assignment-4

September 27, 2023

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

[4]:
```python
df=pd.read_csv("Employee-Attrition.csv")
df.head()
```

[4]:
```
   Age Attrition     BusinessTravel  DailyRate              Department  \
0   41       Yes      Travel_Rarely       1102                   Sales   
1   49        No  Travel_Frequently        279  Research & Development   
2   37       Yes      Travel_Rarely       1373  Research & Development   
3   33        No  Travel_Frequently       1392  Research & Development   
4   27        No      Travel_Rarely        591  Research & Development   

   DistanceFromHome  Education EducationField  EmployeeCount  EmployeeNumber  \
0                 1          2  Life Sciences              1               1   
1                 8          1  Life Sciences              1               2   
2                 2          2          Other              1               4   
3                 3          4  Life Sciences              1               5   
4                 2          1        Medical              1               7   

   …  RelationshipSatisfaction StandardHours  StockOptionLevel  \
0  …                         1            80                 0   
1  …                         4            80                 1   
2  …                         2            80                 0   
3  …                         3            80                 0   
4  …                         4            80                 1   

   TotalWorkingYears  TrainingTimesLastYear WorkLifeBalance  YearsAtCompany  \
0                  8                      0               1               6   
1                 10                      3               3              10   
2                  7                      3               3               0   
3                  8                      3               3               8   
4                  6                      3               3               2   
```

```
  YearsInCurrentRole  YearsSinceLastPromotion  YearsWithCurrManager
0                  4                        0                     5
1                  7                        1                     7
2                  0                        0                     0
3                  7                        3                     0
4                  2                        2                     2

[5 rows x 35 columns]
```

0.1 Data Processing

[6]:
```
df.shape
```

[6]:
```
(1470, 35)
```

[7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 35 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Age                       1470 non-null   int64
 1   Attrition                 1470 non-null   object
 2   BusinessTravel            1470 non-null   object
 3   DailyRate                 1470 non-null   int64
 4   Department                1470 non-null   object
 5   DistanceFromHome          1470 non-null   int64
 6   Education                 1470 non-null   int64
 7   EducationField            1470 non-null   object
 8   EmployeeCount             1470 non-null   int64
 9   EmployeeNumber            1470 non-null   int64
 10  EnvironmentSatisfaction   1470 non-null   int64
 11  Gender                    1470 non-null   object
 12  HourlyRate                1470 non-null   int64
 13  JobInvolvement            1470 non-null   int64
 14  JobLevel                  1470 non-null   int64
 15  JobRole                   1470 non-null   object
 16  JobSatisfaction           1470 non-null   int64
 17  MaritalStatus             1470 non-null   object
 18  MonthlyIncome             1470 non-null   int64
 19  MonthlyRate               1470 non-null   int64
 20  NumCompaniesWorked        1470 non-null   int64
 21  Over18                    1470 non-null   object
 22  OverTime                  1470 non-null   object
 23  PercentSalaryHike         1470 non-null   int64
 24  PerformanceRating         1470 non-null   int64
```

```
 25  RelationshipSatisfaction  1470 non-null   int64
 26  StandardHours             1470 non-null   int64
 27  StockOptionLevel          1470 non-null   int64
 28  TotalWorkingYears         1470 non-null   int64
 29  TrainingTimesLastYear     1470 non-null   int64
 30  WorkLifeBalance           1470 non-null   int64
 31  YearsAtCompany            1470 non-null   int64
 32  YearsInCurrentRole        1470 non-null   int64
 33  YearsSinceLastPromotion   1470 non-null   int64
 34  YearsWithCurrManager      1470 non-null   int64
dtypes: int64(26), object(9)
memory usage: 402.1+ KB
```

[8]:
```
df.describe()
```

[8]:
```
               Age    DailyRate  DistanceFromHome    Education  EmployeeCount
count  1470.000000  1470.000000       1470.000000  1470.000000         1470.0  \
mean     36.923810   802.485714          9.192517     2.912925            1.0
std       9.135373   403.509100          8.106864     1.024165            0.0
min      18.000000   102.000000          1.000000     1.000000            1.0
25%      30.000000   465.000000          2.000000     2.000000            1.0
50%      36.000000   802.000000          7.000000     3.000000            1.0
75%      43.000000  1157.000000         14.000000     4.000000            1.0
max      60.000000  1499.000000         29.000000     5.000000            1.0

       EmployeeNumber  EnvironmentSatisfaction   HourlyRate  JobInvolvement
count     1470.000000              1470.000000  1470.000000     1470.000000  \
mean      1024.865306                 2.721769    65.891156        2.729932
std        602.024335                 1.093082    20.329428        0.711561
min          1.000000                 1.000000    30.000000        1.000000
25%        491.250000                 2.000000    48.000000        2.000000
50%       1020.500000                 3.000000    66.000000        3.000000
75%       1555.750000                 4.000000    83.750000        3.000000
max       2068.000000                 4.000000   100.000000        4.000000

          JobLevel  …  RelationshipSatisfaction  StandardHours
count  1470.000000  …               1470.000000         1470.0  \
mean      2.063946  …                  2.712245           80.0
std       1.106940  …                  1.081209            0.0
min       1.000000  …                  1.000000           80.0
25%       1.000000  …                  2.000000           80.0
50%       2.000000  …                  3.000000           80.0
75%       3.000000  …                  4.000000           80.0
max       5.000000  …                  4.000000           80.0

       StockOptionLevel  TotalWorkingYears  TrainingTimesLastYear
count       1470.000000        1470.000000            1470.000000  \
```

```
mean         0.793878       11.279592                2.799320
std          0.852077        7.780782                1.289271
min          0.000000        0.000000                0.000000
25%          0.000000        6.000000                2.000000
50%          1.000000       10.000000                3.000000
75%          1.000000       15.000000                3.000000
max          3.000000       40.000000                6.000000

       WorkLifeBalance  YearsAtCompany  YearsInCurrentRole
count      1470.000000     1470.000000         1470.000000  \
mean          2.761224        7.008163            4.229252
std           0.706476        6.126525            3.623137
min           1.000000        0.000000            0.000000
25%           2.000000        3.000000            2.000000
50%           3.000000        5.000000            3.000000
75%           3.000000        9.000000            7.000000
max           4.000000       40.000000           18.000000

       YearsSinceLastPromotion  YearsWithCurrManager
count              1470.000000           1470.000000
mean                  2.187755              4.123129
std                   3.222430              3.568136
min                   0.000000              0.000000
25%                   0.000000              2.000000
50%                   1.000000              3.000000
75%                   3.000000              7.000000
max                  15.000000             17.000000

[8 rows x 26 columns]
```

[10]:
```python
corr=dataset.corr(numeric_only = True)
corr
```

[10]:
```
                               Age  DailyRate  DistanceFromHome  Education
Age                       1.000000   0.010661         -0.001686   0.208034  \
DailyRate                 0.010661   1.000000         -0.004985  -0.016806
DistanceFromHome         -0.001686  -0.004985          1.000000   0.021042
Education                 0.208034  -0.016806          0.021042   1.000000
EmployeeCount                  NaN        NaN               NaN        NaN
EmployeeNumber           -0.010145  -0.050990          0.032916   0.042070
EnvironmentSatisfaction   0.010146   0.018355         -0.016075  -0.027128
HourlyRate                0.024287   0.023381          0.031131   0.016775
JobInvolvement            0.029820   0.046135          0.008783   0.042438
JobLevel                  0.509604   0.002966          0.005303   0.101589
JobSatisfaction          -0.004892   0.030571         -0.003669  -0.011296
MonthlyIncome             0.497855   0.007707         -0.017014   0.094961
MonthlyRate               0.028051  -0.032182          0.027473  -0.026084
```

NumCompaniesWorked	0.299635	0.038153	-0.029251	0.126317
PercentSalaryHike	0.003634	0.022704	0.040235	-0.011111
PerformanceRating	0.001904	0.000473	0.027110	-0.024539
RelationshipSatisfaction	0.053535	0.007846	0.006557	-0.009118
StandardHours	NaN	NaN	NaN	NaN
StockOptionLevel	0.037510	0.042143	0.044872	0.018422
TotalWorkingYears	0.680381	0.014515	0.004628	0.148280
TrainingTimesLastYear	-0.019621	0.002453	-0.036942	-0.025100
WorkLifeBalance	-0.021490	-0.037848	-0.026556	0.009819
YearsAtCompany	0.311309	-0.034055	0.009508	0.069114
YearsInCurrentRole	0.212901	0.009932	0.018845	0.060236
YearsSinceLastPromotion	0.216513	-0.033229	0.010029	0.054254
YearsWithCurrManager	0.202089	-0.026363	0.014406	0.069065

	EmployeeCount	EmployeeNumber	
Age	NaN	-0.010145	\
DailyRate	NaN	-0.050990	
DistanceFromHome	NaN	0.032916	
Education	NaN	0.042070	
EmployeeCount	NaN	NaN	
EmployeeNumber	NaN	1.000000	
EnvironmentSatisfaction	NaN	0.017621	
HourlyRate	NaN	0.035179	
JobInvolvement	NaN	-0.006888	
JobLevel	NaN	-0.018519	
JobSatisfaction	NaN	-0.046247	
MonthlyIncome	NaN	-0.014829	
MonthlyRate	NaN	0.012648	
NumCompaniesWorked	NaN	-0.001251	
PercentSalaryHike	NaN	-0.012944	
PerformanceRating	NaN	-0.020359	
RelationshipSatisfaction	NaN	-0.069861	
StandardHours	NaN	NaN	
StockOptionLevel	NaN	0.062227	
TotalWorkingYears	NaN	-0.014365	
TrainingTimesLastYear	NaN	0.023603	
WorkLifeBalance	NaN	0.010309	
YearsAtCompany	NaN	-0.011240	
YearsInCurrentRole	NaN	-0.008416	
YearsSinceLastPromotion	NaN	-0.009019	
YearsWithCurrManager	NaN	-0.009197	

	EnvironmentSatisfaction	HourlyRate	JobInvolvement	
Age	0.010146	0.024287	0.029820	\
DailyRate	0.018355	0.023381	0.046135	
DistanceFromHome	-0.016075	0.031131	0.008783	
Education	-0.027128	0.016775	0.042438	

```
EmployeeCount                       NaN       NaN        NaN
EmployeeNumber                 0.017621  0.035179  -0.006888
EnvironmentSatisfaction        1.000000 -0.049857  -0.008278
HourlyRate                    -0.049857  1.000000   0.042861
JobInvolvement                -0.008278  0.042861   1.000000
JobLevel                       0.001212 -0.027853  -0.012630
JobSatisfaction               -0.006784 -0.071335  -0.021476
MonthlyIncome                 -0.006259 -0.015794  -0.015271
MonthlyRate                    0.037600 -0.015297  -0.016322
NumCompaniesWorked             0.012594  0.022157   0.015012
PercentSalaryHike             -0.031701 -0.009062  -0.017205
PerformanceRating             -0.029548 -0.002172  -0.029071
RelationshipSatisfaction       0.007665  0.001330   0.034297
StandardHours                       NaN       NaN        NaN
StockOptionLevel               0.003432  0.050263   0.021523
TotalWorkingYears             -0.002693 -0.002334  -0.005533
TrainingTimesLastYear         -0.019359 -0.008548  -0.015338
WorkLifeBalance                0.027627 -0.004607  -0.014617
YearsAtCompany                 0.001458 -0.019582  -0.021355
YearsInCurrentRole             0.018007 -0.024106   0.008717
YearsSinceLastPromotion        0.016194 -0.026716  -0.024184
YearsWithCurrManager          -0.004999 -0.020123   0.025976

                          JobLevel  …  RelationshipSatisfaction
Age                       0.509604  …                  0.053535  \
DailyRate                 0.002966  …                  0.007846
DistanceFromHome          0.005303  …                  0.006557
Education                 0.101589  …                 -0.009118
EmployeeCount                  NaN  …                       NaN
EmployeeNumber           -0.018519  …                 -0.069861
EnvironmentSatisfaction   0.001212  …                  0.007665
HourlyRate               -0.027853  …                  0.001330
JobInvolvement           -0.012630  …                  0.034297
JobLevel                  1.000000  …                  0.021642
JobSatisfaction          -0.001944  …                 -0.012454
MonthlyIncome             0.950300  …                  0.025873
MonthlyRate               0.039563  …                 -0.004085
NumCompaniesWorked        0.142501  …                  0.052733
PercentSalaryHike        -0.034730  …                 -0.040490
PerformanceRating        -0.021222  …                 -0.031351
RelationshipSatisfaction  0.021642  …                  1.000000
StandardHours                  NaN  …                       NaN
StockOptionLevel          0.013984  …                 -0.045952
TotalWorkingYears         0.782208  …                  0.024054
TrainingTimesLastYear    -0.018191  …                  0.002497
WorkLifeBalance           0.037818  …                  0.019604
YearsAtCompany            0.534739  …                  0.019367
```

YearsInCurrentRole	0.389447	…	-0.015123
YearsSinceLastPromotion	0.353885	…	0.033493
YearsWithCurrManager	0.375281	…	-0.000867

	StandardHours	StockOptionLevel	TotalWorkingYears	
Age	NaN	0.037510	0.680381	\
DailyRate	NaN	0.042143	0.014515	
DistanceFromHome	NaN	0.044872	0.004628	
Education	NaN	0.018422	0.148280	
EmployeeCount	NaN	NaN	NaN	
EmployeeNumber	NaN	0.062227	-0.014365	
EnvironmentSatisfaction	NaN	0.003432	-0.002693	
HourlyRate	NaN	0.050263	-0.002334	
JobInvolvement	NaN	0.021523	-0.005533	
JobLevel	NaN	0.013984	0.782208	
JobSatisfaction	NaN	0.010690	-0.020185	
MonthlyIncome	NaN	0.005408	0.772893	
MonthlyRate	NaN	-0.034323	0.026442	
NumCompaniesWorked	NaN	0.030075	0.237639	
PercentSalaryHike	NaN	0.007528	-0.020608	
PerformanceRating	NaN	0.003506	0.006744	
RelationshipSatisfaction	NaN	-0.045952	0.024054	
StandardHours	NaN	NaN	NaN	
StockOptionLevel	NaN	1.000000	0.010136	
TotalWorkingYears	NaN	0.010136	1.000000	
TrainingTimesLastYear	NaN	0.011274	-0.035662	
WorkLifeBalance	NaN	0.004129	0.001008	
YearsAtCompany	NaN	0.015058	0.628133	
YearsInCurrentRole	NaN	0.050818	0.460365	
YearsSinceLastPromotion	NaN	0.014352	0.404858	
YearsWithCurrManager	NaN	0.024698	0.459188	

	TrainingTimesLastYear	WorkLifeBalance	
Age	-0.019621	-0.021490	\
DailyRate	0.002453	-0.037848	
DistanceFromHome	-0.036942	-0.026556	
Education	-0.025100	0.009819	
EmployeeCount	NaN	NaN	
EmployeeNumber	0.023603	0.010309	
EnvironmentSatisfaction	-0.019359	0.027627	
HourlyRate	-0.008548	-0.004607	
JobInvolvement	-0.015338	-0.014617	
JobLevel	-0.018191	0.037818	
JobSatisfaction	-0.005779	-0.019459	
MonthlyIncome	-0.021736	0.030683	
MonthlyRate	0.001467	0.007963	
NumCompaniesWorked	-0.066054	-0.008366	

PercentSalaryHike	-0.005221	-0.003280
PerformanceRating	-0.015579	0.002572
RelationshipSatisfaction	0.002497	0.019604
StandardHours	NaN	NaN
StockOptionLevel	0.011274	0.004129
TotalWorkingYears	-0.035662	0.001008
TrainingTimesLastYear	1.000000	0.028072
WorkLifeBalance	0.028072	1.000000
YearsAtCompany	0.003569	0.012089
YearsInCurrentRole	-0.005738	0.049856
YearsSinceLastPromotion	-0.002067	0.008941
YearsWithCurrManager	-0.004096	0.002759

	YearsAtCompany	YearsInCurrentRole	
Age	0.311309	0.212901	\
DailyRate	-0.034055	0.009932	
DistanceFromHome	0.009508	0.018845	
Education	0.069114	0.060236	
EmployeeCount	NaN	NaN	
EmployeeNumber	-0.011240	-0.008416	
EnvironmentSatisfaction	0.001458	0.018007	
HourlyRate	-0.019582	-0.024106	
JobInvolvement	-0.021355	0.008717	
JobLevel	0.534739	0.389447	
JobSatisfaction	-0.003803	-0.002305	
MonthlyIncome	0.514285	0.363818	
MonthlyRate	-0.023655	-0.012815	
NumCompaniesWorked	-0.118421	-0.090754	
PercentSalaryHike	-0.035991	-0.001520	
PerformanceRating	0.003435	0.034986	
RelationshipSatisfaction	0.019367	-0.015123	
StandardHours	NaN	NaN	
StockOptionLevel	0.015058	0.050818	
TotalWorkingYears	0.628133	0.460365	
TrainingTimesLastYear	0.003569	-0.005738	
WorkLifeBalance	0.012089	0.049856	
YearsAtCompany	1.000000	0.758754	
YearsInCurrentRole	0.758754	1.000000	
YearsSinceLastPromotion	0.618409	0.548056	
YearsWithCurrManager	0.769212	0.714365	

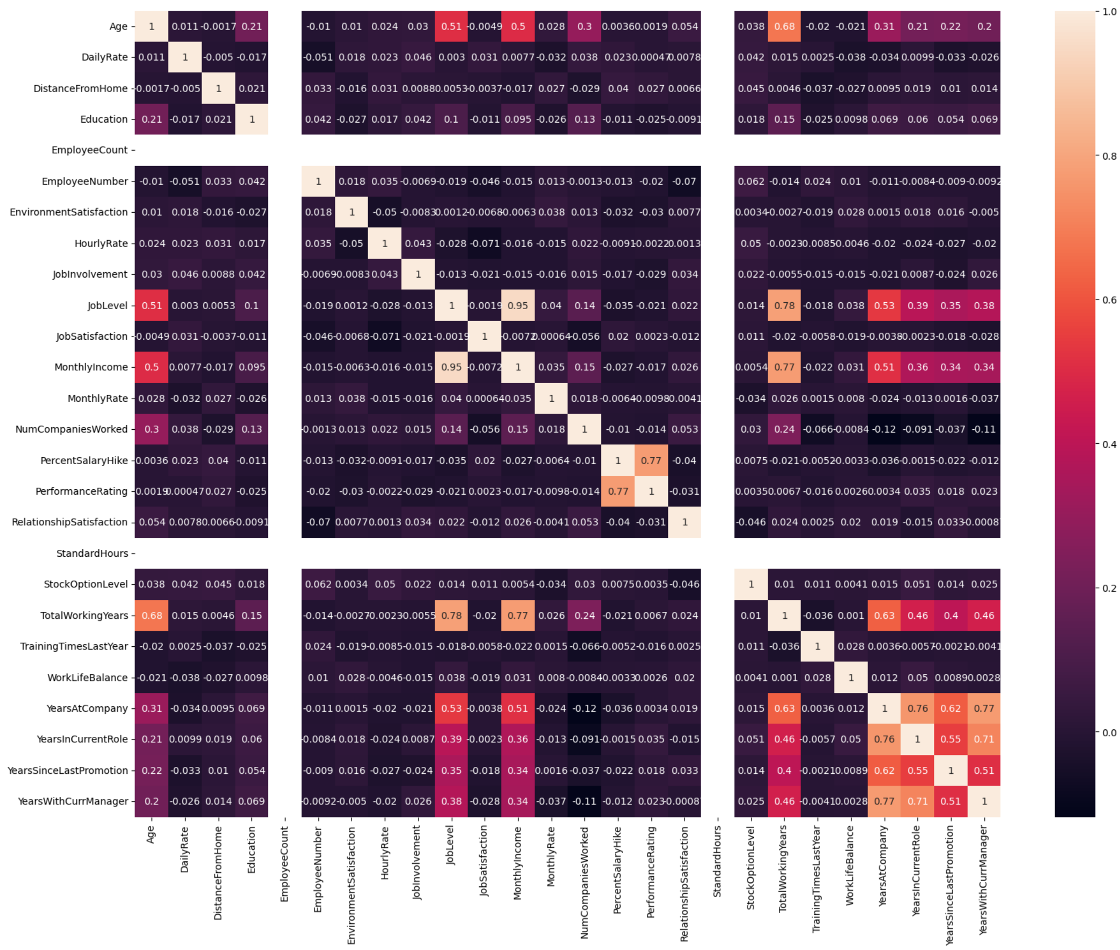
	YearsSinceLastPromotion	YearsWithCurrManager
Age	0.216513	0.202089
DailyRate	-0.033229	-0.026363
DistanceFromHome	0.010029	0.014406
Education	0.054254	0.069065
EmployeeCount	NaN	NaN

```
EmployeeNumber                                -0.009019              -0.009197
EnvironmentSatisfaction                        0.016194              -0.004999
HourlyRate                                    -0.026716              -0.020123
JobInvolvement                                -0.024184               0.025976
JobLevel                                       0.353885               0.375281
JobSatisfaction                               -0.018214              -0.027656
MonthlyIncome                                  0.344978               0.344079
MonthlyRate                                    0.001567              -0.036746
NumCompaniesWorked                            -0.036814              -0.110319
PercentSalaryHike                             -0.022154              -0.011985
PerformanceRating                              0.017896               0.022827
RelationshipSatisfaction                       0.033493              -0.000867
StandardHours                                       NaN                    NaN
StockOptionLevel                               0.014352               0.024698
TotalWorkingYears                              0.404858               0.459188
TrainingTimesLastYear                         -0.002067              -0.004096
WorkLifeBalance                                0.008941               0.002759
YearsAtCompany                                 0.618409               0.769212
YearsInCurrentRole                             0.548056               0.714365
YearsSinceLastPromotion                        1.000000               0.510224
YearsWithCurrManager                           0.510224               1.000000

[26 rows x 26 columns]
```

[11]:
```
plt.subplots(figsize=(20,15))
sns.heatmap(corr,annot=True)
```

[11]:
```
<Axes: >
```



0.1.1 We can conclude following inferences from above correlation graph.

- `jobLevel` is heighly correlated to `MonthlyIncome` with value `(0.95)`.
- There is relation between `TotalWorkingYears` with `JobLevel` & `TotalWorkingYears` with `MonthlyIncome`, value being `(0.78)`.
- The `YearsAtCompany` is also related with `JobLevel` and `MonthlyIncome`, value being `(0.53)`.
- `MonthlyIncome` is also loosely related to `Age` with value `(0.5)`.

[13]:
```
df.Attrition.value_counts()
```

[13]:
```
Attrition
No     1233
Yes     237
Name: count, dtype: int64
```

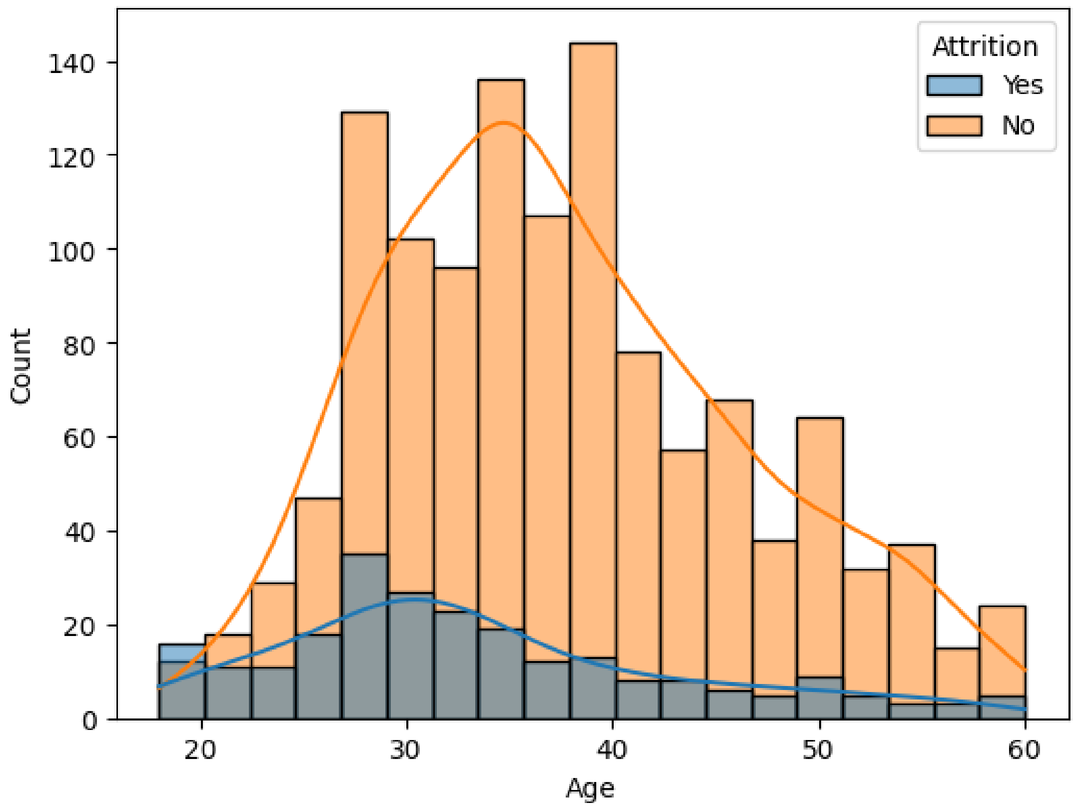
[14]:
```
#Checking for Null Values.
df.isnull().any()
```

[14]:

```
Age                         False
Attrition                   False
BusinessTravel              False
DailyRate                   False
Department                  False
DistanceFromHome            False
Education                   False
EducationField              False
EmployeeCount               False
EmployeeNumber              False
EnvironmentSatisfaction     False
Gender                      False
HourlyRate                  False
JobInvolvement              False
JobLevel                    False
JobRole                     False
JobSatisfaction             False
MaritalStatus               False
MonthlyIncome               False
MonthlyRate                 False
NumCompaniesWorked          False
Over18                      False
OverTime                    False
PercentSalaryHike           False
PerformanceRating           False
RelationshipSatisfaction    False
StandardHours               False
StockOptionLevel            False
TotalWorkingYears           False
TrainingTimesLastYear       False
WorkLifeBalance             False
YearsAtCompany              False
YearsInCurrentRole          False
YearsSinceLastPromotion     False
YearsWithCurrManager        False
dtype: bool
```

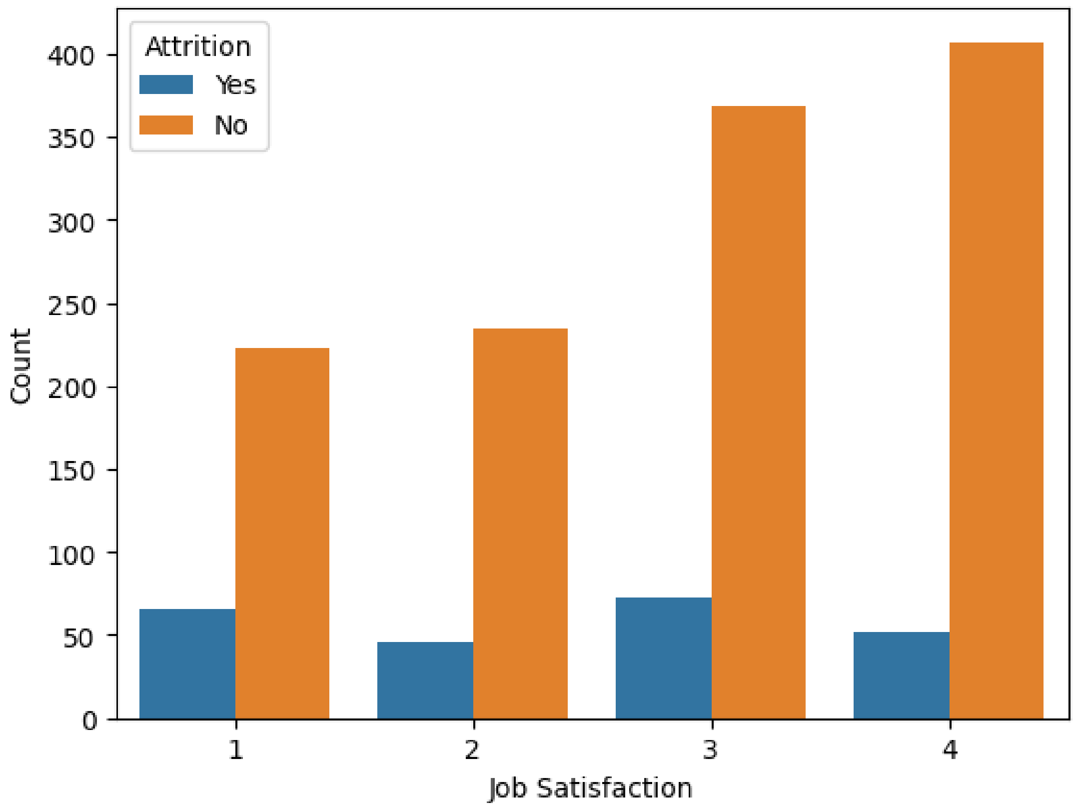
[15]:

```
# EDA: Distribution of Age to Attrition
sns.histplot(data=df, x='Age', hue='Attrition', kde=True)
plt.xlabel('Age')
plt.ylabel('Count')
plt.show()
```



Note:- We can plot `JobSatisfaction` vs `Attrition` to if satisfied employees are being Attrited too.

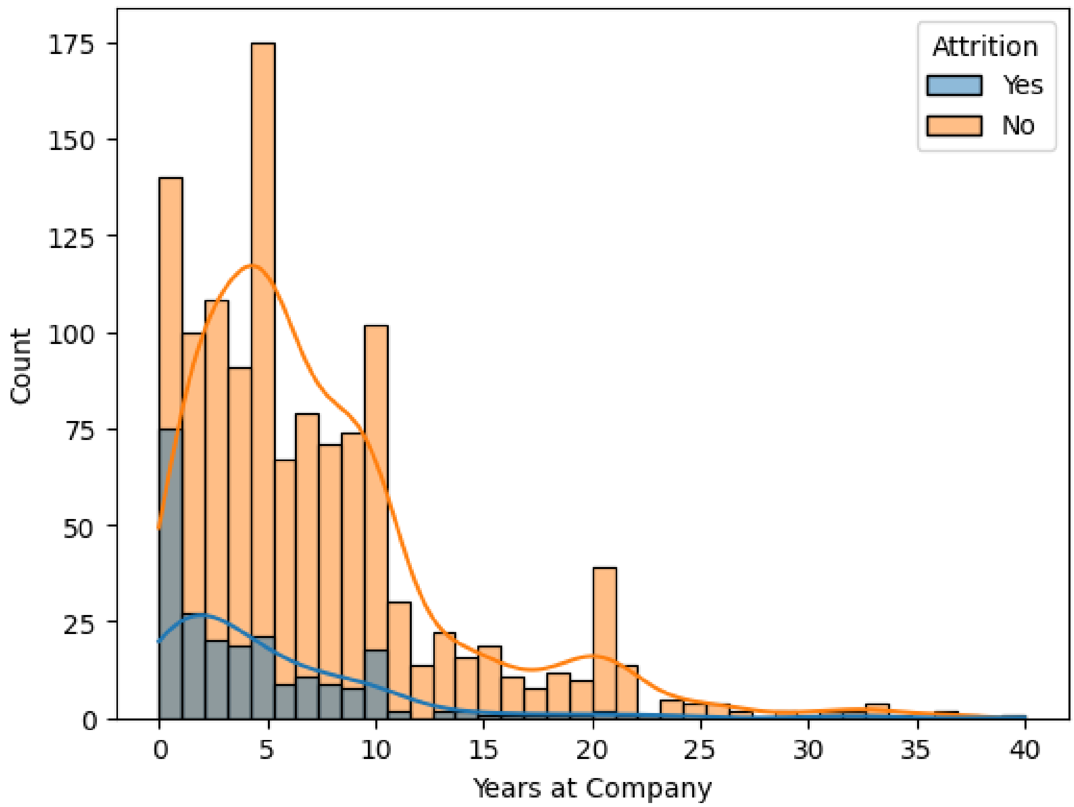
[16]:
```
sns.countplot(x='JobSatisfaction', hue='Attrition', data=df)
plt.xlabel('Job Satisfaction')
plt.ylabel('Count')
plt.show()
```



Inference: * There is very loose relation between `Attrition` and `JobSatisfaction`. * Higher staisfaction level also triggers `Attrition`.

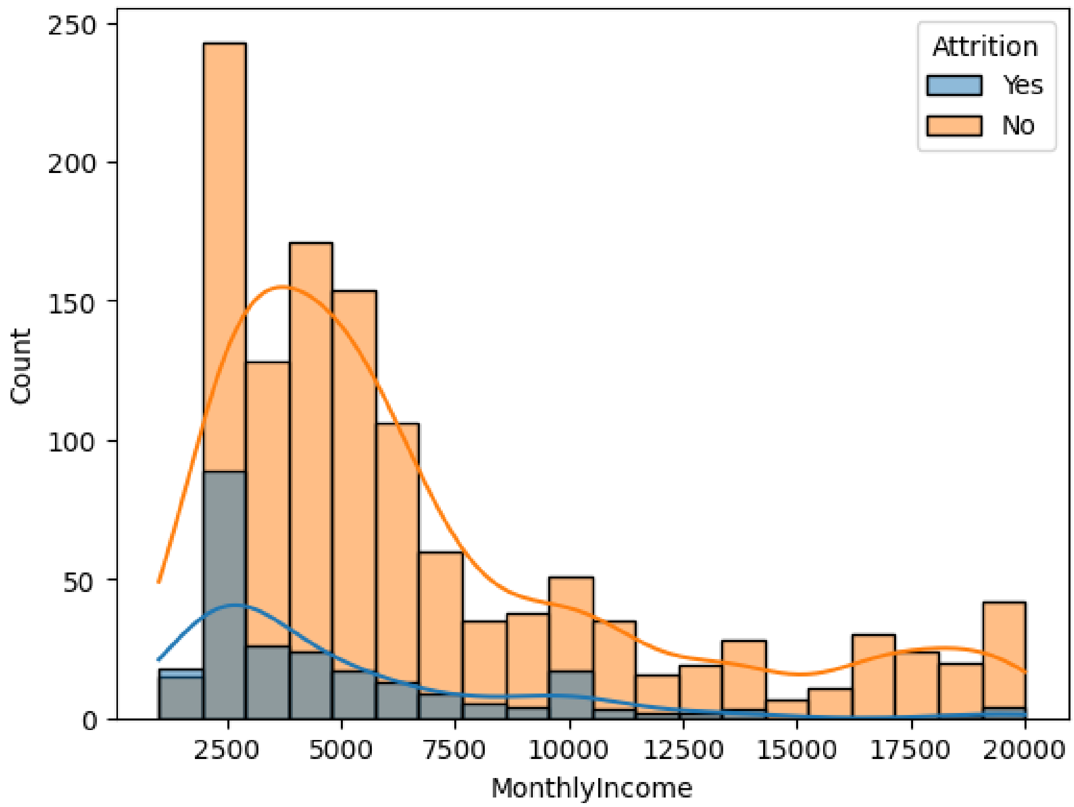
Let's see How `YearsAtCompany` is related to `Attrition`.

[17]:
```
sns.histplot(data=df, x='YearsAtCompany', hue='Attrition', kde=True)
plt.xlabel('Years at Company')
plt.ylabel('Count')
plt.show()
```



Inferences * The Attrition is more frequent at early stage of the job. * When employee gets more used to work and gain more experinces, inshort `Attrition` decreses with time spent at company.

[18]:
```
# Now, Let's check how "MonthlyIncome" is related to "Attrition".
sns.histplot(data=df, x='MonthlyIncome', hue='Attrition', kde=True)
plt.show()
```



Inferences * The Employees with lower `MonthlyIncome` is more likely to face `Attrition`.

[27]:
```
# Define the target variable (dependent variable)
y = df['Attrition']

# Define the independent variables (features)
X = df.drop('Attrition', axis=1)
```

[28]:
```
# Perform one-hot encoding on categorical columns
X_encoded = pd.get_dummies(df, drop_first=True)
X_encoded.head()
```

[28]:
```
   Age  DailyRate  DistanceFromHome  Education  EnvironmentCount  EmployeeNumber
0   41       1102                 1          2               1               1  \
1   49        279                 8          1               1               2
2   37       1373                 2          2               1               4
3   33       1392                 3          4               1               5
4   27        591                 2          1               1               7

   EnvironmentSatisfaction  HourlyRate  JobInvolvement  JobLevel  …
0                        2          94               3         2  …  \
```

```
1                        3          61                2         2  …
2                        4          92                2         1  …
3                        4          56                3         1  …
4                        1          40                3         1  …

   JobRole_Laboratory Technician  JobRole_Manager
0                        False            False  \
1                        False            False
2                         True            False
3                        False            False
4                         True            False

   JobRole_Manufacturing Director  JobRole_Research Director
0                           False                      False  \
1                           False                      False
2                           False                      False
3                           False                      False
4                           False                      False

   JobRole_Research Scientist  JobRole_Sales Executive
0                       False                     True  \
1                        True                    False
2                       False                    False
3                        True                    False
4                       False                    False

   JobRole_Sales Representative  MaritalStatus_Married  MaritalStatus_Single
0                         False                  False                  True  \
1                         False                   True                 False
2                         False                  False                  True
3                         False                   True                 False
4                         False                   True                 False

   OverTime_Yes
0          True
1         False
2          True
3          True
4         False

[5 rows x 48 columns]
```

0.2 Model Building

We'll Follow following below steps to build our model. 1. Make data fit for model. 2. Import the model building Libraries 3. Initializing the model 4. Training and testing the model 5. Evaluation of Model

0.2.1 1. Making data fit for model.

[29]:
```python
from sklearn.preprocessing import MinMaxScaler

# Initialize the scaler
scaler = MinMaxScaler()

# Fit and transform the scaled features
X_scaled = scaler.fit_transform(X_encoded)

# Convert the scaled features back to a DataFrame (optional)
X_scaled_df = pd.DataFrame(X_scaled, columns=X_encoded.columns)

# Check data
X_scaled_df.head()
```

[29]:
```
        Age  DailyRate  DistanceFromHome  Education  EmployeeCount
0  0.547619   0.715820          0.000000       0.25            0.0  \
1  0.738095   0.126700          0.250000       0.00            0.0
2  0.452381   0.909807          0.035714       0.25            0.0
3  0.357143   0.923407          0.071429       0.75            0.0
4  0.214286   0.350036          0.035714       0.00            0.0

   EmployeeNumber  EnvironmentSatisfaction  HourlyRate  JobInvolvement
0        0.000000                 0.333333    0.914286        0.666667  \
1        0.000484                 0.666667    0.442857        0.333333
2        0.001451                 1.000000    0.885714        0.333333
3        0.001935                 1.000000    0.371429        0.666667
4        0.002903                 0.000000    0.142857        0.666667

   JobLevel  …  JobRole_Laboratory Technician  JobRole_Manager
0      0.25  …                            0.0              0.0  \
1      0.25  …                            0.0              0.0
2      0.00  …                            1.0              0.0
3      0.00  …                            0.0              0.0
4      0.00  …                            1.0              0.0

   JobRole_Manufacturing Director  JobRole_Research Director
0                             0.0                        0.0  \
1                             0.0                        0.0
2                             0.0                        0.0
3                             0.0                        0.0
4                             0.0                        0.0

   JobRole_Research Scientist  JobRole_Sales Executive
0                         0.0                      1.0  \
1                         1.0                      0.0
```

```
2                         0.0                      0.0
3                         1.0                      0.0
4                         0.0                      0.0

   JobRole_Sales Representative  MaritalStatus_Married  MaritalStatus_Single  \
0                           0.0                    0.0                   1.0
1                           0.0                    1.0                   0.0
2                           0.0                    0.0                   1.0
3                           0.0                    1.0                   0.0
4                           0.0                    1.0                   0.0

   OverTime_Yes
0           1.0
1           0.0
2           1.0
3           1.0
4           0.0

[5 rows x 48 columns]
```

[30]:
```python
from sklearn.model_selection import train_test_split

# Split the data into training and testing sets (e.g., 80% train, 20% test)
X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, random_state=42)
```

0.2.2 2. Import the model building Libraries

[35]:
```python
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score
```

0.2.3 3. Initializing the model

[36]:
```python
logistic_model = LogisticRegression(random_state=42)
random_forest_model = RandomForestClassifier(random_state=42)
```

0.2.4 4. Training and Testing the Model

[37]:
```python
# Training and testing the Logistic Regression model
logistic_model.fit(X_train, y_train)
logistic_result = logistic_model.predict(X_test)

# Training and testing the Random Forest model
random_forest_model.fit(X_train, y_train)
random_forest_result = random_forest_model.predict(X_test)
```

0.2.5 5. Evaluation

[41]:
```
# Evaluation of Logistic Regression model
logistic_accuracy = accuracy_score(y_test, logistic_result)

print("Logistic Regression Model Accuracy:", logistic_accuracy)
```

```
Logistic Regression Model Accuracy: 1.0
```

[42]:
```
# Evaluation of Random Forest model
random_forest_accuracy = accuracy_score(y_test, random_forest_result)

print("Random Forest Model Accuracy:", random_forest_accuracy)
```

```
Random Forest Model Accuracy: 1.0
```