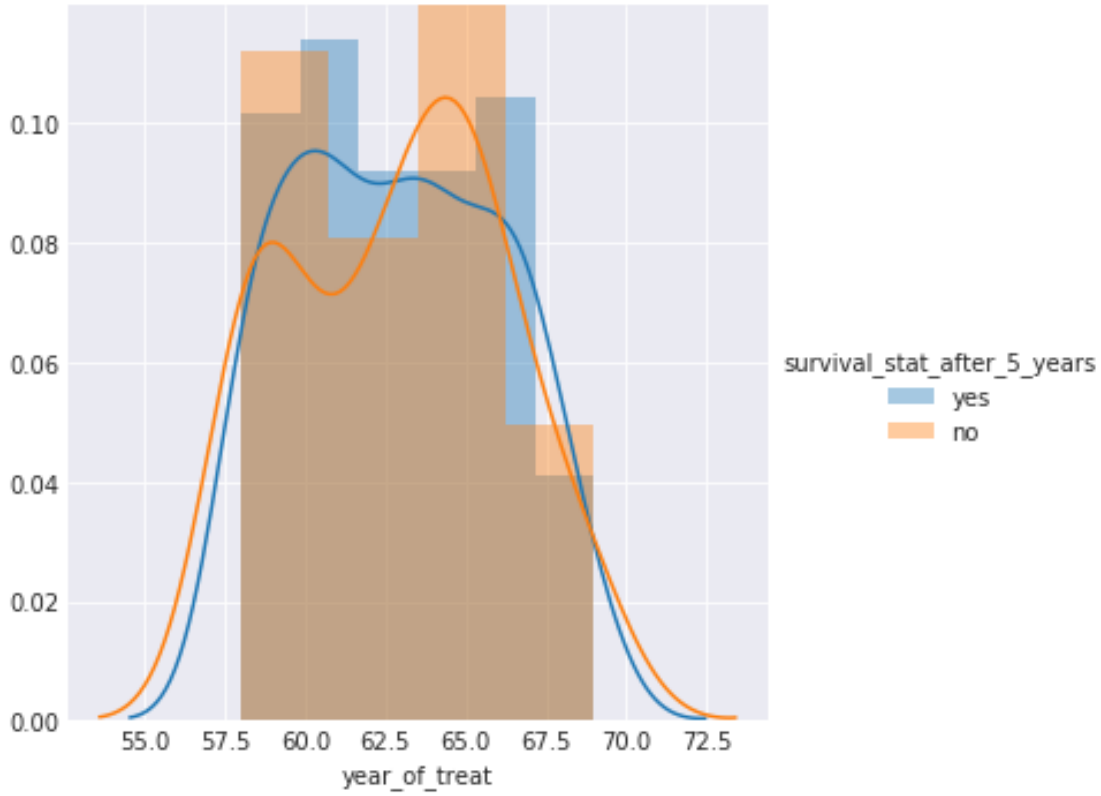
- when we see plot between age vs +ve_aux_nodes, probability of patients survived in the age group (30 - 40) is very high.
- other plots are not that much useful, since they are crowded.

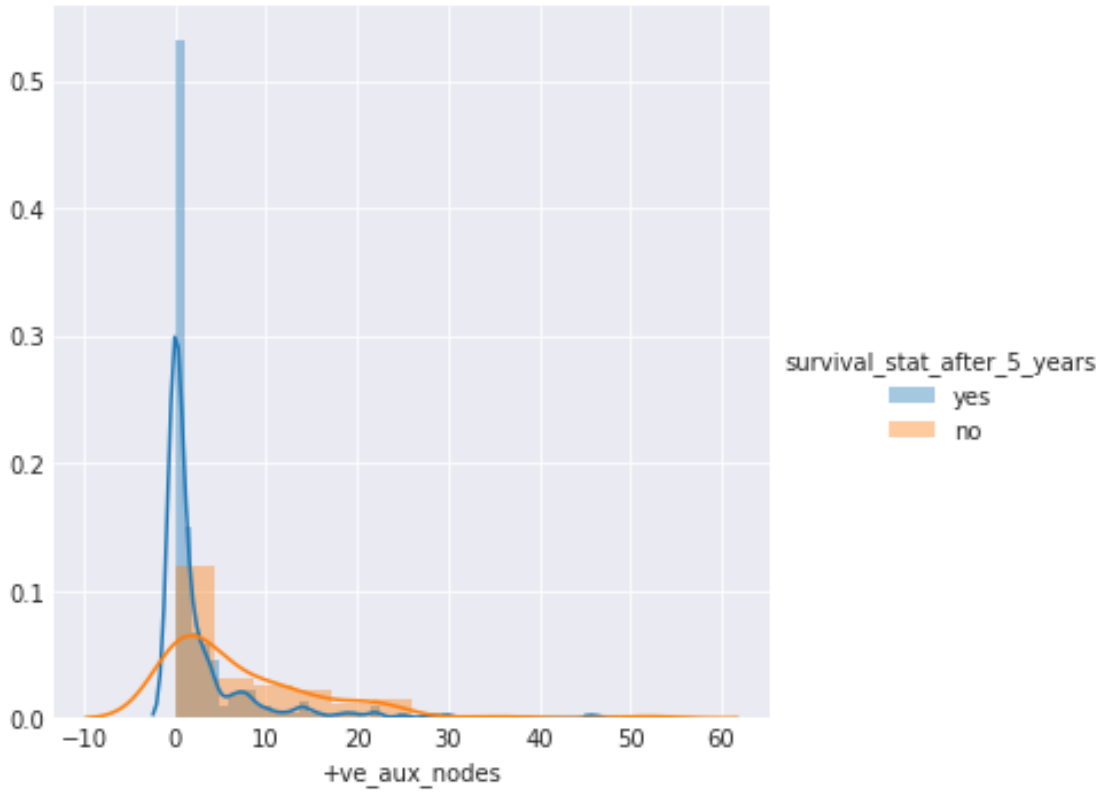
5 Histograms and PDF

In [10]: # Plotting Histograms and Probability Density Functions.

```
for idx, feature in enumerate(list(habe.columns)[:-1]):
    fg = sns.FacetGrid(habe, hue='survival_stat_after_5_years', size=5)
    fg.map(sns.distplot, feature).add_legend()
    plt.show()
```




0.10
0.08
0.06
0.04
0.02
0.00
55.0
57.5
60.0
62.5
65.0
67.5
70.0
72.5
year_of_treat
survival_stat_after_5_years
yes
no

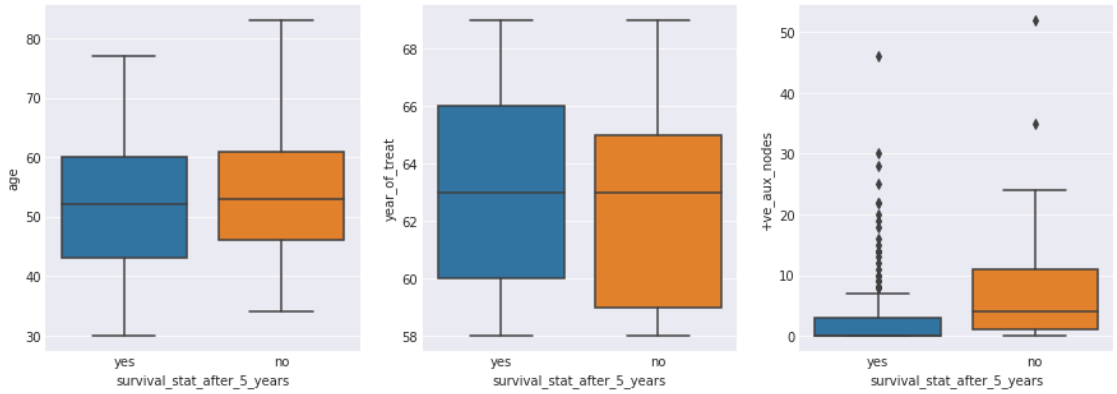

0.5
0.4
0.3
0.2
0.1
0.0
−10
0
10
20
30
40
50
60
+ve_aux_nodes
survival_stat_after_5_years
yes
no

6 Observations

- More percentage of people have survived in the age group (50 - 55)
- More percentage of people have not survived in the age group (40 - 45)
- More percentage of people have survived having operation in the year group (1960 - 1962.5)
- Patients having (0 - 4) positive auxiliary nodes are having very high chances of survival after 5 years.

7 Box Plots :

In [11]:
```
# Plotting Box Plots
fig, axes = plt.subplots(1, 3, figsize=(15, 5))
for idx, feature in enumerate(list(habe.columns)[:-1]):
    sns.boxplot( x='survival_stat_after_5_years', y=feature, data=habe, ax=axes[idx])
plt.show()
```

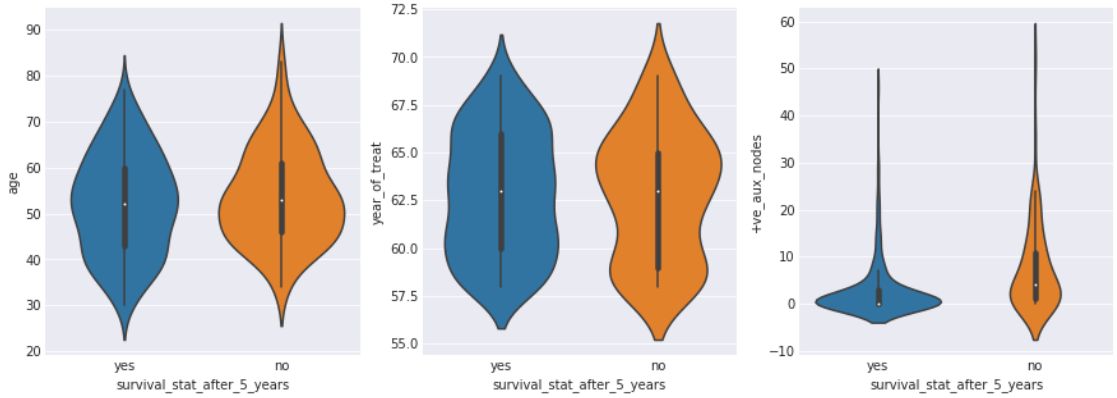


8 Observations

- many outliers are there in plot (+ve_aux_nodes VS survival_stat_after_5_years)

In [12]:
```
# Plotting Violin Plots

fig, axes = plt.subplots(1, 3, figsize=(15, 5))
for idx, feature in enumerate(list(habe.columns)[:-1]):
    sns.violinplot( x='survival_stat_after_5_years', y=feature, data=habe, ax=axes[idx])
plt.show()
```

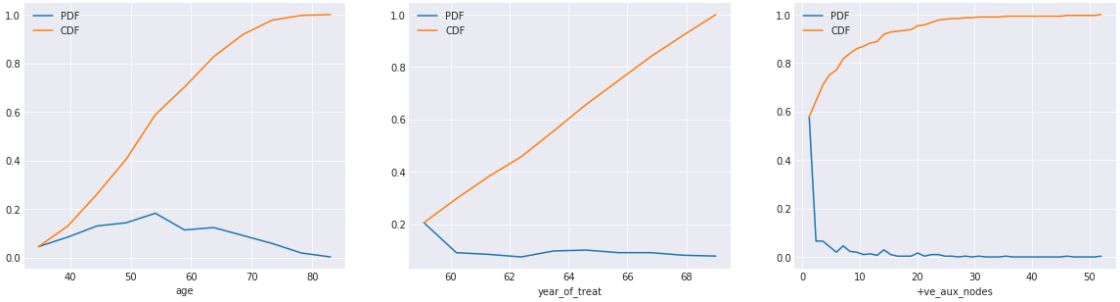


9 Observations

- Plot of (survival_stat_after_5_years VS +ve_aux_nodes) is very denser in the range of (0 - 4) positive auxiliary nodes i,e more number of patients who have survived are having (0 - 4) positive auxiliary nodes

10 Cumulative Distributive Frequency Plot (CDF) and Probability Density Function Plot (PDF)

In [13]:
```
plt.figure(figsize=(20,5))
for idx, feature in enumerate(list(habe.columns)[:-1]):
    plt.subplot(1, 3, idx+1)
    counts, bin_edges = np.histogram(habe[feature], bins='auto', density=True)
    pdf = counts/sum(counts)
    cdf = np.cumsum(pdf)
    pdfP, = plt.plot(bin_edges[1:], pdf)
    cdfP, = plt.plot(bin_edges[1:], cdf)
    plt.legend([pdfP, cdfP], ["PDF", "CDF"])
    plt.xlabel(feature)
```



11 Observations

- in this plot we can see cdf as well as pdf (orange line is cdf, blue line is pdf).
- age plot is like close to gaussian curve obviously as its a small dataset.
- there are 80 percent of patients who are having less than or equal to 8 positive auxiliary nodes and they haven't survived.

12 Conclusions

- min age of a patient is 30yrs and max is 83yrs, mean age is 52.45 yrs
- min number of positive auxiliary nodes in patient is 0.00 and max is 52.00
- 75th percentile lies at 4.00 in +ve auxiliary nodes column, so we can say 75 percent of patients are having less than or equal to 4 positive auxiliary nodes
- similarly with year of treatment, 75 percent of patients having operation before 1965 to 1966 (since 75th percentile lies at 65.75 in year_of_treat column)
- This study is conducted on 306 patients

13 References :

- https://medium.com/@gokulkarthikk/habermans-cancer-survival-visual-exploratory-data-analysis-using-python-e7dcb7ac01ed