ml

June 28, 2023

[ ]:

[1]:
```
import warnings
warnings.filterwarnings('ignore')
```

[2]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
import plotly.express as px
```

[3]:
```
bornoutDf=pd.read_csv('train.csv')
bornoutDf
```

[3]:

	Employee ID	Date of Joining	Gender	Company Type	WFH Setup Available	Designation	Resource Allocation
0	fffe32003000360033003200	2008-09-30	Female	Service	No	2.0	3.0
1	fffe3700360033003500	2008-11-30	Male	Service	Yes	1.0	2.0
2	fffe31003300320037003900	2008-03-10	Female	Product	Yes	2.0	NaN
3	fffe32003400380032003900	2008-11-03	Male	Service	Yes	1.0	1.0
4	fffe31003900340031003600	2008-07-24	Female	Service	No	3.0	7.0
…	…	…	…	…	…	…	…
22745	fffe31003500370039003100	2008-12-30	Female	Service	No	1.0	3.0
22746	fffe33003000350031003800	2008-01-19	Female	Product	Yes	3.0	6.0
22747	fffe390032003000	2008-11-05	Male	Service	Yes	3.0	7.0
22748	fffe33003300320036003900	2008-01-10	Female	Service			
22749	fffe3400350031003800	2008-01-06	Male	Product			

```
22748                  No          2.0                  5.0
22749                  No          3.0                  6.0

       Mental Fatigue Score  Burn Rate
0                       3.8       0.16
1                       5.0       0.36
2                       5.8       0.49
3                       2.6       0.20
4                       6.9       0.52
…                       …         …
22745                   NaN       0.41
22746                   6.7       0.59
22747                   NaN       0.72
22748                   5.9       0.52
22749                   7.8       0.61

[22750 rows x 9 columns]
```

[4]:
```
bornoutDf["Date of Joining"]=pd.to_datetime(bornoutDf["Date of Joining"])
```

[5]:
```
bornoutDf.shape
```

[5]:
```
(22750, 9)
```

[6]:
```
bornoutDf.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 22750 entries, 0 to 22749
Data columns (total 9 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   Employee ID           22750 non-null  object
 1   Date of Joining       22750 non-null  datetime64[ns]
 2   Gender                22750 non-null  object
 3   Company Type          22750 non-null  object
 4   WFH Setup Available   22750 non-null  object
 5   Designation           22750 non-null  float64
 6   Resource Allocation   21369 non-null  float64
 7   Mental Fatigue Score  20633 non-null  float64
 8   Burn Rate             21626 non-null  float64
dtypes: datetime64[ns](1), float64(4), object(4)
memory usage: 1.6+ MB
```

[7]:
```
bornoutDf.head()
```

[7]:
```
                Employee ID Date of Joining  Gender Company Type  \
0  fffe32003000360033003200      2008-09-30  Female      Service
```

```
1      fffe3700360033003500      2008-11-30    Male      Service
2  fffe31003003200370039 00      2008-03-10  Female      Product
3  fffe32003400380032003900      2008-11-03    Male      Service
4  fffe31003900340031003600      2008-07-24  Female      Service

  WFH Setup Available  Designation  Resource Allocation  Mental Fatigue Score  \
0                  No          2.0                  3.0                   3.8
1                 Yes          1.0                  2.0                   5.0
2                 Yes          2.0                  NaN                   5.8
3                 Yes          1.0                  1.0                   2.6
4                  No          3.0                  7.0                   6.9

   Burn Rate
0       0.16
1       0.36
2       0.49
3       0.20
4       0.52
```

[8]:
```
bornoutDf.columns
```

[8]:
```
Index(['Employee ID', 'Date of Joining', 'Gender', 'Company Type',
       'WFH Setup Available', 'Designation', 'Resource Allocation',
       'Mental Fatigue Score', 'Burn Rate'],
      dtype='object')
```

[9]:
```
bornoutDf.isna().sum()
```

[9]:
```
Employee ID                0
Date of Joining            0
Gender                     0
Company Type               0
WFH Setup Available        0
Designation                0
Resource Allocation     1381
Mental Fatigue Score    2117
Burn Rate               1124
dtype: int64
```

[10]:
```
bornoutDf.duplicated().sum()
```

[10]:
```
0
```

[11]:
```
bornoutDf.describe()
```

[11]:
```
         Designation  Resource Allocation  Mental Fatigue Score     Burn Rate
count  22750.000000         21369.000000          20633.000000  21626.000000
```

mean	2.178725	4.481398	5.728188	0.452005
std	1.135145	2.047211	1.920839	0.198226
min	0.000000	1.000000	0.000000	0.000000
25%	1.000000	3.000000	4.600000	0.310000
50%	2.000000	4.000000	5.900000	0.450000
75%	3.000000	6.000000	7.100000	0.590000
max	5.000000	10.000000	10.000000	1.000000

[12]:
```
for i,col in enumerate(bornoutDf.columns):
    print(f"\n\n{bornoutDf[col].unique()}")
    print(f"\n{bornoutDf[col].value_counts()}\n\n")
```

```
['fffe32003000360033003200' 'fffe3700360033003500'
 'fffe31003300320037003900' … 'fffe390032003000'
 'fffe33003300320036003900' 'fffe3400350031003800']

fffe32003000360033003200    1
fffe3600360035003500        1
fffe3800360034003400        1
fffe31003000310033003600    1
fffe31003400350031003700    1
                           ..
fffe33003400340032003400    1
fffe32003100370036003600    1
fffe31003900310035003800    1
fffe32003400320034003200    1
fffe3400350031003800        1
Name: Employee ID, Length: 22750, dtype: int64



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 '2008-05-24T00:00:00.000000000' '2008-06-10T00:00:00.000000000'
 '2008-03-31T00:00:00.000000000' '2008-12-01T00:00:00.000000000'
 '2008-01-05T00:00:00.000000000' '2008-09-15T00:00:00.000000000'
 '2008-12-10T00:00:00.000000000' '2008-02-10T00:00:00.000000000'
 '2008-12-03T00:00:00.000000000' '2008-02-01T00:00:00.000000000']

2008-01-06    86
2008-05-21    85
2008-02-04    82
2008-07-16    81
2008-07-13    80
              ..
2008-06-27    44
2008-07-06    44
2008-07-04    43
2008-12-24    43
2008-12-07    39
Name: Date of Joining, Length: 366, dtype: int64



['Female' 'Male']

Female    11908
Male      10842
Name: Gender, dtype: int64
```

```
['Service' 'Product']

Service    14833
Product     7917
Name: Company Type, dtype: int64
```

```
['No' 'Yes']

Yes    12290
No     10460
Name: WFH Setup Available, dtype: int64
```

```
[2. 1. 3. 0. 4. 5.]

2.0    7588
3.0    5985
1.0    4881
4.0    2391
0.0    1507
5.0     398
Name: Designation, dtype: int64
```

```
[ 3.  2. nan  1.  7.  4.  6.  5.  8. 10.  9.]

4.0     3893
5.0     3861
3.0     3192
6.0     2943
2.0     2075
7.0     1965
1.0     1791
8.0     1044
9.0      446
10.0     159
Name: Resource Allocation, dtype: int64
```

```
[ 3.8  5.   5.8  2.6  6.9  3.6  7.9  4.4  nan  5.3  1.8  4.7  5.9  6.7
  4.   7.6  6.3  7.7  6.6  7.4  3.9  3.   8.7  7.3  5.4  6.   7.5 10.
  6.4  5.1  5.6  6.1  3.1  8.   6.8  4.9  9.2  6.5  6.2  8.2  4.1  4.3
  0.8  2.9  2.   9.1  0.   5.7  8.3  5.5  7.   3.3  7.8  7.2  5.2  8.9
  4.5  8.1  8.6  9.5  3.5  4.8  2.4  3.7  1.   8.8  9.3  4.6  9.9  0.5
  2.8  9.   3.4  4.2  1.6  2.7  1.3  3.2  8.4  7.1  9.4  2.1  9.7  2.5
  1.9  1.7  9.6  0.7  0.2  1.2  8.5  9.8  2.2  1.1  0.9  2.3  0.4  1.4
  1.5  0.6  0.3  0.1]

6.0    470
5.8    464
5.9    458
6.1    457
6.3    454
      …
0.5     24
0.2     23
0.4     19
0.1     17
0.3     13
Name: Mental Fatigue Score, Length: 101, dtype: int64
```

```
[0.16 0.36 0.49 0.2  0.52 0.29 0.62 0.33 0.56 0.67 0.5  0.12 0.4  0.51
 0.32 0.39 0.59 0.22 0.68 0.57 0.47 0.46 0.61 0.91 0.44 0.6  0.45 0.19
 0.31 0.81 0.42 0.53  nan 0.94 0.37 0.65 0.38 0.15 0.26 0.28 0.71 0.8
 0.63 0.79 0.72 0.34 0.27 0.66 0.04 0.05 0.11 0.41 0.76 0.43 0.85 0.35
 0.   0.55 0.48 0.7  0.18 0.23 0.25 0.75 0.1  0.73 0.58 0.88 0.77 0.3
 0.06 0.03 0.69 0.24 0.74 0.86 0.92 0.78 0.21 0.98 0.02 0.82 0.93 0.83
 0.87 0.64 0.54 0.17 1.   0.08 0.09 0.14 0.13 0.07 0.84 0.99 0.01 0.97
 0.95 0.9  0.96 0.89]

0.47    475
0.43    444
0.41    434
0.45    431
0.50    428
       …
0.98     18
0.97     17
0.95     17
0.96     13
```

```
0.99      8
Name: Burn Rate, Length: 101, dtype: int64
```

[13]:
```
bornoutDf=bornoutDf.drop(['Employee ID'],axis=1)
```

[14]:
```
intFloatbornoutDf=bornoutDf.select_dtypes([np.int,np.float])
for i , col in enumerate(intFloatbornoutDf.columns):
    if(intFloatbornoutDf[col].skew()>=0.1):
        print("\n",col,"feature is positively skewed and value is :
 ↪",intFloatbornoutDf[col].skew())
    elif(intFloatbornoutDf[col].skew()<=0.1):
         print("\n",col,"feature is negitively skewed and value is :
 ↪",intFloatbornoutDf[col].skew())
    else:
         print("\n",col,"feature is normally distributed and value is :
 ↪",intFloatbornoutDf[col].skew())
```

```
 Designation feature is negitively skewed and value is : 0.09242138478903683

 Resource Allocation feature is positively skewed and value is :
0.20457273454318103

 Mental Fatigue Score feature is negitively skewed and value is :
-0.4308950578815428

 Burn Rate feature is negitively skewed and value is : 0.045737370909640515
```

[15]:
```
bornoutDf['Resource Allocation'].fillna(bornoutDf['Resource Allocation'].
 ↪mean(),inplace=True)
bornoutDf['Mental Fatigue Score'].fillna(bornoutDf['Mental Fatigue Score'].
 ↪mean(),inplace=True)
bornoutDf['Burn Rate'].fillna(bornoutDf['Burn Rate'].mean(),inplace=True)
```

[16]:
```
bornoutDf.isna().sum()
```

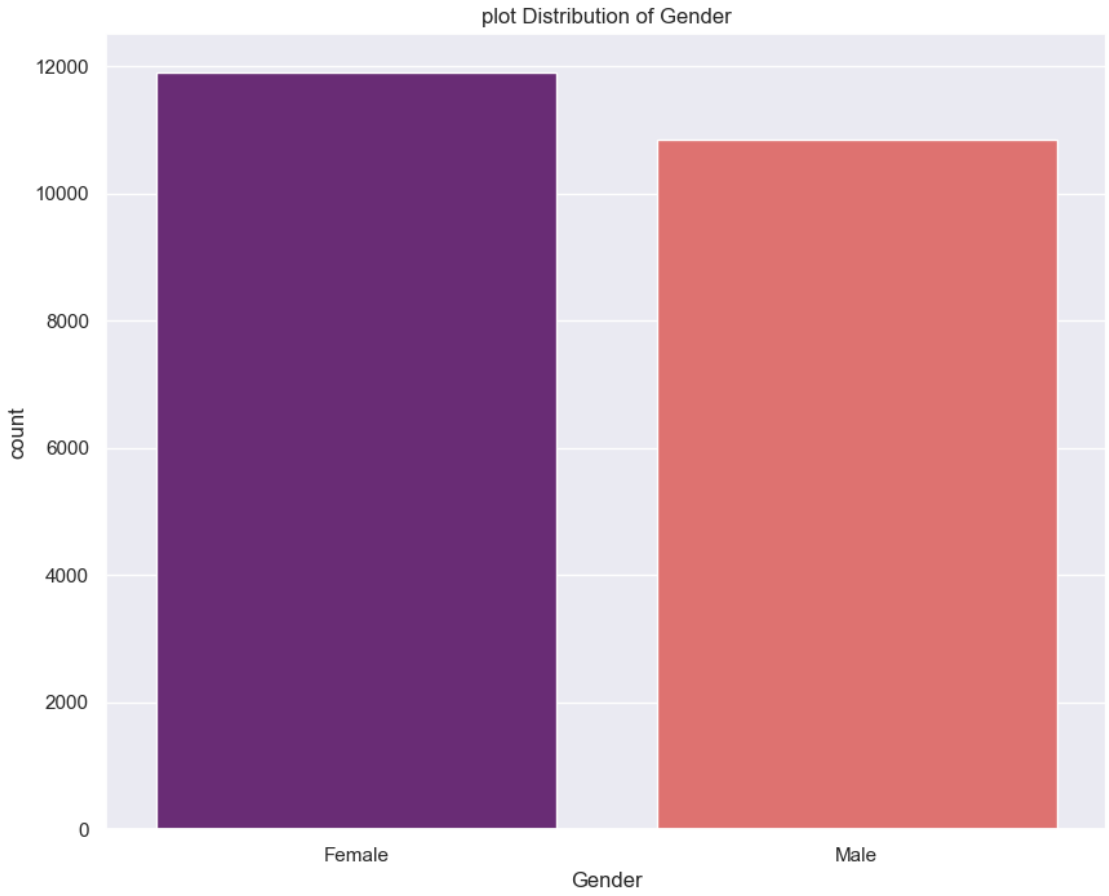
[16]:
```
Date of Joining         0
Gender                  0
Company Type            0
WFH Setup Available     0
Designation             0
Resource Allocation     0
Mental Fatigue Score    0
Burn Rate               0
dtype: int64
```

[17]:
```
bornoutDf.corr()
```

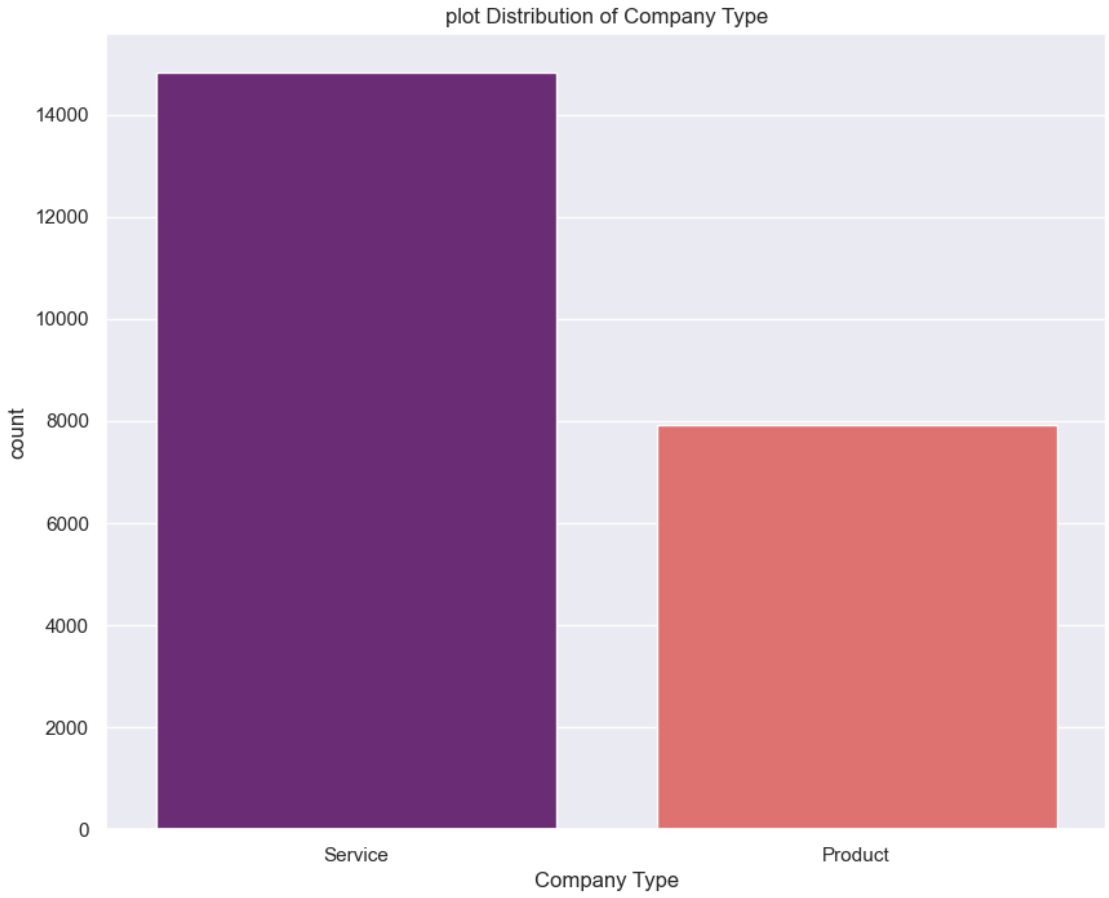
[17]:
```
                       Designation  Resource Allocation  Mental Fatigue Score  \
Designation               1.000000             0.852046              0.656445
Resource Allocation       0.852046             1.000000              0.739268
Mental Fatigue Score      0.656445             0.739268              1.000000
Burn Rate                 0.719284             0.811062              0.878217

                       Burn Rate
Designation             0.719284
Resource Allocation     0.811062
Mental Fatigue Score    0.878217
Burn Rate               1.000000
```

[18]:
```
corr=bornoutDf.corr()
sns.set(rc={'figure.figsize':(14,12)})
fig=px.imshow(corr,text_auto=True,aspect="auto")
fig.show()
```

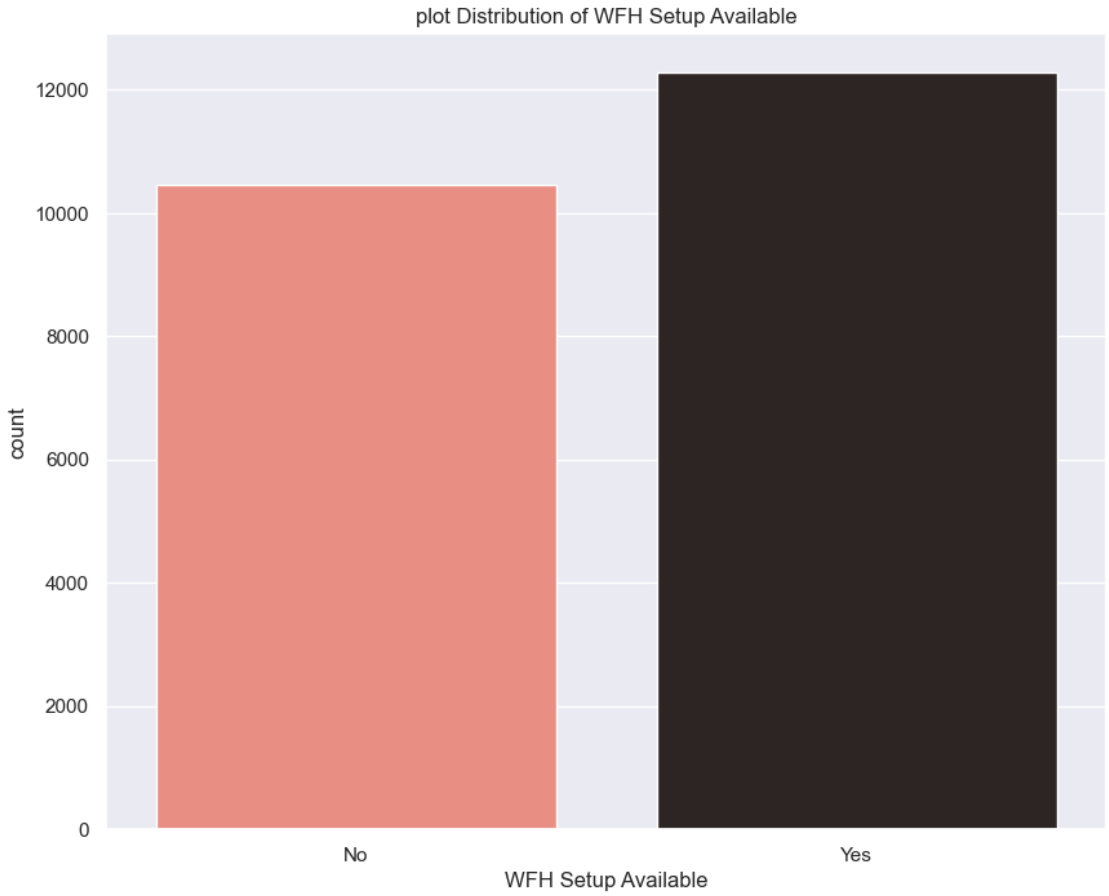
[19]:
```
plt.figure(figsize=(10,8))
sns.countplot(x="Gender",data=bornoutDf,palette="magma")
plt.title("plot Distribution of Gender")
plt.show()
```



[20]:
```
plt.figure(figsize=(10,8))
sns.countplot(x="Company Type", data=bornoutDf, palette="magma")
plt.title("plot Distribution of Company Type")
plt.show()
```



[21]:
```
plt.figure(figsize=(10,8))
sns.countplot(x="WFH Setup Available",data=bornoutDf,palette="dark:salmon_r")
plt.title("plot Distribution of WFH Setup Available")
plt.show()
```



[22]:
```
burn_st=bornoutDf.loc[:,'Date of Joining':'Burn Rate']
burn_st=burn_st.select_dtypes([int,float])
for i ,col in enumerate(burn_st.columns):
    fig=px.histogram(burn_st,x=col,title="Plot Distribution␣
 ↪of"+col,color_discrete_sequence=['indianred'])
    fig.update_layout(bargap=0.2)
    fig.show()
```

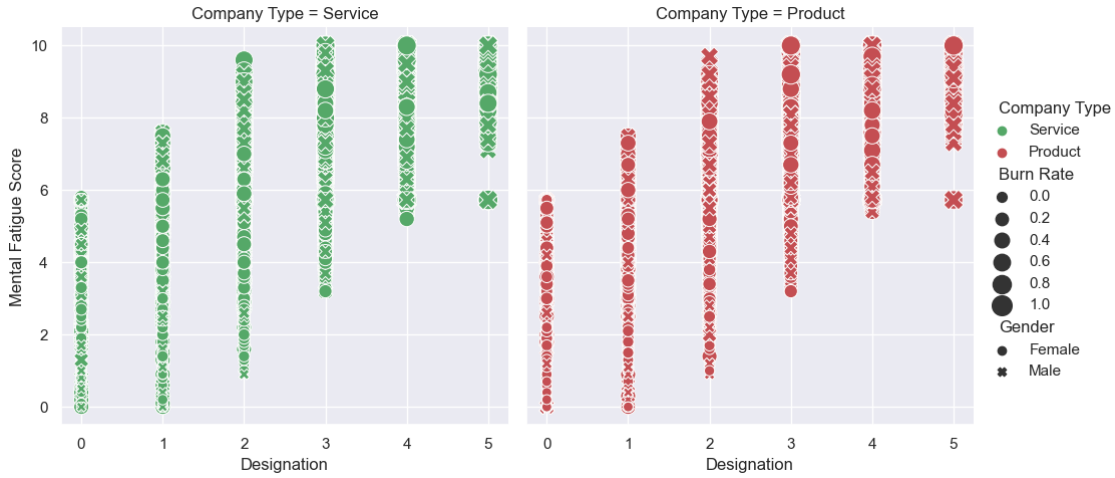
[23]:
```
fig=px.line(bornoutDf,y="Burn Rate",color="Designation",title="Burn rate on the␣
 ↪basis of Desgination",color_discrete_sequence=px.colors.qualitative.Pastel1)
fig.update_layout(bargap=0.1)
fig.show()
```

[24]:
```
fig=px.line(bornoutDf,y="Burn Rate",color="Gender",title="Burn rate on the␣
 ↪basis of Gender",color_discrete_sequence=px.colors.qualitative.Pastel1)
fig.update_layout(bargap=0.2)
fig.show()
```

[25]:
```
fig=px.line(bornoutDf,y="Mental Fatigue␣
 ↪Score",color="Designation",title="Mental Fatigue Score vs␣
 ↪Desgination",color_discrete_sequence=px.colors.qualitative.Pastel1)
fig.update_layout(bargap=0.1)
fig.show()
```

[26]:
```
sns.relplot(
       bornoutDf,x="Designation",y="Mental Fatigue Score", col="Company Type",
        hue="Company Type",size ="Burn Rate",style="Gender",
         palette=["g","r"],sizes=(50,200)
        )
```

[26]:
```
<seaborn.axisgrid.FacetGrid at 0x259f0ddcc40>
```



[27]:
```
from sklearn import preprocessing
Label_encode=preprocessing.LabelEncoder()
```

[28]:
```
bornoutDf['GenderLabel']=Label_encode.fit_transform(bornoutDf['Gender'].values)
bornoutDf['Company_TypeLabel']=Label_encode.fit_transform(bornoutDf['Company␣
 ↪Type'].values)
bornoutDf['WFH_Setup_AvailableLabel']=Label_encode.fit_transform(bornoutDf['WFH␣
 ↪Setup Available'].values)
```

[29]:
```
gn=bornoutDf.groupby('Gender')
gn=gn['GenderLabel']
gn.first()
```

[29]:
```
Gender
Female    0
Male      1
```

```
Name: GenderLabel, dtype: int32
```

[30]:
```
ct=bornoutDf.groupby('Company Type')
ct=ct['Company_TypeLabel']
ct.first()
```

[30]:
```
Company Type
Product    0
Service    1
Name: Company_TypeLabel, dtype: int32
```

[31]:
```
wsa=bornoutDf.groupby('WFH Setup Available')
wsa=wsa['WFH_Setup_AvailableLabel']
wsa.first()
```

[31]:
```
WFH Setup Available
No     0
Yes    1
Name: WFH_Setup_AvailableLabel, dtype: int32
```

[32]:
```
bornoutDf.tail(10)
```

[32]:

	Date of Joining	Gender	Company Type	WFH Setup Available	Designation	\
22740	2008-09-05	Female	Product	No	3.0	
22741	2008-01-07	Male	Product	No	2.0	
22742	2008-07-28	Male	Product	No	3.0	
22743	2008-12-15	Female	Product	Yes	1.0	
22744	2008-05-27	Male	Product	No	3.0	
22745	2008-12-30	Female	Service	No	1.0	
22746	2008-01-19	Female	Product	Yes	3.0	
22747	2008-11-05	Male	Service	Yes	3.0	
22748	2008-01-10	Female	Service	No	2.0	
22749	2008-01-06	Male	Product	No	3.0	

	Resource Allocation	Mental Fatigue Score	Burn Rate	GenderLabel	\
22740	6.0	7.300000	0.550000	0	
22741	5.0	6.000000	0.452005	1	
22742	5.0	8.100000	0.690000	1	
22743	3.0	6.000000	0.480000	0	
22744	7.0	6.200000	0.540000	1	
22745	3.0	5.728188	0.410000	0	
22746	6.0	6.700000	0.590000	0	
22747	7.0	5.728188	0.720000	1	
22748	5.0	5.900000	0.520000	0	
22749	6.0	7.800000	0.610000	1	

	Company_TypeLabel	WFH_Setup_AvailableLabel

```
22740                  0                          0
22741                  0                          0
22742                  0                          0
22743                  0                          1
22744                  0                          0
22745                  1                          0
22746                  0                          1
22747                  1                          1
22748                  1                          0
22749                  0                          0
```

[33]:
```
columns=['Designation','Resource Allocation','Mental Fatigue␣
 ↪Score','GenderLabel','Company_TypeLabel','WFH_Setup_AvailableLabel']
x=bornoutDf[columns]
y=bornoutDf['Burn Rate']
```

[34]:
```
print(x)
```

```
       Designation  Resource Allocation  Mental Fatigue Score  GenderLabel  \
0              2.0             3.000000              3.800000            0
1              1.0             2.000000              5.000000            1
2              2.0             4.481398              5.800000            0
3              1.0             1.000000              2.600000            1
4              3.0             7.000000              6.900000            0
…              …                    …                     …            …
22745          1.0             3.000000              5.728188            0
22746          3.0             6.000000              6.700000            0
22747          3.0             7.000000              5.728188            1
22748          2.0             5.000000              5.900000            0
22749          3.0             6.000000              7.800000            1

       Company_TypeLabel  WFH_Setup_AvailableLabel
0                      1                         0
1                      1                         1
2                      0                         1
3                      1                         1
4                      1                         0
…                    …                         …
22745                  1                         0
22746                  0                         1
22747                  1                         1
22748                  1                         0
22749                  0                         0

[22750 rows x 6 columns]
```

[35]:
```
print(y)
```

```
0        0.16
1        0.36
2        0.49
3        0.20
4        0.52
         …
22745    0.41
22746    0.59
22747    0.72
22748    0.52
22749    0.61
Name: Burn Rate, Length: 22750, dtype: float64
```

[37]:
```
from sklearn.decomposition import PCA
pca=PCA(0.95)
x_pca=pca.fit_transform(x)
print("PCA shape of x is :",x_pca.shape,"and orginal shape is ",x.shape)
print("% of important of selected features is :",pca.explained_variance_ratio_)
print("the number of features selected through PCA is:",pca.n_components_)
```

```
PCA shape of x is : (22750, 4) and orginal shape is  (22750, 6)
% of important of selected features is : [0.78371089 0.11113597 0.03044541
0.02632422]
the number of features selected through PCA is: 4
```

[38]:
```
from sklearn.model_selection import train_test_split
x_train_pca,x_test,y_train,y_test=train_test_split(x_pca,y,test_size=0.
  ↪25,random_state=10)
```

[39]:
```
print(x_train_pca.shape,x_test.shape,y_train.shape,y_test.shape)
```

```
(17062, 4) (5688, 4) (17062,) (5688,)
```

[41]:
```
from sklearn.metrics import r2_score
```

[44]:
```
from sklearn.ensemble import RandomForestRegressor
rf_model=RandomForestRegressor()
rf_model.fit(x_train_pca,y_train)
train_pred_rf=rf_model.predict(x_train_pca)
train_r2=r2_score(y_train,train_pred_rf)
test_pred_rf=rf_model.predict(x_test)
test_r2=r2_score(y_test,test_pred_rf)
print("accuray score of train data:"+str(round(100*train_r2,4))+"%")
print("accuray score of test data:"+str(round(100*test_r2,4))+"%")
```

```
accuray score of train data:91.1947%
accuray score of test data:83.8504%
```

[46]:
```
from sklearn.ensemble import AdaBoostRegressor
abr_model=AdaBoostRegressor()
abr_model.fit(x_train_pca,y_train)

train_pred_adboost=abr_model.predict(x_train_pca)
train_r2=r2_score(y_train,train_pred_adboost)
test_pred_adboost=abr_model.predict(x_test)
test_r2=r2_score(y_test,test_pred_adboost)

print("accuray score of train data:"+str(round(100*train_r2,4))+"%")
print("accuray score of test data:"+str(round(100*test_r2,4))+"%")
```

```
accuray score of train data:76.9526%
accuray score of test data:76.5259%
```

[ ]: