In [1]:
```
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
#load haberman dataset
data = pd.read_csv('Q:\Exploratory-Data-Analysis-master\khormi.csv')
# no. of data-points and features
data.shape
```

Out[1]:
```
(305, 4)
```

In [2]:
```
# set columns names to dataset
data.columns = ['Age','Op_Year','axil_nodes_det','Status']
data.columns
```

Out[2]:
```
Index(['Age', 'Op_Year', 'axil_nodes_det', 'Status'], dtype='object')
```

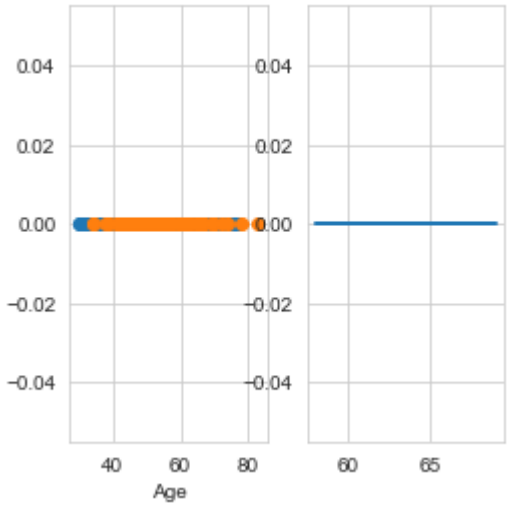
In [3]:
```
# no. of data-points in each class
data['Status'].value_counts()
```

Out[3]:
```
1    224
2     81
Name: Status, dtype: int64
```

In [5]:
```
# divide the target values into lists by using class names
class1 = data.loc[data['Status'] == 1]
class2 = data.loc[data['Status'] == 2]
```

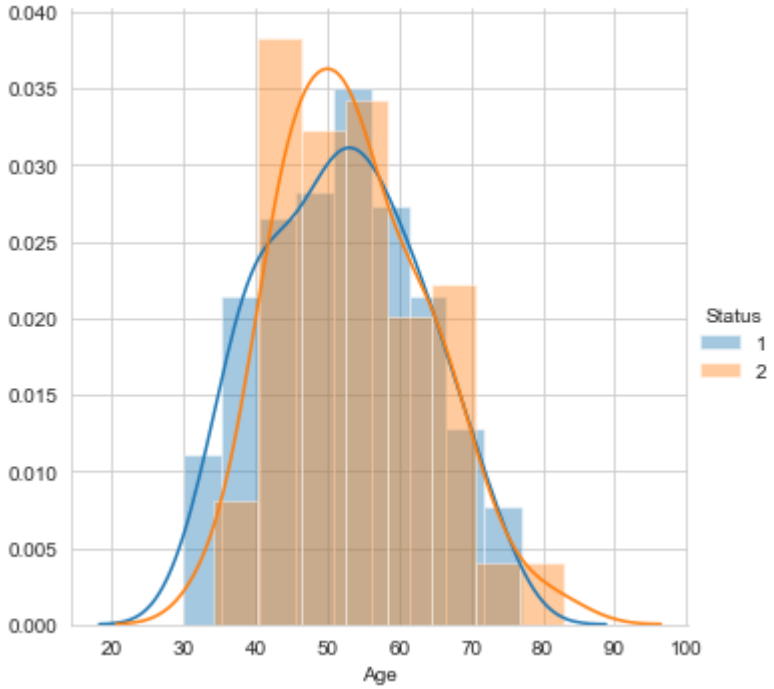
In [6]:
```
# 1D-scatter plot
import numpy as np
sns.set_style("whitegrid");
plt.figure(1)
plt.subplot(1,3,1)
plt.plot(class1['Age'],np.zeros_like(class1['Age']),'o')
plt.plot(class2['Age'],np.zeros_like(class2['Age']),'o')
plt.xlabel('Age')
plt.subplot(1,3,2)
plt.plot(class1['Op_Year'],np.zeros_like(class1['Op_Year']),'-')
```

Out[6]:
```
[<matplotlib.lines.Line2D at 0x1dd4345e748>]
```

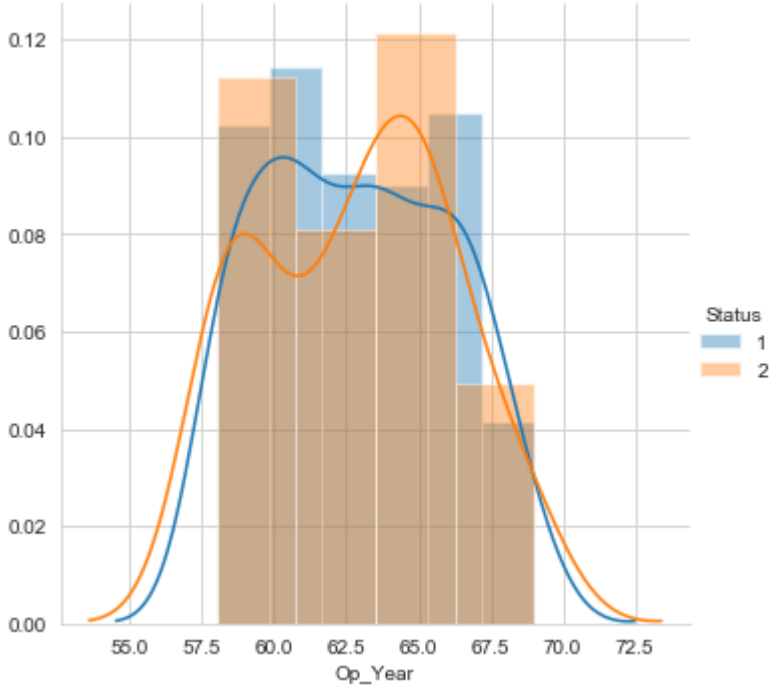


In [7]:
```
# Histograms and Probability Density Functions (PDF)
plt.close()
sns.FacetGrid(data, hue="Status", size=5) \
.map(sns.distplot, "Age") \
.add_legend();
plt.xlabel('Age')
plt.show();
plt.close()
sns.FacetGrid(data, hue="Status", size=5) \
.map(sns.distplot, "Op_Year") \
.add_legend();
plt.xlabel('Op_Year')
plt.show();
plt.close()
sns.FacetGrid(data, hue="Status", size=5) \
.map(sns.distplot, "axil_nodes_det") \
.add_legend();
plt.xlabel('axil_nodes_det')
plt.show();
```

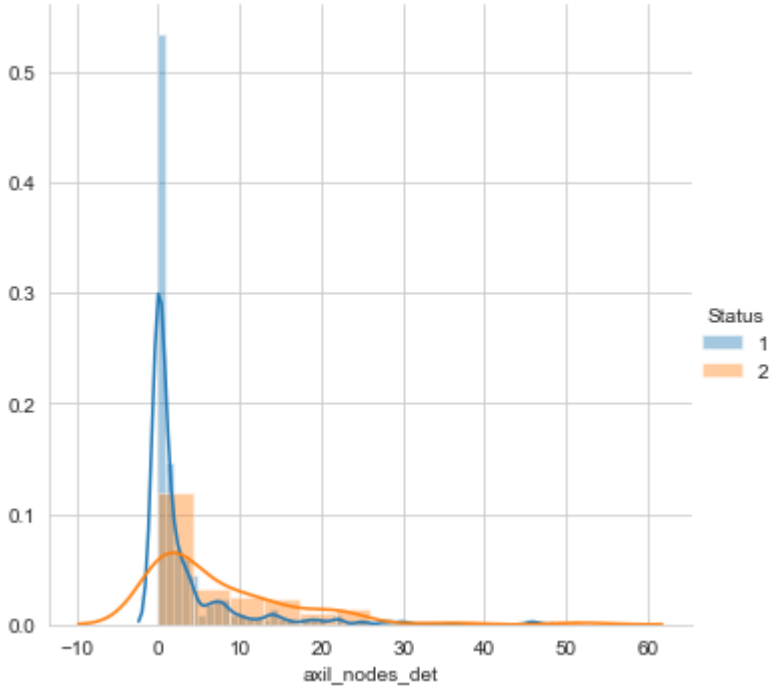
```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\axisgrid.py:243: UserWarni
ng: The `size` parameter has been renamed to `height`; please update your cod
e.
  warnings.warn(msg, UserWarning)
```



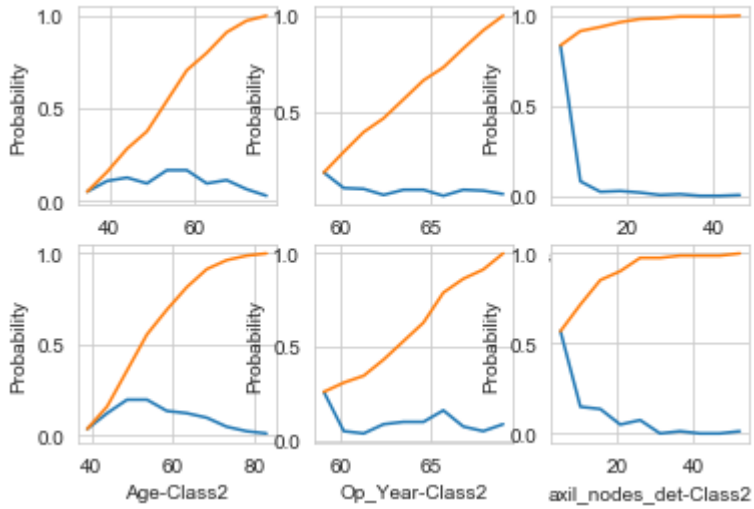

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\axisgrid.py:243: UserWarni
ng: The `size` parameter has been renamed to `height`; please update your cod
e.
  warnings.warn(msg, UserWarning)
```




```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\axisgrid.py:243: UserWarni
ng: The `size` parameter has been renamed to `height`; please update your cod
e.
  warnings.warn(msg, UserWarning)
```


0.5
0.4
0.3
0.2
0.1
0.0
−10
0
10
20
30
40
50
60
axil_nodes_det
Status
1
2

In [14]:
```
# Cumulative Distribution Function (CDF)
plt.close()
plt.figure(1)
counts,bin_edges = np.histogram(class1['Age'],bins=10,density = True)
pdf = counts/sum(counts)
cdf = np.cumsum(pdf)
plt.subplot(2,3,1)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)
plt.xlabel('Age-Class12')
plt.ylabel('Probability')
counts,bin_edges = np.histogram(class2['Age'],bins=10,density = True)
pdf = counts/sum(counts)
cdf = np.cumsum(pdf)
plt.subplot(2,3,4)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)
plt.xlabel('Age-Class2')
plt.ylabel('Probability')
counts,bin_edges = np.histogram(class1['Op_Year'],bins=10,density = True)
pdf = counts/sum(counts)
cdf = np.cumsum(pdf)
plt.subplot(2,3,2)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)
plt.xlabel('Op_Year-Class1')
plt.ylabel('Probability')
counts,bin_edges = np.histogram(class2['Op_Year'],bins=10,density = True)
pdf = counts/sum(counts)
cdf = np.cumsum(pdf)
plt.subplot(2,3,5)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)
plt.xlabel('Op_Year-Class2')
plt.ylabel('Probability')
counts,bin_edges = np.histogram(class1['axil_nodes_det'],bins=10,density = Tru
e)
pdf = counts/sum(counts)
cdf = np.cumsum(pdf)
plt.subplot(2,3,3)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)
plt.xlabel('axil_nodes_det-Class1')
plt.ylabel('Probability')
counts,bin_edges = np.histogram(class2['axil_nodes_det'],bins=10,density = Tru
e)
pdf = counts/sum(counts)
cdf = np.cumsum(pdf)
plt.subplot(2,3,6)
plt.plot(bin_edges[1:],pdf)
plt.plot(bin_edges[1:],cdf)
plt.xlabel('axil_nodes_det-Class2')
plt.ylabel('Probability')
plt.show()
```




In [17]:
```
# Means
print("Mean:")
print("Class1 - Age : ",np.mean(class1['Age']))
print("Class2 - Age : ",np.mean(class2['Age']))
print("Class1 - Op_Year : ",np.mean(class1['Op_Year']))
print("Class2 - Op_Year : ",np.mean(class1['Op_Year']))

print("Class1 - axil_nodes_det : ",np.mean(class1['axil_nodes_det']))
print("Class2 - axil_nodes_det : ",np.mean(class2['axil_nodes_det']))
```

```
Mean:
Class1 - Age :  52.11607142857143
Class2 - Age :  53.67901234567901
Class1 - Op_Year :  62.857142857142854
Class2 - Op_Year :  62.857142857142854
Class1 - axil_nodes_det :  2.799107142857143
Class2 - axil_nodes_det :  7.45679012345679
```

In [18]:
```
print("Std-dev:")
print("Class1 - Age : ",np.std(class1['Age']))
print("Class2 - Age : ",np.std(class2['Age']))
print("Class1 - Op_Year : ",np.std(class1['Op_Year']))
print("Class2 - Op_Year : ",np.std(class1['Op_Year']))
print("Class1 - axil_nodes_det : ",np.std(class1['axil_nodes_det']))
print("Class2 - axil_nodes_det : ",np.std(class2['axil_nodes_det']))
```

```
Std-dev:
Class1 - Age :  10.913004640364269
Class2 - Age :  10.10418219303131
Class1 - Op_Year :  3.2220145175061514
Class2 - Op_Year :  3.2220145175061514
Class1 - axil_nodes_det :  5.869092706952767
Class2 - axil_nodes_det :  9.128776076761632
```

In [19]:
```
# Median
print("Median:")
print("Class1 - Age : ",np.median(class1['Age']))
print("Class2 - Age : ",np.median(class2['Age']))
print("Class1 - Op_Year : ",np.median(class1['Op_Year']))
print("Class2 - Op_Year : ",np.median(class1['Op_Year']))
print("Class1 - axil_nodes_det : ",np.median(class1['axil_nodes_det']))
print("Class2 - axil_nodes_det : ",np.median(class2['axil_nodes_det']))
```

```
Median:
Class1 - Age :  52.0
Class2 - Age :  53.0
Class1 - Op_Year :  63.0
Class2 - Op_Year :  63.0
Class1 - axil_nodes_det :  0.0
Class2 - axil_nodes_det :  4.0
```

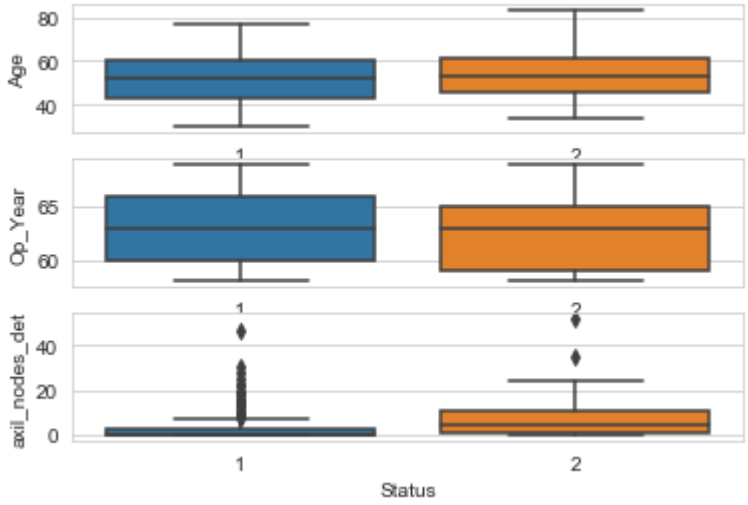
In [20]:
```
# Quantiles
print("Quantiles:")
print("Class1 - Age : ",np.percentile(class1['Age'],np.arange(0,100,25)))
print("Class2 - Age : ",np.percentile(class2['Age'],np.arange(0,100,25)))
print("Class1 - Op_Year : ",np.percentile(class1['Op_Year'],np.arange(0,100,25
)))
print("Class2 - Op_Year : ",np.percentile(class1['Op_Year'],np.arange(0,100,25
)))
print("Class1 - axil_nodes_det : ",np.percentile(class1['axil_nodes_det'],np.a
range(0,100,25)))
print("Class2 - axil_nodes_det : ",np.percentile(class2['axil_nodes_det'],np.a
range(0,100,25)))
```

```
Quantiles:
Class1 - Age :  [30. 43. 52. 60.]
Class2 - Age :  [34. 46. 53. 61.]
Class1 - Op_Year :  [58. 60. 63. 66.]
Class2 - Op_Year :  [58. 60. 63. 66.]
Class1 - axil_nodes_det :  [0. 0. 0. 3.]
Class2 - axil_nodes_det :  [ 0.  1.  4. 11.]
```

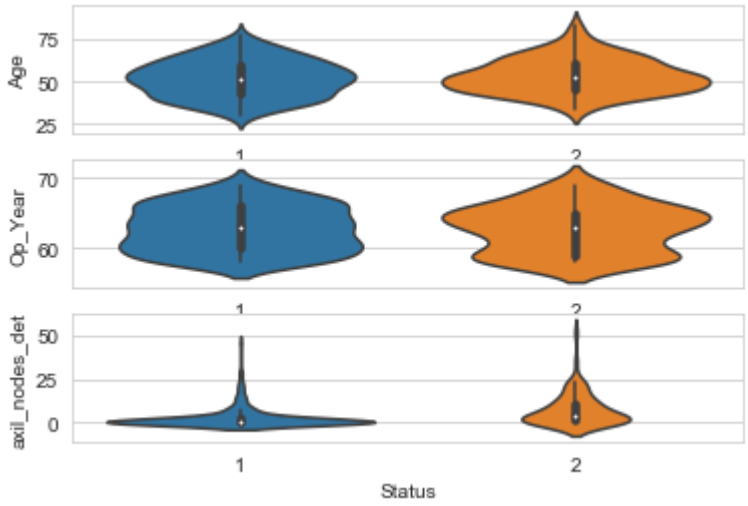
In [21]:
```
from statsmodels import robust
# Median Absolute Deviation
print("Median Absolute Deviation:")
print("Class1 - Age : ",robust.mad(class1['Age']))
print("Class2 - Age : ",robust.mad(class2['Age']))
print("Class1 - Op_Year : ",robust.mad(class1['Op_Year']))
print("Class2 - Op_Year : ",robust.mad(class1['Op_Year']))
print("Class1 - axil_nodes_det : ",robust.mad(class1['axil_nodes_det']))
print("Class2 - axil_nodes_det : ",robust.mad(class2['axil_nodes_det']))
```

```
Median Absolute Deviation:
Class1 - Age :  13.343419966550417
Class2 - Age :  11.860817748044816
Class1 - Op_Year :  4.447806655516806
Class2 - Op_Year :  4.447806655516806
Class1 - axil_nodes_det :  0.0
Class2 - axil_nodes_det :  5.930408874022408
```

In [22]:
```
plt.close()
plt.figure(1)
plt.subplot(3,1,1)
sns.boxplot(x='Status',y='Age',data=data)
plt.subplot(3,1,2)
sns.boxplot(x='Status',y='Op_Year',data=data)
plt.subplot(3,1,3)
sns.boxplot(x='Status',y='axil_nodes_det',data=data)
plt.show()
```

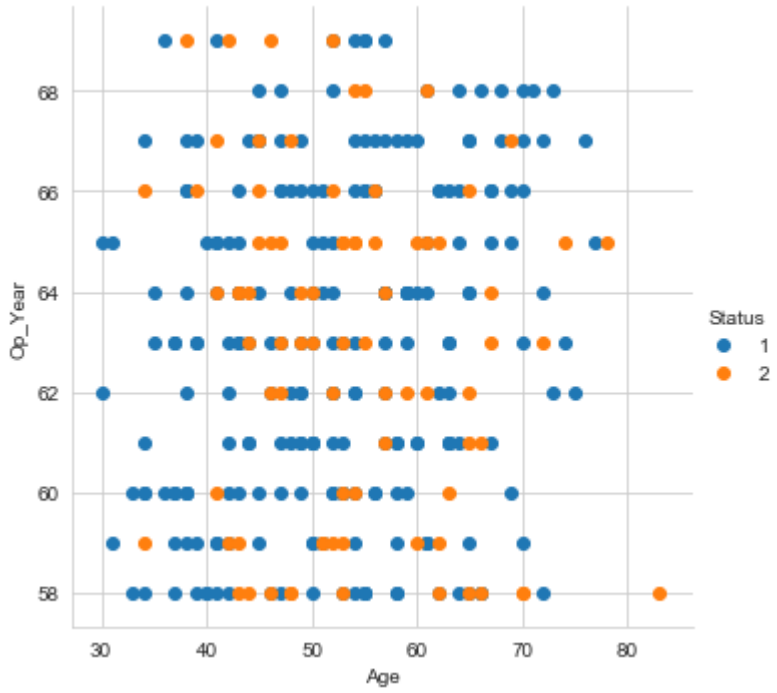


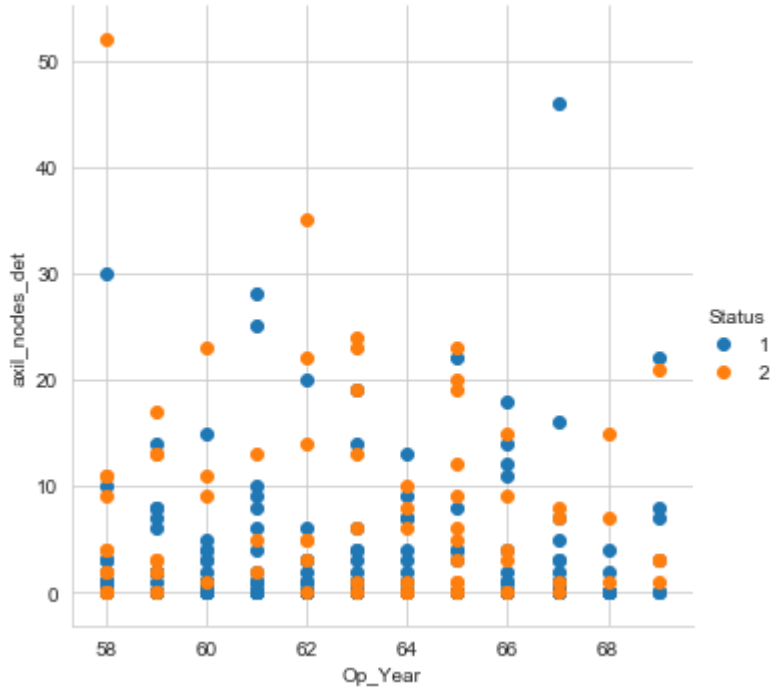

In [23]:
```
# Violin ploting
plt.close()
plt.figure(1)
plt.subplot(3,1,1)
sns.violinplot(x='Status',y='Age',data=data)
plt.subplot(3,1,2)
sns.violinplot(x='Status',y='Op_Year',data=data)
plt.subplot(3,1,3)
sns.violinplot(x='Status',y='axil_nodes_det',data=data)
plt.show()
```

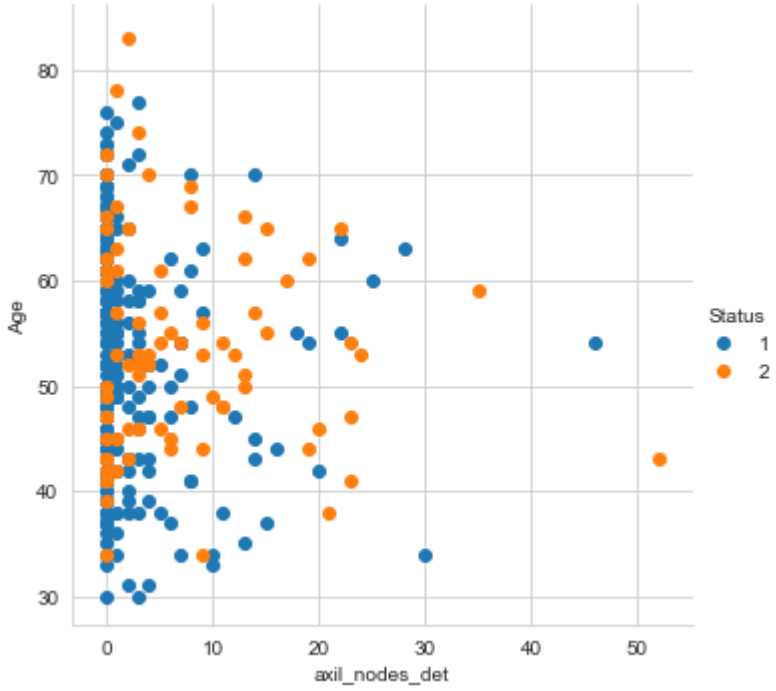


In [28]:
```
plt.close()
# 2D-Scatter ploting
sns.FacetGrid(data, hue="Status", size=5) \
.map(plt.scatter, "Age","Op_Year") \
.add_legend();
plt.xlabel('Age')
plt.ylabel('Op_Year')
plt.show();
sns.FacetGrid(data, hue="Status", size=5) \
.map(plt.scatter, "Op_Year","axil_nodes_det") \
.add_legend();
plt.xlabel('Op_Year')
plt.ylabel("axil_nodes_det")
plt.show();
sns.FacetGrid(data, hue="Status", size=5) \
.map(plt.scatter, "axil_nodes_det","Age") \
.add_legend();
plt.xlabel('axil_nodes_det')
plt.ylabel('Age')
plt.show();
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\axisgrid.py:243: UserWarni
ng: The `size` parameter has been renamed to `height`; please update your cod
e.
  warnings.warn(msg, UserWarning)
```

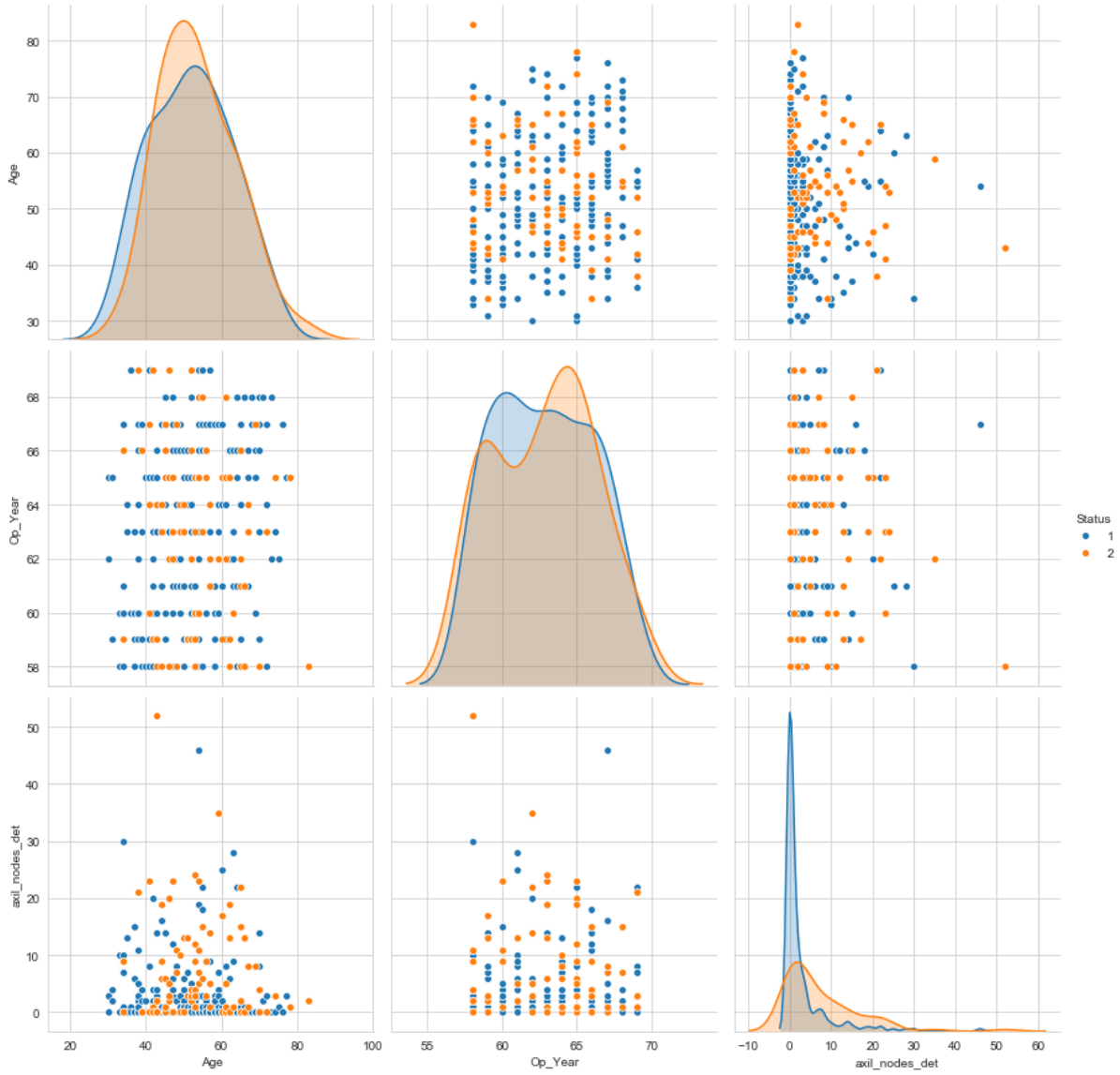



80
70
60
50
40
30
Age
0
10
20
30
40
50
axil_nodes_det
Status
1
2

In [29]:
```
plt.close()
# Pair ploting
sns.set_style("whitegrid");
sns.pairplot(data, hue="Status",vars=['Age','Op_Year','axil_nodes_det'],size=4
);
plt.show()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\seaborn\axisgrid.py:2079: UserWarn
ing: The `size` parameter has been renamed to `height`; please update your co
de.
  warnings.warn(msg, UserWarning)
```




In [ ]:
```
```