HR Employees Analysis

In this file we'll be analyzing HR Employees information

```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

%matplotlib inline
import plotly.figure_factory as ff
import plotly.express as px
import plotly.graph_objects as go
from plotly.subplots import make_subplots
```

Reading data:

```
pd.read_excel
```

```
<function pandas.io.excel._base.read_excel(io, sheet_name: 'str | int | list[IntStrT] | None' = 0, *, header: 'int | Sequence[int] | None' = 0, names: 'list[str] | None' = None, index_col: 'int | Sequence[int] | None' = None, usecols: 'int | str | Sequence[int] | Sequence[str] | Callable[[str], bool] | None' = None, dtype: 'DtypeArg | None' = None, engine: "Literal['xlrd', 'openpyxl', 'odf', 'pyxlsb'] | None" = None, converters: 'dict[str, Callable] | dict[int, Callable] | None' = None, true_values: 'Iterable[Hashable] | None' = None, false_values: 'Iterable[Hashable] | None' = None, skiprows: 'Sequence[int] | int | Callable[[int], object] | None' = None, nrows: 'int | None' = None, na_values=None, keep_default_na: 'bool' = True, na_filter: 'bool' = True, verbose: 'bool' = False, parse_dates: 'list | dict | bool' = False, date_parser: 'Callable | lib.NoDefault' = <no_default>, date_format: 'dict[Hashable, str] | str | None' = None, thousands: 'str | None' = None, decimal: 'str' = '.', comment: 'str | None' = None, skipfooter: 'int' = 0, storage_options: 'StorageOptions' = None, dtype_backend: 'DtypeBackend | lib.NoDefault' = <no_default>) -> 'DataFrame | dict[IntStrT, DataFrame]'>
```

```
hr_df = pd.read_excel('E:\MeriSkillInternship\Project 3 - HR Analytics\HR-Employee-Attrition_python.xlsx')
```

```
hr_df.head()
```

	Age	Age Category	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education	EducationField	EmployeeCount	...	Re
0	41	Middle Age	Yes	Travel_Rarely	1102	Sales	1	2	Life Sciences	1	...	
1	49	Middle Age	No	Travel_Frequently	279	Research & Development	8	1	Life Sciences	1	...	
2	37	Middle Age	Yes	Travel_Rarely	1373	Research & Development	2	2	Other	1	...	
3	33	Middle Age	No	Travel_Frequently	1392	Research & Development	3	4	Life Sciences	1	...	
4	27	Adolescent	No	Travel_Rarely	591	Research & Development	2	1	Medical	1	...	

5 rows × 36 columns

```
hr_df.shape
```

```
(1470, 36)
```

```
hr_df.tail(5)
```

	Age	Age Category	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education	EducationField	EmployeeCount	...
1465	36	Middle Age	No	Travel_Frequently	884	Research & Development	23	2	Medical	1	...
1466	39	Middle Age	No	Travel_Rarely	613	Research & Development	6	1	Medical	1	...
1467	27	Adolescent	No	Travel_Rarely	155	Research & Development	4	3	Life Sciences	1	...
1468	49	Middle Age	No	Travel_Frequently	1023	Sales	2	3	Medical	1	...
1469	34	Middle Age	No	Travel_Rarely	628	Research & Development	8	3	Medical	1	...

5 rows × 36 columns

```
hr_df.head()
```

	Age	Age Category	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education	EducationField	EmployeeCount	...	Re
0	41	Middle Age	Yes	Travel_Rarely	1102	Sales	1	2	Life Sciences	1	...	
1	49	Middle Age	No	Travel_Frequently	279	Research & Development	8	1	Life Sciences	1	...	
2	37	Middle Age	Yes	Travel_Rarely	1373	Research & Development	2	2	Other	1	...	
3	33	Middle Age	No	Travel_Frequently	1392	Research & Development	3	4	Life Sciences	1	...	
4	27	Adolescent	No	Travel_Rarely	591	Research & Development	2	1	Medical	1	...	

5 rows × 36 columns

```
hr_df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 36 columns):
 #   Column                    Non-Null Count  Dtype 
---  ------                    --------------  ----- 
 0   Age                       1470 non-null   int64 
 1   Age Category              1470 non-null   object
 2   Attrition                 1470 non-null   object
 3   BusinessTravel            1470 non-null   object
 4   DailyRate                 1470 non-null   int64 
 5   Department                1470 non-null   object
 6   DistanceFromHome          1470 non-null   int64 
 7   Education                 1470 non-null   int64 
 8   EducationField            1470 non-null   object
 9   EmployeeCount             1470 non-null   int64 
 10  EmployeeNumber            1470 non-null   int64 
 11  EnvironmentSatisfaction   1470 non-null   int64 
 12  Gender                    1470 non-null   object
 13  HourlyRate                1470 non-null   int64 
 14  JobInvolvement            1470 non-null   int64 
 15  JobLevel                  1470 non-null   int64 
 16  JobRole                   1470 non-null   object
 17  JobSatisfaction           1470 non-null   int64 
 18  MaritalStatus             1470 non-null   object
 19  MonthlyIncome             1470 non-null   int64 
 20  MonthlyRate               1470 non-null   int64 
 21  NumCompaniesWorked        1470 non-null   int64 
 22  Over18                    1470 non-null   object
 23  OverTime                  1470 non-null   object
 24  PercentSalaryHike         1470 non-null   int64 
 25  PerformanceRating         1470 non-null   int64 
 26  RelationshipSatisfaction  1470 non-null   int64 
 27  StandardHours             1470 non-null   int64 
 28  StockOptionLevel          1470 non-null   int64 
 29  TotalWorkingYears         1470 non-null   int64 
 30  TrainingTimesLastYear     1470 non-null   int64 
```

```
 31  WorkLifeBalance           1470 non-null   int64
 32  YearsAtCompany            1470 non-null   int64
 33  YearsInCurrentRole        1470 non-null   int64
 34  YearsSinceLastPromotion   1470 non-null   int64
 35  YearsWithCurrManager      1470 non-null   int64
dtypes: int64(26), object(10)
memory usage: 413.6+ KB
```

```
hr_df.describe()
```

	Age	DailyRate	DistanceFromHome	Education	EmployeeCount	EmployeeNumber	EnvironmentSatisfaction	HourlyRate	JobInv
count	1470.000000	1470.000000	1470.000000	1470.000000	1470.0	1470.000000	1470.000000	1470.000000	14
mean	36.923810	802.485714	9.192517	2.912925	1.0	1024.865306	2.721769	65.891156	
std	9.135373	403.509100	8.106864	1.024165	0.0	602.024335	1.093082	20.329428	
min	18.000000	102.000000	1.000000	1.000000	1.0	1.000000	1.000000	30.000000	
25%	30.000000	465.000000	2.000000	2.000000	1.0	491.250000	2.000000	48.000000	
50%	36.000000	802.000000	7.000000	3.000000	1.0	1020.500000	3.000000	66.000000	
75%	43.000000	1157.000000	14.000000	4.000000	1.0	1555.750000	4.000000	83.750000	
max	60.000000	1499.000000	29.000000	5.000000	1.0	2068.000000	4.000000	100.000000	

8 rows × 26 columns

```
hr_df.columns
```

```
Index(['Age', 'Age Category', 'Attrition', 'BusinessTravel', 'DailyRate',
       'Department', 'DistanceFromHome', 'Education', 'EducationField',
       'EmployeeCount', 'EmployeeNumber', 'EnvironmentSatisfaction', 'Gender',
       'HourlyRate', 'JobInvolvement', 'JobLevel', 'JobRole',
       'JobSatisfaction', 'MaritalStatus', 'MonthlyIncome', 'MonthlyRate',
       'NumCompaniesWorked', 'Over18', 'OverTime', 'PercentSalaryHike',
       'PerformanceRating', 'RelationshipSatisfaction', 'StandardHours',
       'StockOptionLevel', 'TotalWorkingYears', 'TrainingTimesLastYear',
       'WorkLifeBalance', 'YearsAtCompany', 'YearsInCurrentRole',
       'YearsSinceLastPromotion', 'YearsWithCurrManager'],
      dtype='object')
```

Check Null Values

```
hr_df.isna().sum()
```

```
Age                         0
Age Category                0
Attrition                   0
BusinessTravel              0
DailyRate                   0
Department                  0
DistanceFromHome            0
Education                   0
EducationField              0
EmployeeCount               0
EmployeeNumber              0
EnvironmentSatisfaction     0
Gender                      0
HourlyRate                  0
JobInvolvement              0
JobLevel                    0
JobRole                     0
JobSatisfaction             0
MaritalStatus               0
MonthlyIncome               0
MonthlyRate                 0
NumCompaniesWorked          0
Over18                      0
OverTime                    0
PercentSalaryHike           0
PerformanceRating           0
RelationshipSatisfaction    0
StandardHours               0
StockOptionLevel            0
TotalWorkingYears           0
TrainingTimesLastYear       0
```

```
WorkLifeBalance           0
YearsAtCompany            0
YearsInCurrentRole        0
YearsSinceLastPromotion   0
YearsWithCurrManager      0
dtype: int64
```

Check Duplicate Values

```
hr_df.duplicated().sum()
```

```
0
```

```
#mapping non-numeric values to numeric values
hr_df_Nu = hr_df.copy()
YN_mapping = {"Yes": 1, "No": 0}
hr_df_Nu['Attrition'] = hr_df_Nu['Attrition'].map(YN_mapping)
hr_df_Nu['OverTime'] = hr_df_Nu['OverTime'].map(YN_mapping)
BusinessTravel_mapping = {"Travel_Rarely": 0, "Travel_Frequently": 1, "Non-Travel": 0}
hr_df_Nu['BusinessTravel'] = hr_df_Nu['BusinessTravel'].map(BusinessTravel_mapping)
Gender_mapping = {"Female": 1, "Male": 0}
hr_df_Nu['Gender'] = hr_df_Nu['Gender'].map(Gender_mapping)
Marital_mapping = {"Married": 1, "Single": 0, "Divorced": 0}
hr_df_Nu['MaritalStatus'] = hr_df_Nu['MaritalStatus'].map(Marital_mapping)

hr_df_Nu.head(3)
```

	Age	Age Category	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education	EducationField	EmployeeCount	...	Rela
0	41	Middle Age	1	0	1102	Sales	1	2	Life Sciences	1	...	
1	49	Middle Age	0	1	279	Research & Development	8	1	Life Sciences	1	...	
2	37	Middle Age	1	0	1373	Research & Development	2	2	Other	1	...	

3 rows × 36 columns

Numerical analysis and visualization

We'll analyze the `MonthlyIncome` column:

```
hr_df['MonthlyIncome'].describe()
```

```
count     1470.000000
mean      6502.931293
std       4707.956783
min       1009.000000
25%       2911.000000
50%       4919.000000
75%       8379.000000
max      19999.000000
Name: MonthlyIncome, dtype: float64
```

```
hr_df['MonthlyIncome'].mean()
```

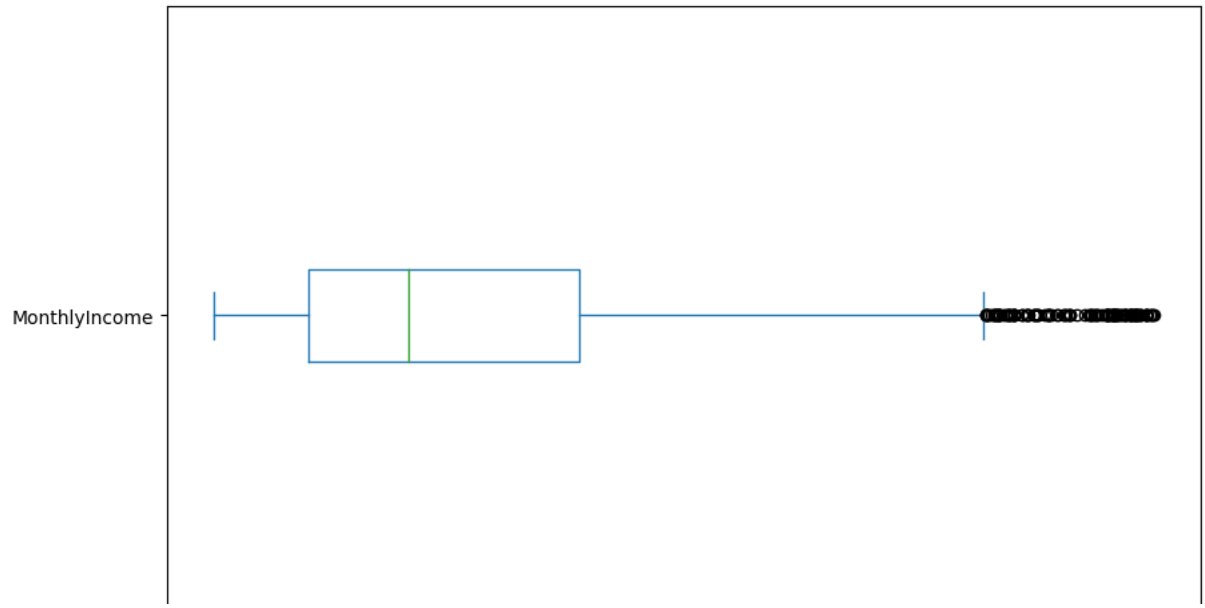
```
6502.931292517007
```

```
hr_df['MonthlyIncome'].median()
```

```
4919.0
```

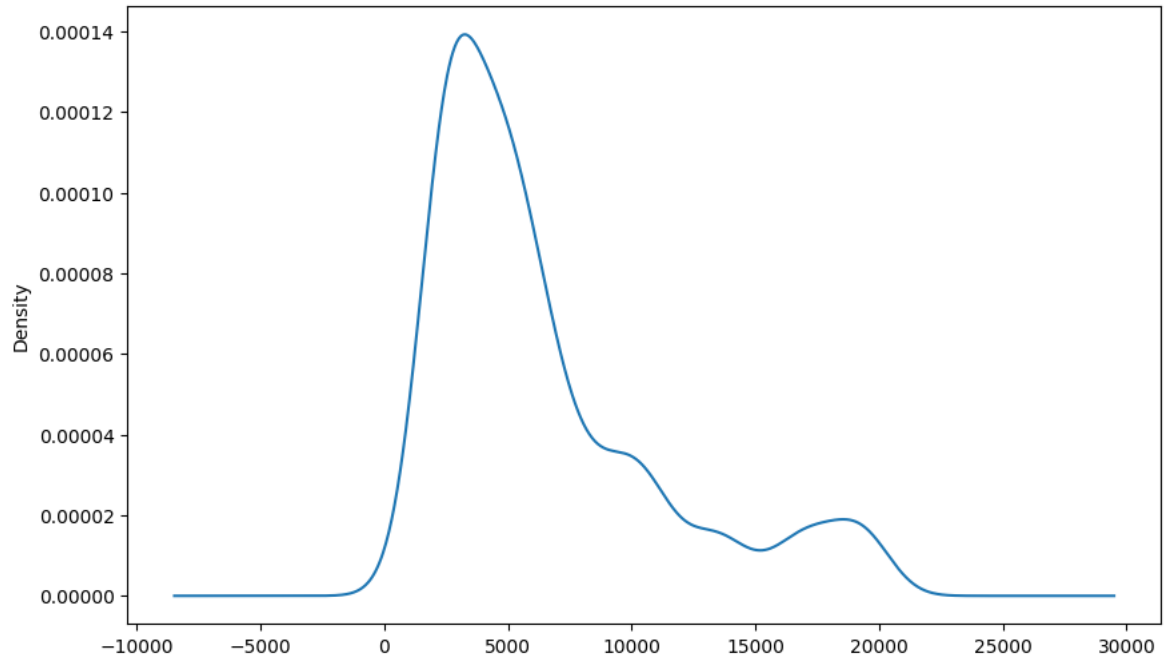
```
hr_df['MonthlyIncome'].plot(kind='box', vert=False, figsize=(10,6))
```

```
<Axes: >
```



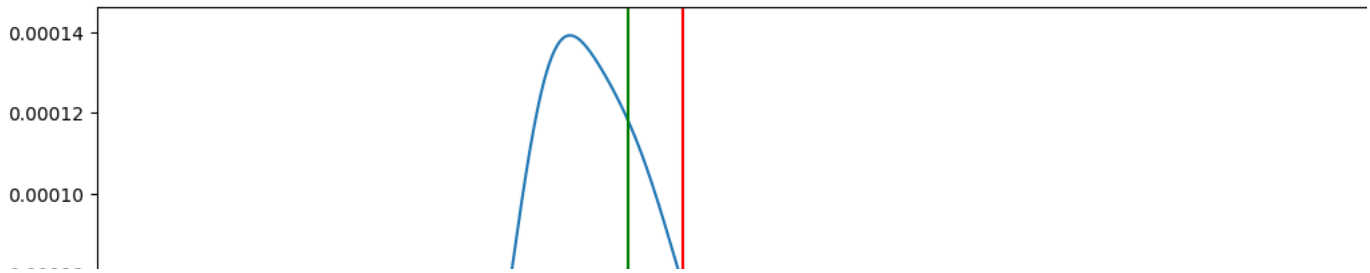

```
hr_df['MonthlyIncome'].plot(kind='density', figsize=(10,6))
```

```
<Axes: ylabel='Density'>
```



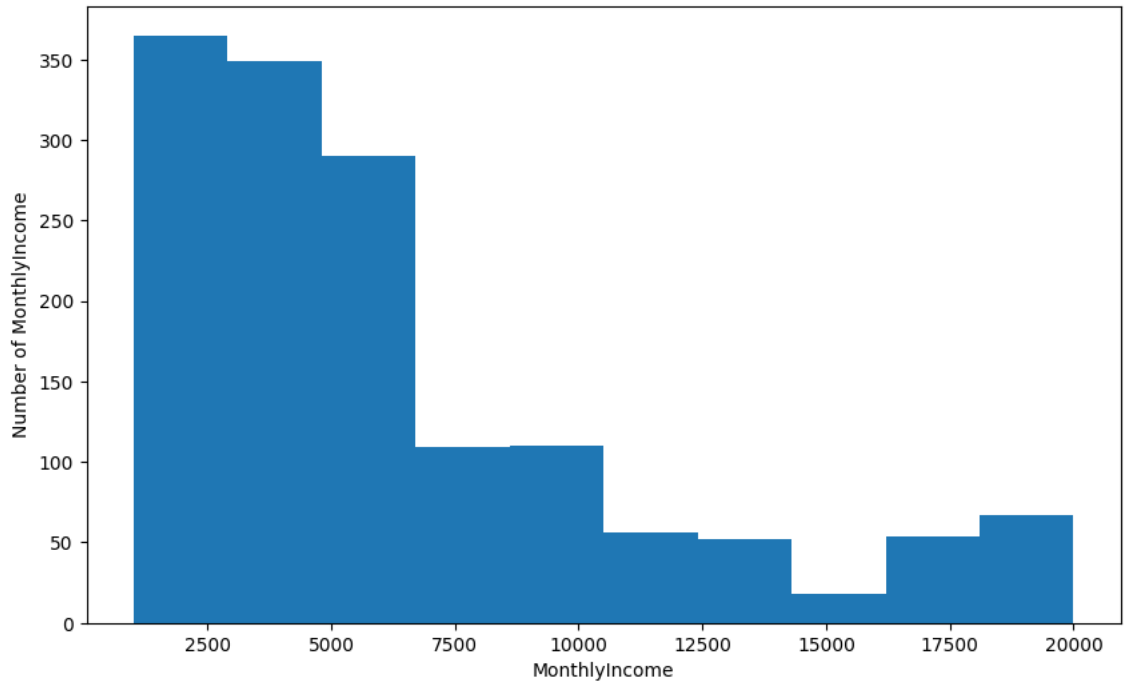

```
ax = hr_df['MonthlyIncome'].plot(kind='density', figsize=(14,6)) # kde
ax.axvline(hr_df['MonthlyIncome'].mean(), color='red')
ax.axvline(hr_df['MonthlyIncome'].median(), color='green')
```

```
<matplotlib.lines.Line2D at 0x134778afd50>
```




```
ax = hr_df['MonthlyIncome'].plot(kind='hist', figsize=(10,6))
ax.set_ylabel('Number of MonthlyIncome')
ax.set_xlabel('MonthlyIncome')
```

```
Text(0.5, 0, 'MonthlyIncome')
```



Categorical analysis and visualization

We'll analyze the `AgeCategories` column:

```
hr_df.head()
```

	Age	Age Category	Attrition	BusinessTravel	DailyRate	Department	DistanceFromHome	Education	EducationField	EmployeeCount	...	Re
0	41	Middle Age	Yes	Travel_Rarely	1102	Sales	1	2	Life Sciences	1	...	
1	49	Middle Age	No	Travel_Frequently	279	Research & Development	8	1	Life Sciences	1	...	
2	37	Middle Age	Yes	Travel_Rarely	1373	Research & Development	2	2	Other	1	...	
3	33	Middle Age	No	Travel_Frequently	1392	Research & Development	3	4	Life Sciences	1	...	
4	27	Adolescent	No	Travel_Rarely	591	Research & Development	2	1	Medical	1	...	

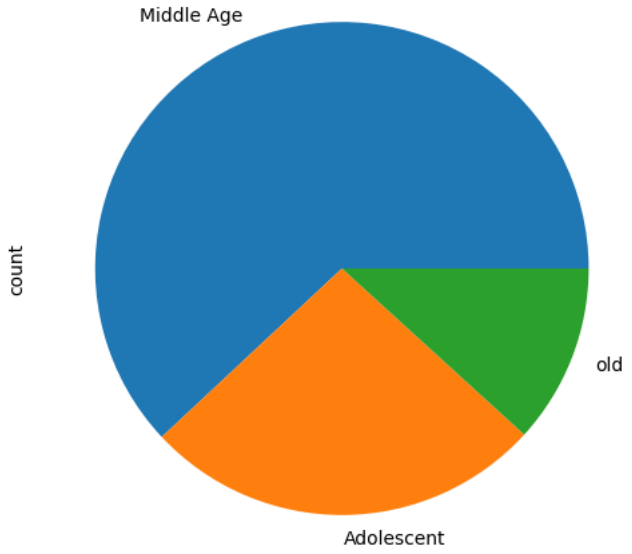
5 rows × 36 columns

```
hr_df['Age Category'].value_counts()
```

```
Age Category
Middle Age    911
Adolescent    386
old           173
Name: count, dtype: int64
```

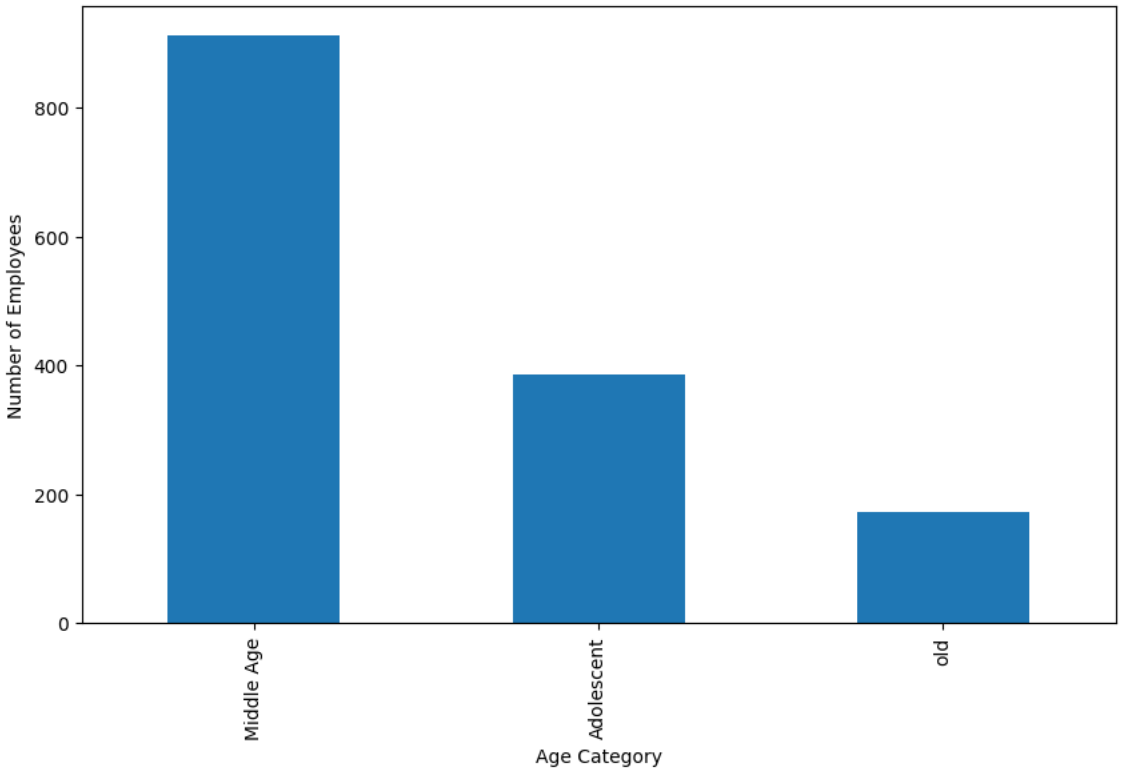
```
hr_df['Age Category'].value_counts().plot(kind='pie', figsize=(6,6))
```

```
<Axes: ylabel='count'>
```




```
ax = hr_df['Age Category'].value_counts().plot(kind='bar', figsize=(10,6))
ax.set_ylabel('Number of Employees')
```

```
Text(0, 0.5, 'Number of Employees')
```

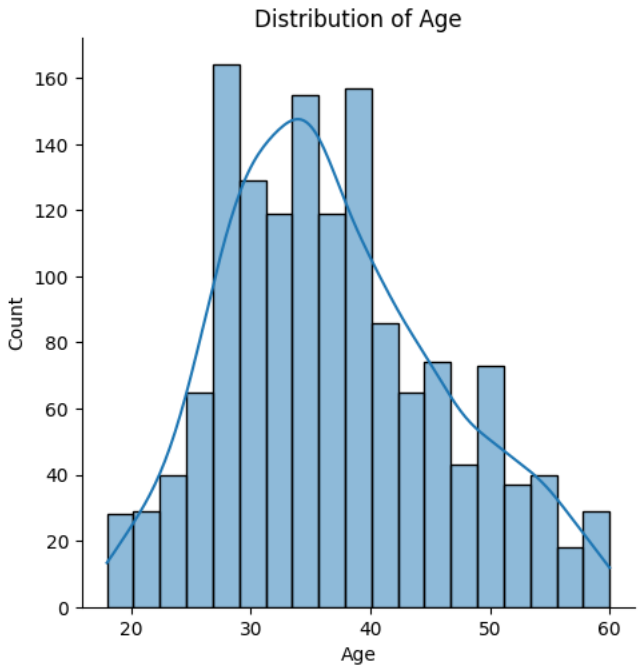


Age Distribution

```
sns.displot(hr_df['Age'], kde=True)
plt.title('Distribution of Age')
```

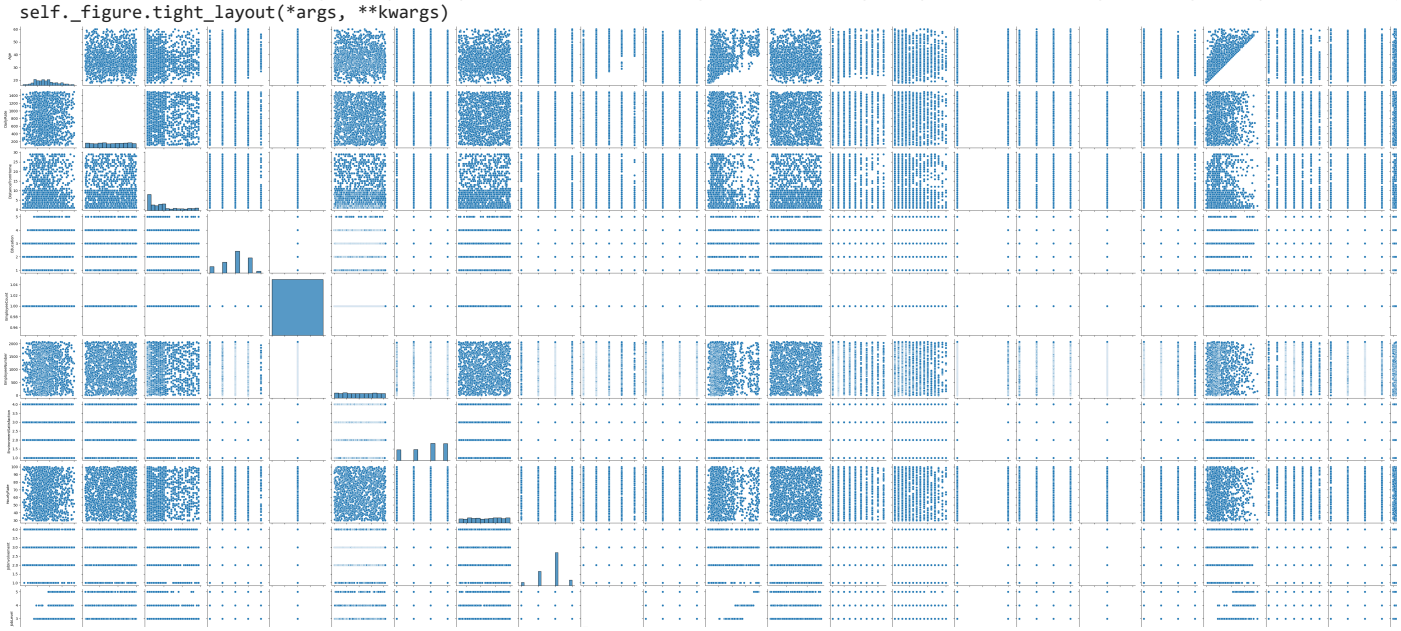
```
plt.title('Distribution of Age')
plt.show()
```

```
c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning: The figure layout has chang
  self._figure.tight_layout(*args, **kwargs)
```

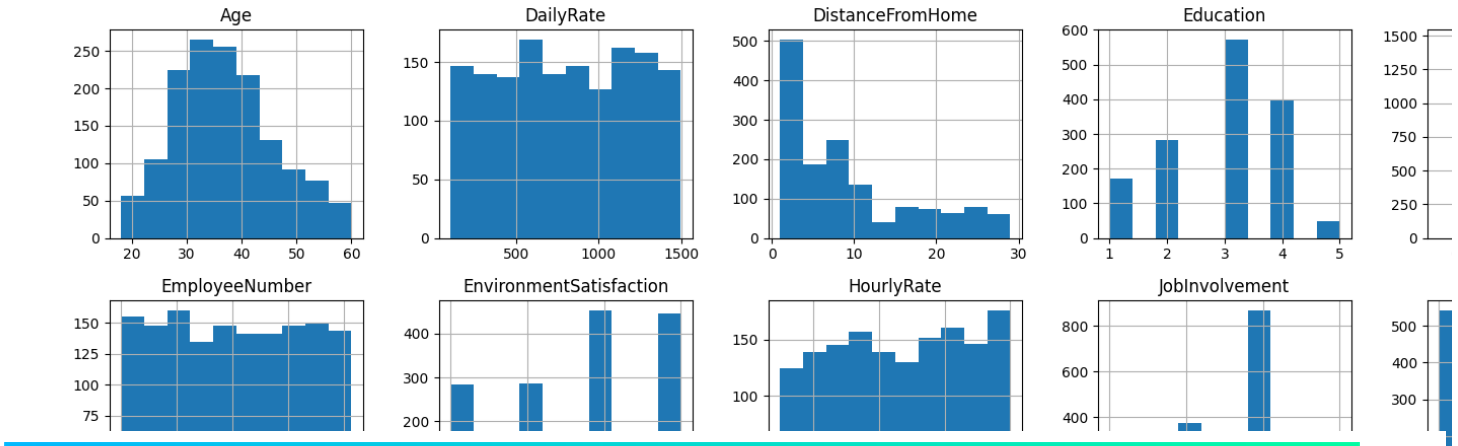



```
sns.pairplot(hr_df)
plt.show()
```

```
c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning: The figure layout has chang
  self._figure.tight_layout(*args, **kwargs)
```



```
hr_df.hist(figsize=(20,20))
plt.show()
```



Relationship between the columns?

We will find any significant relationship

```
front =hr_df['Attrition']
hr_df.drop(labels=['Attrition'], axis=1,inplace = True)
hr_df.insert(0, 'Attrition', front)
hr_df.head()
```

	Attrition	Age	Age Category	BusinessTravel	DailyRate	Department	DistanceFromHome	Education	EducationField	EmployeeCount	...	Re
0	Yes	41	Middle Age	Travel_Rarely	1102	Sales	1	2	Life Sciences	1	...	
1	No	49	Middle Age	Travel_Frequently	279	Research & Development	8	1	Life Sciences	1	...	
2	Yes	37	Middle Age	Travel_Rarely	1373	Research & Development	2	2	Other	1	...	
3	No	33	Middle Age	Travel_Frequently	1392	Research & Development	3	4	Life Sciences	1	...	
4	No	27	Adolescent	Travel_Rarely	591	Research & Development	2	1	Medical	1	...	

5 rows × 36 columns

```
attrition_rate = hr_df.Attrition.value_counts() / 1470
attrition_rate
```

```
Attrition
No     0.838776
Yes    0.161224
Name: count, dtype: float64
```

```
AttritionSummery= hr_df.groupby('Attrition')
AttritionSummery
```

```
<pandas.core.groupby.generic.DataFrameGroupBy object at 0x000001340B301090>
```

```
AttritionSummery.max()
```

```
cat_cols=hr_df.select_dtypes(include=object).columns.tolist()
cat_df=pd.DataFrame(hr_df[cat_cols].melt(var_name='column', value_name='value')
                    .value_counts()).rename(columns={0: 'count'}).sort_values(by=['column', 'count'])
display(hr_df.select_dtypes(include=object).describe())
display(cat_df)
```

	Attrition	Age Category	BusinessTravel	Department	EducationField	Gender	JobRole	MaritalStatus	Over18	Over
count	1470	1470	1470	1470	1470	1470	1470	1470	1470	
unique	2	3	3	3	6	2	9	3	1	
top	No	Middle Age	Travel_Rarely	Research & Development	Life Sciences	Male	Sales Executive	Married	Y	
freq	1233	911	1043	961	606	882	326	673	1470	

		count
column	value	
Age Category	old	173
	Adolescent	386
	Middle Age	911
Attrition	Yes	237
	No	1233
BusinessTravel	Non-Travel	150
	Travel_Frequently	277
	Travel_Rarely	1043
Department	Human Resources	63
	Sales	446
	Research & Development	961
EducationField	Human Resources	27
	Other	82
	Technical Degree	132
	Marketing	159
	Medical	464
	Life Sciences	606
Gender	Female	588
	Male	882
JobRole	Human Resources	52
	Research Director	80
	Sales Representative	83
	Manager	102
	Healthcare Representative	131
	Manufacturing Director	145

```
fig=make_subplots(rows=1, cols=2,
                  subplot_titles=("", "Employee Attrition by Department"),
                  specs=[[{"type": "bar"}, {"type": "pie"}]])

# Bar chart
plot_df=hr_df['Attrition'].value_counts(normalize=True)
plot_df=plot_df.mul(100).rename('Percent').reset_index().sort_values('Percent')
plot_df.rename(columns={'index':'Attrition'}, inplace=True)
plot_df['Attrition']=['Former Employees' if i == 'Yes' else 'Current Employees' for i in plot_df['Attrition']]
x=plot_df['Attrition']
y=plot_df['Percent']
fig.add_trace(
    go.Bar(x=x, y=y, text=y,opacity=.8,
           hovertemplate='Employee Attrition Rate<br>%{x}: %{y:.3}%<extra></extra>',
           showlegend=False), row=1, col=1)
fig.update_traces(texttemplate='%{text:.3s}%', textposition='outside',
                  marker_line=dict(width=1, color='#1F0202'), marker_color=['#C02B34','#CDBBA7'])
fig.update_yaxes(zeroline=True, zerolinewidth=1, zerolinecolor='gray')
fig.update_layout(yaxis_ticksuffix = '%')

# Pie chart
plot_df2=hr_df[hr_df.Attrition=='Yes']
plot_df2=plot_df2['Department'].value_counts(normalize=True)
plot_df2=plot_df2.mul(100).rename('Percent').reset_index().sort_values('Percent', ascending=False)
plot_df2.rename(columns={'index':'Department'}, inplace=True)
fig.add_trace(go.Pie(labels=plot_df2['Department'], values=plot_df2['Percent'], opacity=0.85, hole=0.4,
                     hovertemplate='%{label}<br>Attrition Rate: %{value:.3}%<extra></extra>',
                     marker_colors=['#587D65','#ADC4B2','#D1C9C2']), row=1, col=2)
fig.update_yaxes(tickmode = 'array', range=[0, 90], dtick=5)
fig.update_traces(textfont_size=14,textfont_color='black',marker=dict(line=dict(color='#28221D', width=1)))
fig.update_layout(title_text="Employee Attrition Statistics", font_color='#28221D',
                  paper_bgcolor='#F4F2F0', plot_bgcolor='#F4F2F0')
fig.show()
```

```
plot_df = hr_df.groupby(['WorkLifeBalance','Gender'])['Attrition'].value_counts(normalize=True)
plot_df = plot_df.mul(100).rename('Percent').reset_index()
fig = px.bar(plot_df, x='WorkLifeBalance', y='Percent', color='Attrition',
             facet_row='Gender', text='Percent', opacity=0.75, barmode='group',
             category_orders={'Attrition': ['Yes', 'No']},
             color_discrete_map={'Yes': '#C02B34','No': '#CDBBA7'})
fig.update_traces(texttemplate='%{text:.2s}%', textposition='outside',
                  marker_line=dict(width=1, color='#28221D'))
fig.update_yaxes(title="",zeroline=True, zerolinewidth=1, zerolinecolor='#1F0202',ticksuffix = '%')
fig.update_layout(title_text='Attrition Rates by Work Life Balance and Gender',height=750,font_color='#28221D',
                  xaxis_title='Work Life Balance', paper_bgcolor='#F4F2F0', plot_bgcolor='#F4F2F0',
                  xaxis = dict(tickmode = 'array', tickvals = [1, 2, 3, 4],
                               ticktext = ['Poor', 'Neutral', 'Good', 'Excellent']))
fig.show()
```

```
plot_df = hr_df.groupby(['Gender','Department'])['Attrition'].value_counts(normalize=True)
plot_df = plot_df.mul(100).rename('Percent').reset_index()
fig = px.bar(plot_df, x="Department", y="Percent", color="Attrition", barmode="group",
             text='Percent', opacity=.75, facet_col="Gender", category_orders={'Attrition': ['Yes', 'No']},
             color_discrete_map={'Yes': '#C02B34','No': '#CDBBA7'})
fig.update_traces(texttemplate='%{text:.3s}%', textposition='outside',
                  marker_line=dict(width=1, color='#28221D'),  width=.4)
fig.update_layout(title_text='Attrition Rates by Department and Gender', yaxis_ticksuffix = '%',
                  paper_bgcolor='#F4F2F0', plot_bgcolor='#F4F2F0',font_color='#28221D',
                  height=500, xaxis=dict(tickangle=30))
fig.update_xaxes(showticklabels=True,tickangle=30,col=2)
fig.update_yaxes(title = "", zeroline=True, zerolinewidth=1, zerolinecolor='#28221D')
fig.show()
```

```
plot_df = hr_df.groupby(['Attrition'])['JobSatisfaction'].value_counts(normalize=True)
plot_df = plot_df.mul(100).rename('Percent').reset_index().sort_values('JobSatisfaction')
plot_df.JobSatisfaction=pd.Categorical(plot_df.JobSatisfaction).rename_categories(
    {1:'Poor', 2:'Neutral', 3:'Good', 4:'Excellent'})
fig = px.bar(plot_df, x='JobSatisfaction', y='Percent', text='Percent', opacity=0.8,
             facet_col="Attrition", category_orders={"Attrition": ["Yes", "No"]})
fig.update_traces(texttemplate='%{text:.2s}%', textposition='outside',
```

```
                  marker_color=['#B6735F', '#D7C2B0', '#497B7A', '#9EB5A3'],
                  marker_line=dict(width=1, color='#28221D'))
fig.update_yaxes(title="",zeroline=True, zerolinewidth=1, zerolinecolor='#28221D', ticksuffix='%')
fig.update_layout(title_text='Attrition Rates by Job Satisfaction', bargap=.09,font_color='#28221D',
                  xaxis_title='Job Satisfaction',paper_bgcolor='#F4F2F0', plot_bgcolor='#F4F2F0')
fig.show()
```

```
plot_df = hr_df.groupby(['Department', 'Gender'])['MonthlyIncome'].mean()
plot_df = plot_df.mul(12).rename('Salary').reset_index().sort_values('Salary', ascending=False)
fig = px.bar(plot_df, x='Department', y='Salary', color='Gender', text='Salary',
             barmode='group', opacity=0.75, color_discrete_map={'Female': '#214D5C','Male': '#ACBCC2'})
fig.update_traces(texttemplate='$%{text:,.0f}', textposition='outside',
                  marker_line=dict(width=1, color='#28221D'))
fig.update_yaxes(zeroline=True, zerolinewidth=1, zerolinecolor='#28221D')
fig.update_layout(title_text='Average Salaries by Department & Gender', font_color='#28221D',
                  yaxis=dict(title='Salary',tickprefix='$'), paper_bgcolor='#F4F2F0', plot_bgcolor='#F4F2F0')
fig.show()
```

```
plot_df = hr_df.groupby(['Department', 'Attrition', 'Gender'])['MonthlyIncome'].median()
plot_df = plot_df.mul(12).rename('Salary').reset_index().sort_values('Salary', ascending=False).sort_values('Gender')
fig = px.bar(plot_df, x='Department', y='Salary', color='Gender', text='Salary',
             barmode='group', opacity=0.75, color_discrete_map={'Female': '#214D5C','Male': '#ACBCC2'},
             facet_col='Attrition', category_orders={'Attrition': ['Yes', 'No']})
fig.update_traces(texttemplate='$%{text:,.0f}', textposition='outside',
                  marker_line=dict(width=1, color='#28221D'))
fig.update_yaxes(zeroline=True, zerolinewidth=1, zerolinecolor='#28221D')
fig.update_layout(title_text='Median Salaries by Department and Attrition Status', font_color='#28221D',
                  yaxis=dict(title='Salary',tickprefix='$',range=(0,79900)),width=950,height=500,
                  paper_bgcolor='#F4F2F0', plot_bgcolor='#F4F2F0')
fig.show()
```

```
plot_df = hr_df.groupby('JobRole')['MonthlyIncome'].mean()
plot_df = plot_df.mul(12).rename('Salary').reset_index().sort_values('Salary', ascending=False)
fig = px.bar(plot_df, x='JobRole', y='Salary', text='Salary', opacity=0.7)
fig.update_traces(texttemplate='$%{text:,.0f}', textposition='outside',
                  marker_line=dict(width=1, color='#28221D'), marker_color='#3A5F53')
fig.update_yaxes(zeroline=True, zerolinewidth=1, zerolinecolor='#28221D')
fig.update_layout(title_text='Average Salaries by Job Role', font_color='#28221D',
                  yaxis=dict(title='Salary',tickprefix='$'), height=500,
                  xaxis_title='', paper_bgcolor='#F4F2F0', plot_bgcolor='#F4F2F0')
fig.show()
```

```
cat_cols=[]
for i in hr_df.columns:
    if hr_df[i].nunique() <= 5 or hr_df[i].dtype == object:
        cat_cols.append(i)
df=hr_df.copy()
df.drop(df[cat_cols], axis=1, inplace=True)
df.drop('EmployeeNumber', axis=1, inplace=True)
corr=df.corr().round(2)
x=corr.index.tolist()
y=corr.columns.tolist()
z=corr.to_numpy()
fig = ff.create_annotated_heatmap(z=z, x=x, y=y, annotation_text=z, name='',
                                  hovertemplate="Correlation between %{x} and %{y}= %{z}",
                                  colorscale='GnBu')
fig.update_yaxes(autorange="reversed")
fig.update_layout(title="Correlation Matrix of Employee Attrition",
                  font_color='#28221D',margin=dict(t=180),height=600)
fig.show()
```

Objective Factors

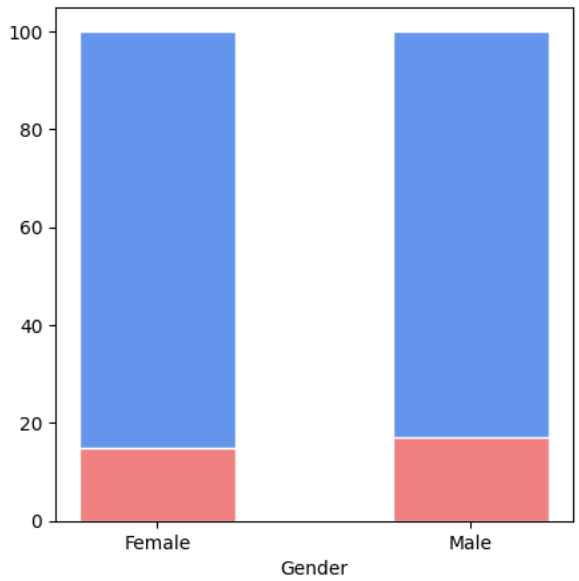
```
Age_YAC_NCW = hr_df[['Age','YearsAtCompany','NumCompaniesWorked','Attrition']]
Age_YAC_NCW.head()
AYN_melt = Age_YAC_NCW.melt(['Attrition'], var_name='cols',  value_name='vals')
AYN_melt.head()
```

	Attrition	cols	vals
0	Yes	Age	41
1	No	Age	49
2	Yes	Age	37
3	No	Age	33
4	No	Age	27

```
g = sns.FacetGrid(AYN_melt, col='cols', hue="Attrition", palette="Set1")
g = (g.map(sns.distplot, "vals", hist=False, rug=False, kde_kws={"shade": True}).add_legend());
#Focus on the red area--distribution of Attrition
#Lots of attrition among the 'young' employees (for Age or for YearsAtCompany)-- not surprising -- trial to find a suit -- company culture..
#Those who have worked in more than 5 companies tend to attrit. -- The average time spent in every company is shorter -- HR insight..
```

```
c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:


`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:


`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:
```

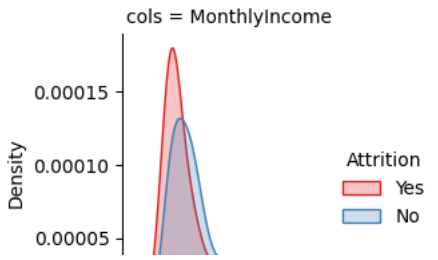
```
# Data
r = [0,1]
Y_F = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['Gender'] == 'Female')])
N_F = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['Gender'] == 'Female')])
Y_M = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['Gender'] == 'Male')])
N_M = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['Gender'] == 'Male')])
raw_data = {'greenBars': [Y_F, Y_M], 'orangeBars': [N_F, N_M]}
df = pd.DataFrame(raw_data)

# From raw value to percentage
totals = [i+j for i,j in zip(df['greenBars'], df['orangeBars'])]
greenBars = [i / j * 100 for i,j in zip(df['greenBars'], totals)]
orangeBars = [i / j * 100 for i,j in zip(df['orangeBars'], totals)]

# plot
plt.figure(figsize=(5,5))
barWidth = 0.5
names = ('Female','Male')
# Create green Bars
plt.bar(r, greenBars, color='lightcoral', edgecolor='white', width=barWidth)
# Create orange Bars
plt.bar(r, orangeBars, bottom=greenBars, color='cornflowerblue', edgecolor='white', width=barWidth)
# Create blue Bars
#plt.bar(r, blueBars, bottom=[i+j for i,j in zip(greenBars, orangeBars)], color='#a3acff', edgecolor='white', width=barWidth)

# Custom x axis
plt.xticks(r, names)
plt.xlabel("Gender")

# Show graphic
plt.show()
```



Return and Bonus

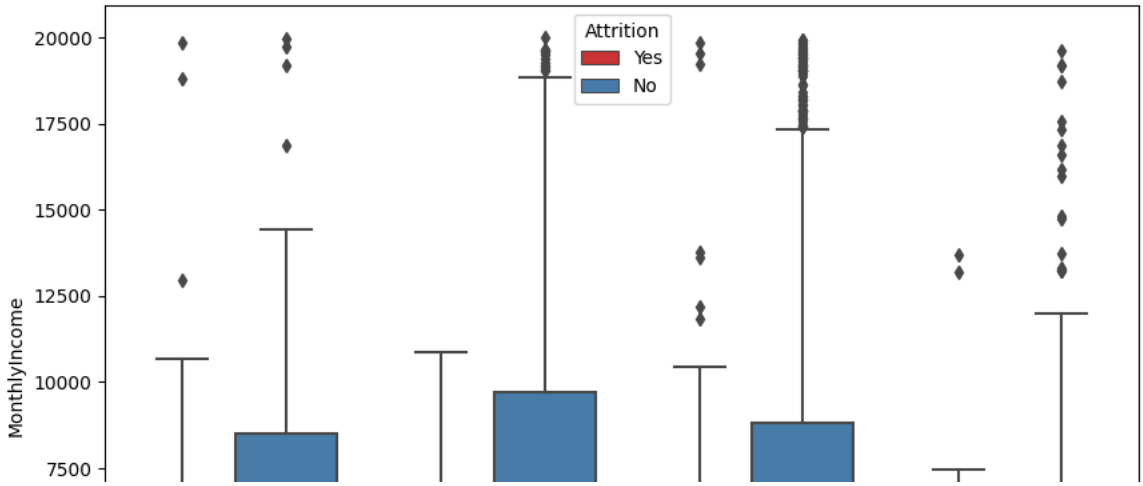
```
Income = hr_df[['MonthlyIncome','Attrition']]
Income_melt = Income.melt(['Attrition'], var_name='cols',  value_name='vals')


g = sns.FacetGrid(Income_melt, col='cols', hue="Attrition", palette="Set1")
g = (g.map(sns.distplot, "vals", hist=False, rug=False, kde_kws={"shade": True}).add_legend())
#Employees with low income tend to attrit
```

```
c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:


`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:


`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning:

The figure layout has changed to tight
```




```
plt.figure(figsize=(10,7))
sns.boxplot(x="JobInvolvement", y="MonthlyIncome", hue="Attrition",
            data=hr_df, palette="Set1")
##Interesting Finding: Low income together with similar involvement is the reason behind attrition
```

```
<Axes: xlabel='JobInvolvement', ylabel='MonthlyIncome'>
```




```
TS = hr_df[['TrainingTimesLastYear','StockOptionLevel','Attrition']]
#Age_YAC_NCW.head()
TS_melt = TS.melt(['Attrition'], var_name='cols',  value_name='vals')
#AYN_melt.head()
g = sns.FacetGrid(TS_melt, col='cols', hue="Attrition", palette="Set1")
g = (g.map(sns.distplot, "vals", hist=False, rug=False, kde_kws={"shade": True}).add_legend())
#Employee pay attention to stock option -- when given option, work for the company may increase return.
```

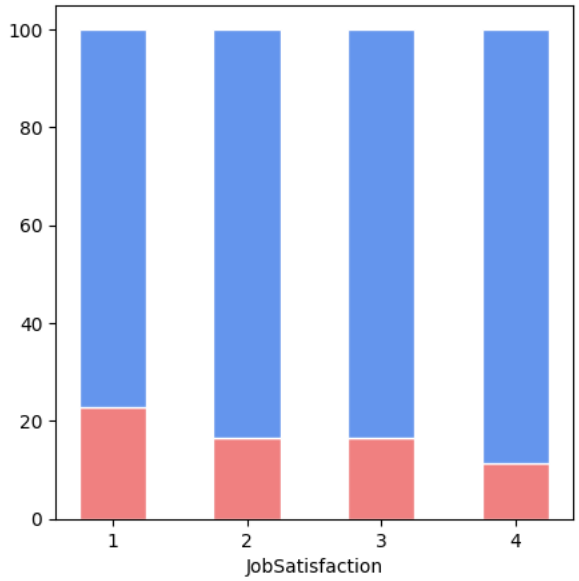
```
c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:


`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:


`shade` is now deprecated in favor of `fill`; setting `fill=True`.
This will become an error in seaborn v0.14.0; please update your code.


c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\axisgrid.py:848: UserWarning:


`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `kdeplot` (an axes-level function for kernel density plots).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751
```

Satisfaction

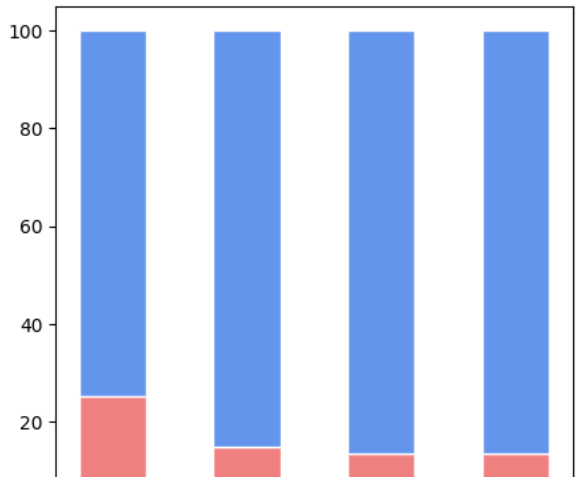
```
c:\Users\USER\AppData\Local\Programs\Python\Python311\Lib\site-packages\seaborn\distributions.py:2511: FutureWarning:
```

```
# Data
r = [0,1,2,3]
Y_J1 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['JobSatisfaction'] == 1)])
N_J1 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['JobSatisfaction'] == 1)])
Y_J2 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['JobSatisfaction'] == 2)])
N_J2 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['JobSatisfaction'] == 2)])
Y_J3 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['JobSatisfaction'] == 3)])
N_J3 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['JobSatisfaction'] == 3)])
Y_J4 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['JobSatisfaction'] == 4)])
N_J4 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['JobSatisfaction'] == 4)])
raw_data = {'greenBars': [Y_J1, Y_J2,Y_J3,Y_J4], 'orangeBars': [N_J1,N_J2,N_J3,N_J4]}
df = pd.DataFrame(raw_data)

# From raw value to percentage
totals = [i+j for i,j in zip(df['greenBars'], df['orangeBars'])]
greenBars = [i / j * 100 for i,j in zip(df['greenBars'], totals)]
orangeBars = [i / j * 100 for i,j in zip(df['orangeBars'], totals)]

# plot
plt.figure(figsize=(5,5))
barWidth = 0.5
names = ('1','2','3','4')
# Create green Bars
plt.bar(r, greenBars, color='lightcoral', edgecolor='white', width=barWidth)
# Create orange Bars
```

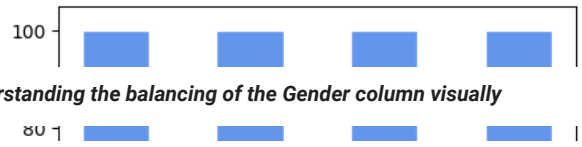
```
plt.bar(r, orangeBars, bottom=greenBars, color='cornflowerblue', edgecolor='white', width=barWidth)
# Create blue Bars
#plt.bar(r, blueBars, bottom=[i+j for i,j in zip(greenBars, orangeBars)], color='#a3acff', edgecolor='white', width=barWidth)

# Custom x axis
plt.xticks(r, names)
plt.xlabel("JobSatisfaction")

# Show graphic
plt.show()
```




```
# Data
r = [0,1,2,3]
Y_J1 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['EnvironmentSatisfaction'] == 1)])
N_J1 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['EnvironmentSatisfaction'] == 1)])
Y_J2 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['EnvironmentSatisfaction'] == 2)])
N_J2 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['EnvironmentSatisfaction'] == 2)])
Y_J3 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['EnvironmentSatisfaction'] == 3)])
N_J3 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['EnvironmentSatisfaction'] == 3)])
Y_J4 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['EnvironmentSatisfaction'] == 4)])
N_J4 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['EnvironmentSatisfaction'] == 4)])
raw_data = {'greenBars': [Y_J1, Y_J2,Y_J3,Y_J4], 'orangeBars': [N_J1,N_J2,N_J3,N_J4]}
df = pd.DataFrame(raw_data)

# From raw value to percentage
totals = [i+j for i,j in zip(df['greenBars'], df['orangeBars'])]
greenBars = [i / j * 100 for i,j in zip(df['greenBars'], totals)]
orangeBars = [i / j * 100 for i,j in zip(df['orangeBars'], totals)]

# plot
plt.figure(figsize=(5,5))
barWidth = 0.5
names = ('1','2','3','4')
# Create green Bars
plt.bar(r, greenBars, color='lightcoral', edgecolor='white', width=barWidth)
# Create orange Bars
plt.bar(r, orangeBars, bottom=greenBars, color='cornflowerblue', edgecolor='white', width=barWidth)
# Create blue Bars
#plt.bar(r, blueBars, bottom=[i+j for i,j in zip(greenBars, orangeBars)], color='#a3acff', edgecolor='white', width=barWidth)

# Custom x axis
plt.xticks(r, names)
plt.xlabel("EnvironmentSatisfaction")

# Show graphic
plt.show()
```



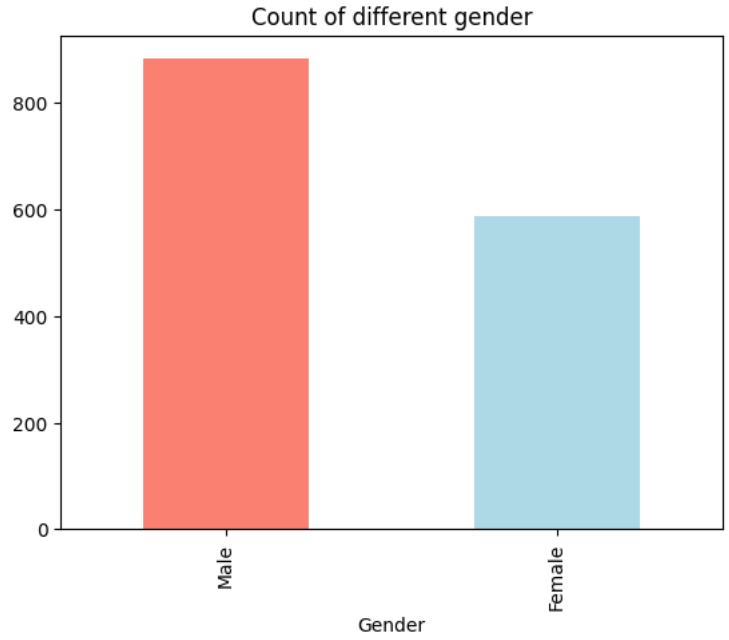

```
# Data
r = [0,1,2,3]
Y_J1 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['RelationshipSatisfaction'] == 1)])
N_J1 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['RelationshipSatisfaction'] == 1)])
Y_J2 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['RelationshipSatisfaction'] == 2)])
N_J2 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['RelationshipSatisfaction'] == 2)])
Y_J3 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['RelationshipSatisfaction'] == 3)])
N_J3 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['RelationshipSatisfaction'] == 3)])
Y_J4 = len(hr_df[(hr_df['Attrition'] == 'Yes') & (hr_df['RelationshipSatisfaction'] == 4)])
N_J4 = len(hr_df[(hr_df['Attrition'] == 'No') & (hr_df['RelationshipSatisfaction'] == 4)])
raw_data = {'greenBars': [Y_J1, Y_J2,Y_J3,Y_J4], 'orangeBars': [N_J1,N_J2,N_J3,N_J4]}
df = pd.DataFrame(raw_data)

# From raw value to percentage
totals = [i+j for i,j in zip(df['greenBars'], df['orangeBars'])]
greenBars = [i / j * 100 for i,j in zip(df['greenBars'], totals)]
orangeBars = [i / j * 100 for i,j in zip(df['orangeBars'], totals)]

# plot
plt.figure(figsize=(5,5))
barWidth = 0.5
names = ('1','2','3','4')
# Create green Bars
plt.bar(r, greenBars, color='lightcoral', edgecolor='white', width=barWidth)
# Create orange Bars
plt.bar(r, orangeBars, bottom=greenBars, color='cornflowerblue', edgecolor='white', width=barWidth)
# Create blue Bars
#plt.bar(r, blueBars, bottom=[i+j for i,j in zip(greenBars, orangeBars)], color='#a3acff', edgecolor='white', width=barWidth)

# Custom x axis
plt.xticks(r, names)
plt.xlabel("RelationshipSatisfaction")

# Show graphic
plt.show()
```



Understanding the balancing of the Gender column visually


```
hr_df['Gender'].value_counts().plot(kind='bar',color=['salmon','lightblue'],title="Count of different gender")
```

```
<Axes: title={'center': 'Count of different gender'}, xlabel='Gender'>
```

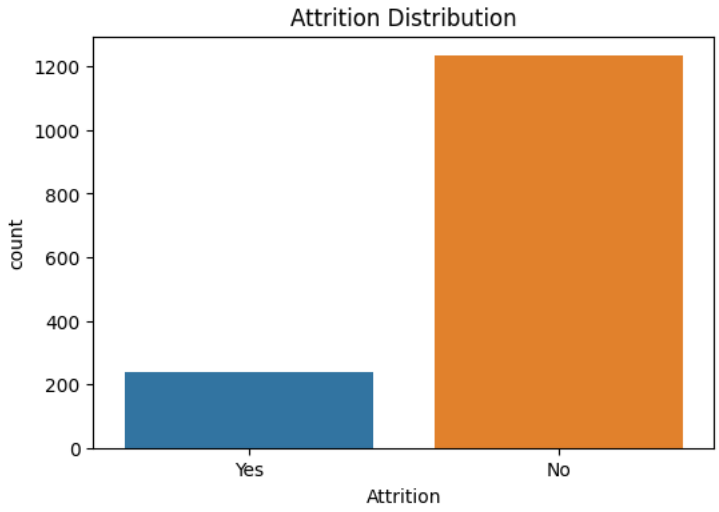



```
hr_df['Gender'].value_counts()
```

```
Gender
Male      882
Female    588
Name: count, dtype: int64
```

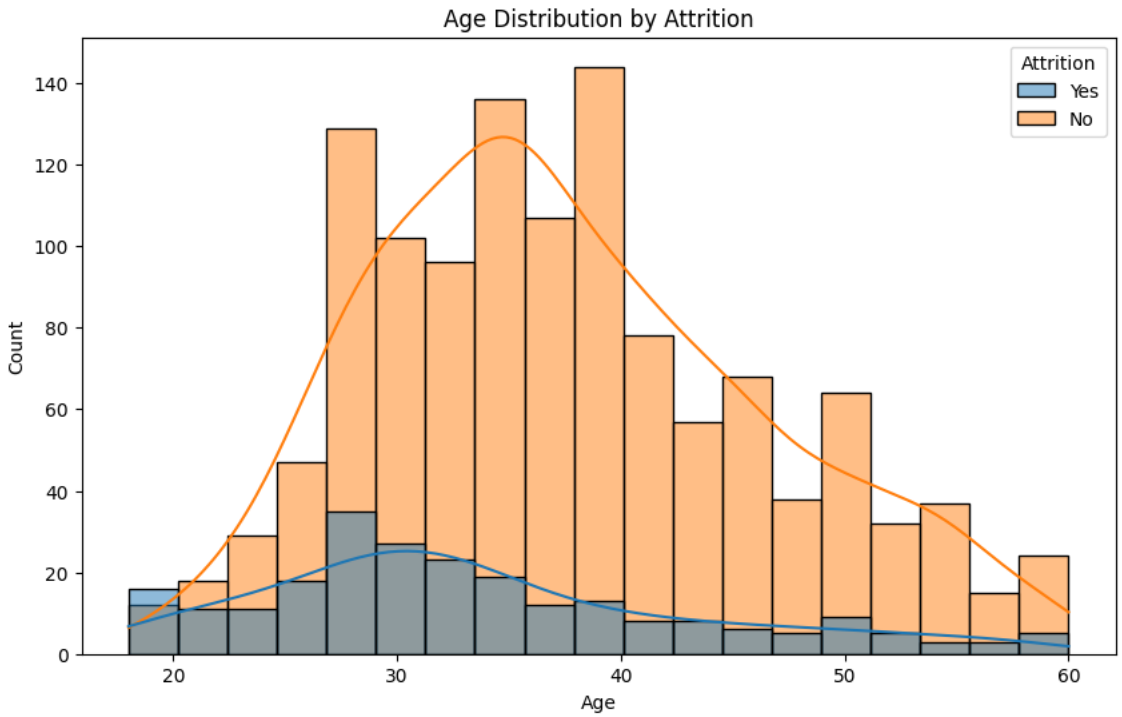
Attrition Distribution

```
plt.figure(figsize=(6, 4))
sns.countplot(data=hr_df, x='Attrition')
plt.title('Attrition Distribution')
plt.show()
```

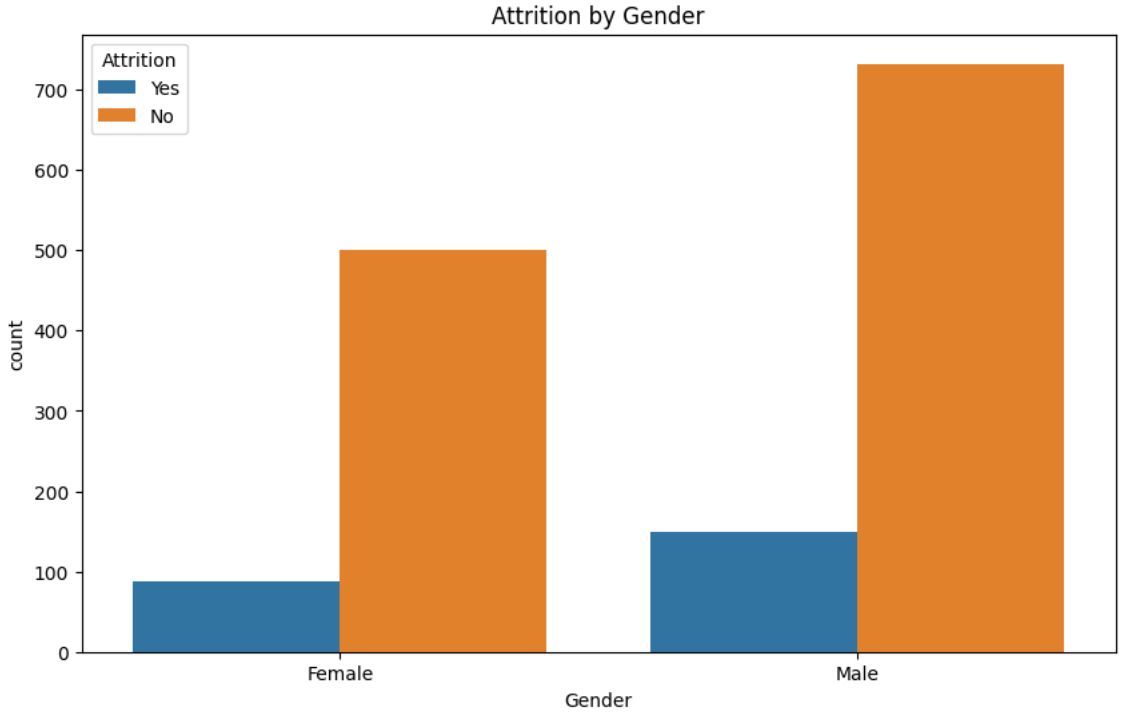



```
# Explore numeric variables (e.g., Age, MonthlyIncome) with histograms and box plots
plt.figure(figsize=(10, 6))
```

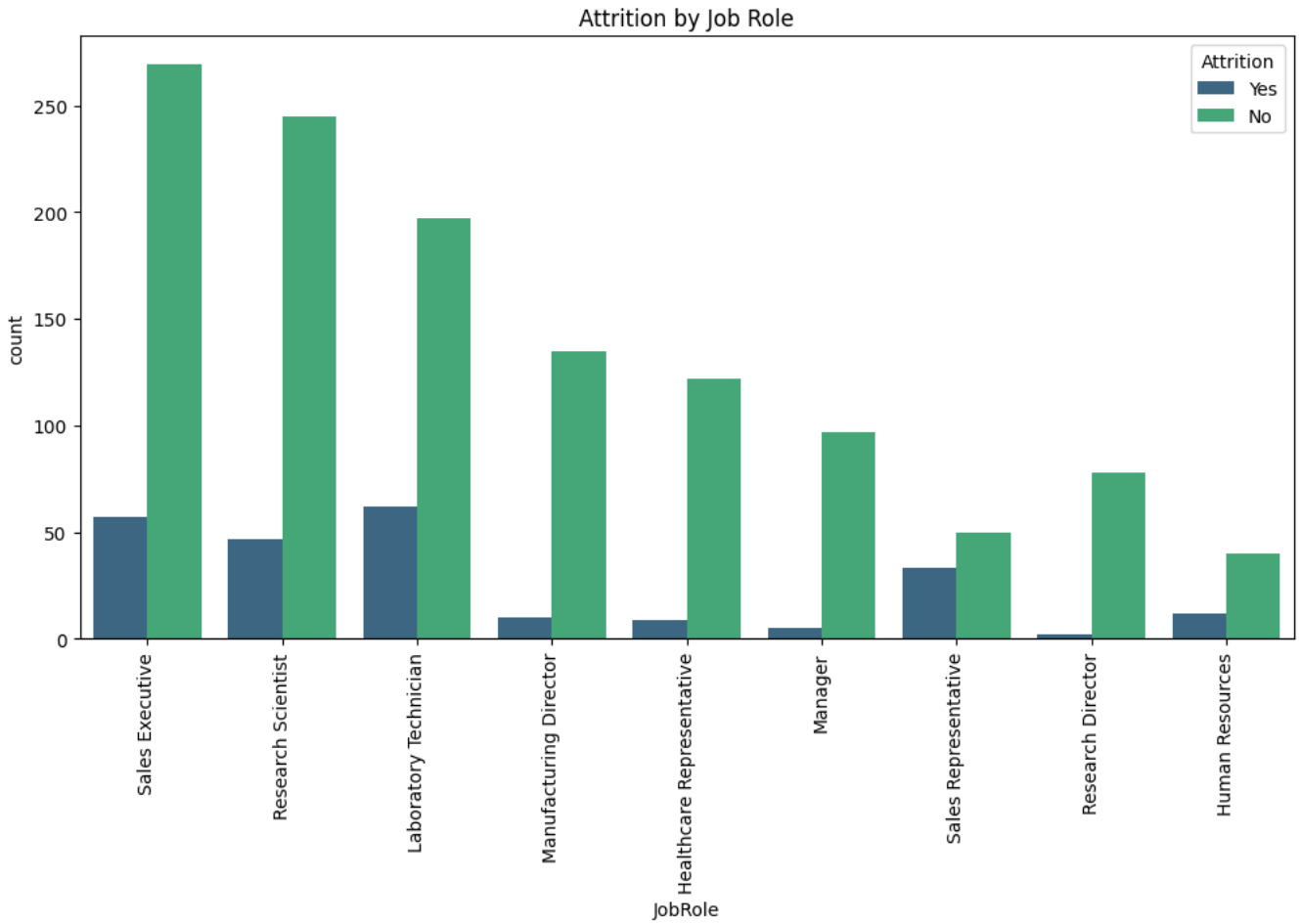
```
sns.histplot(data=hr_df, x='Age', hue='Attrition', kde=True)
plt.title('Age Distribution by Attrition')
plt.show()
```



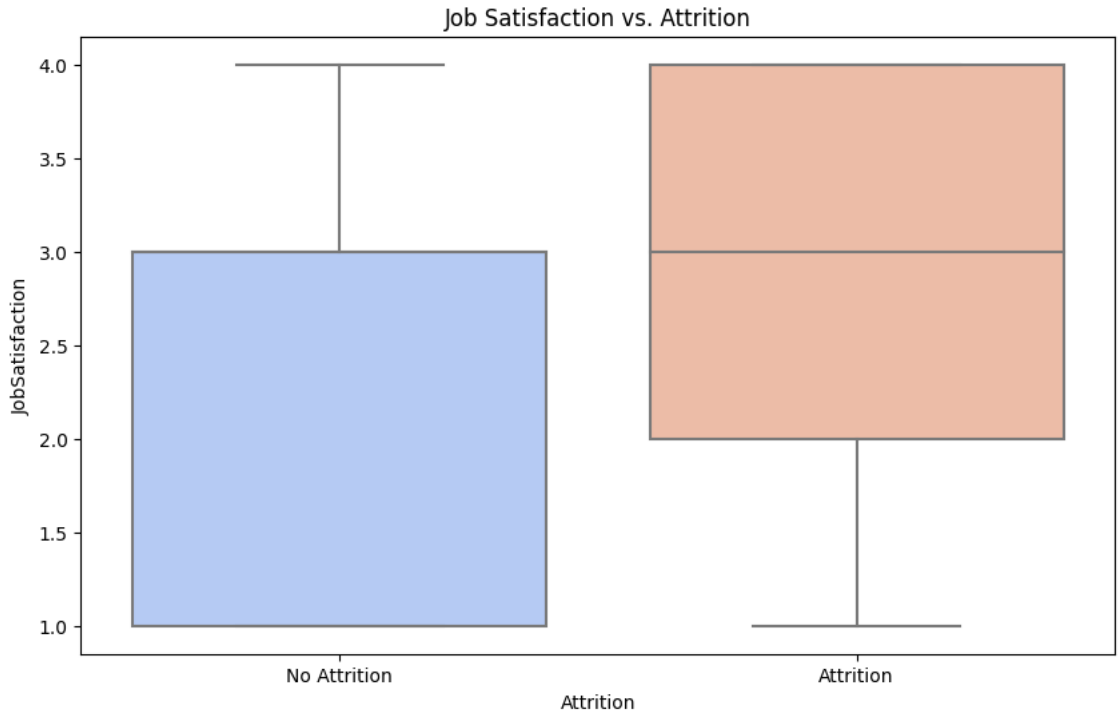

```
# Explore categorical variables (e.g., Gender, Department) with bar plots
plt.figure(figsize=(10, 6))
sns.countplot(data=hr_df, x='Gender', hue='Attrition')
plt.title('Attrition by Gender')
plt.show()
```



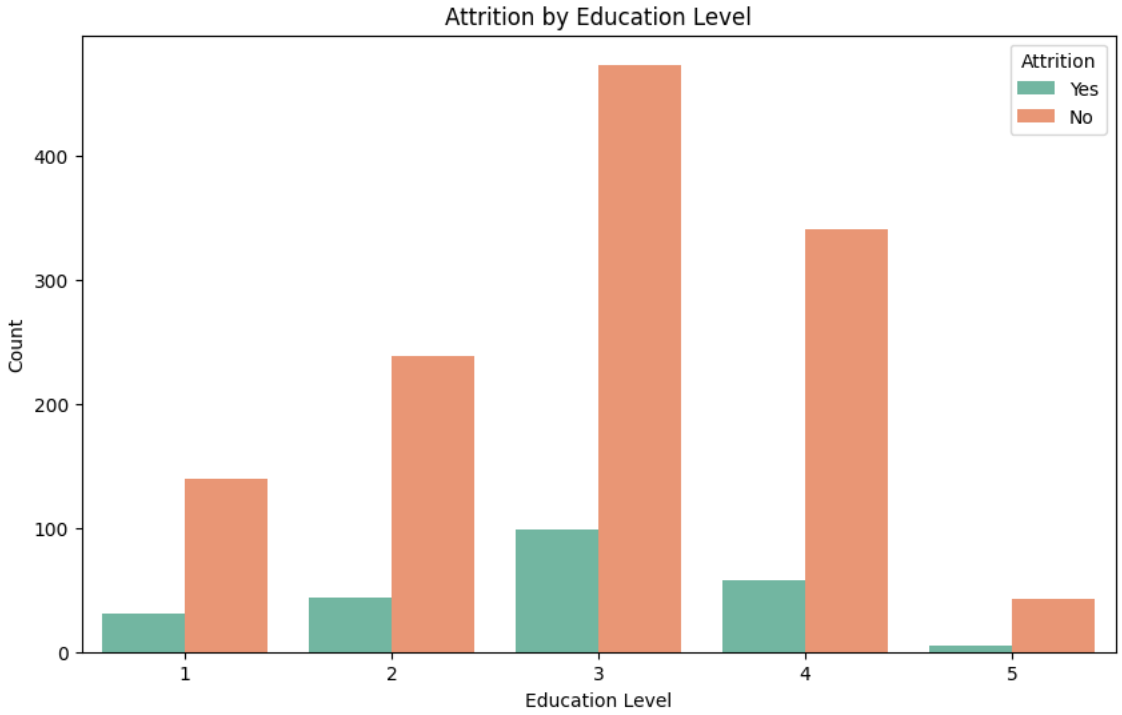

```
plt.figure(figsize=(12, 6))
sns.countplot(data=hr_df, x='JobRole', hue='Attrition', palette='viridis')
plt.title('Attrition by Job Role')
plt.xticks(rotation=90)
plt.show()
```



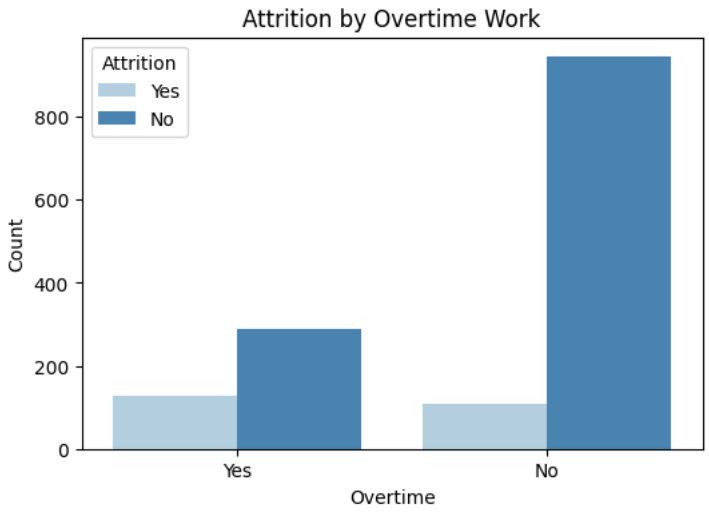

```
plt.figure(figsize=(10, 6))
sns.boxplot(data=hr_df, x='Attrition', y='JobSatisfaction', palette='coolwarm')
plt.title('Job Satisfaction vs. Attrition')
plt.xticks([0, 1], ['No Attrition', 'Attrition'])
plt.show()
```



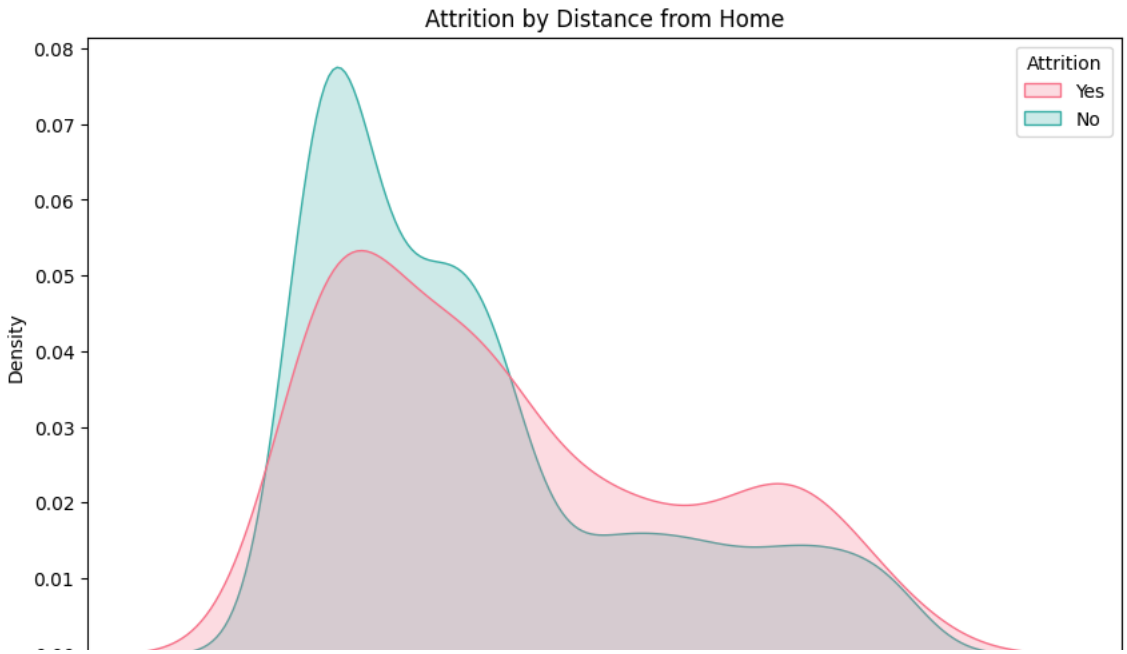
```
plt.figure(figsize=(10, 6))
sns.countplot(data=hr_df, x='Education', hue='Attrition', palette='Set2')
plt.title('Attrition by Education Level')
plt.xlabel('Education Level')
plt.ylabel('Count')
plt.show()
```



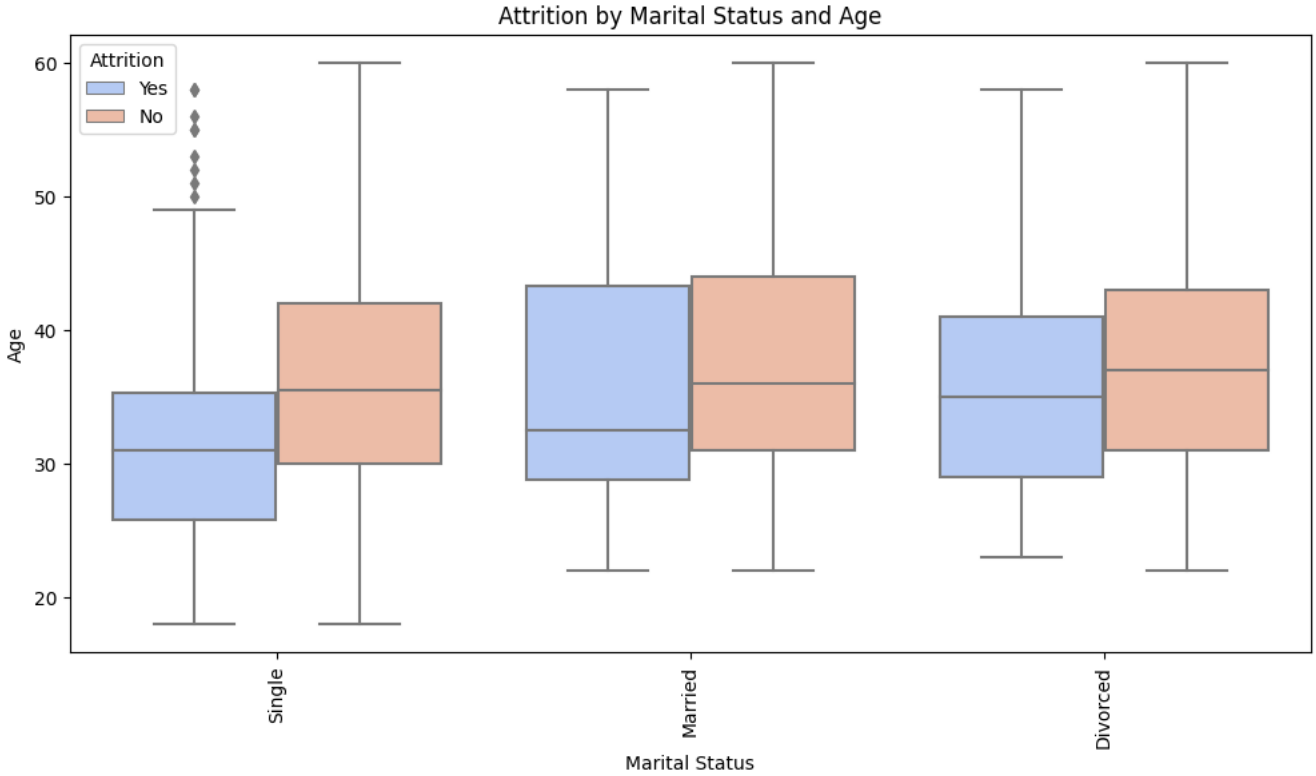

```
plt.figure(figsize=(6, 4))
sns.countplot(data=hr_df, x='OverTime', hue='Attrition', palette='Blues')
plt.title('Attrition by Overtime Work')
plt.xlabel('Overtime')
plt.ylabel('Count')
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.kdeplot(data=hr_df, x='DistanceFromHome', hue='Attrition', fill=True, common_norm=False, palette='husl')
plt.title('Attrition by Distance from Home')
plt.xlabel('Distance from Home (Miles)')
plt.ylabel('Density')
plt.show()
```




```
plt.figure(figsize=(12, 6))
sns.boxplot(data=hr_df, x='MaritalStatus', y='Age', hue='Attrition', palette='coolwarm')
plt.title('Attrition by Marital Status and Age')
plt.xticks(rotation=90)
plt.xlabel('Marital Status')
plt.ylabel('Age')
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.histplot(data=hr_df, x='MonthlyIncome', hue='Attrition', kde=True, palette='husl')
plt.title('Monthly Income Distribution by Attrition')
plt.xlabel('Monthly Income')
plt.ylabel('Count')
plt.show()
```