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```
[10]: import numpy as np
import pandas as pd
import tensorflow as tf
import matplotlib.pyplot as plt
%matplotlib inline
from patsy import dmatrices
import sklearn
import seaborn as sns
import os
print(os.getcwd())
path=os.getcwd()
os.listdir(path)

/drive/notebooks
[10]: ['IBM Data.csv',
      'IBM Attrition Data.csv',
      'IBM_Employee_Attrition_Prediction.ipynb',
      'Untitled.ipynb',
      'Untitled1.ipynb',
      'Untitled2.ipynb',
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      'Untitled4.ipynb',
      'ibm attrition data.csv',
      'ibm data.csv',
      'raj practice (2).ipynb',
      'weather data.csv',
      'Lorenz.ipynb',
      'sqlite.ipynb',
      'IBM Data.csv']
```

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Untitled2.ipynb	an hour ago
Untitled3.ipynb	36 minutes ago
Untitled4.ipynb	9 minutes ago
weather data.csv	40 minutes ago

Untitled4.ipynb

```
[14]: data=pd.read_csv("/drive/notebooks/ibm data.csv")
data.head()

[14]:
```

	Age	Attrition	Department	DistanceFromHome	Education	EducationField	EnvironmentSatisfaction	JobSatisfaction	MaritalStatus
0	41	Yes	Sales	1	2	Life Sciences	2	4	Single
1	49	No	Research & Development	8	1	Life Sciences	3	2	Married
2	37	Yes	Research & Development	2	2	Other	4	3	Single
3	33	No	Research & Development	3	4	Life Sciences	4	3	Married
4	27	No	Research & Development	2	1	Medical	1	2	Married

```
[15]: names = dataframe.columns.values
print(names)

['Age' 'Attrition' 'Department' 'DistanceFromHome' 'Education'
 'EducationField' 'EnvironmentSatisfaction' 'JobSatisfaction'
 'MaritalStatus' 'MonthlyIncome' 'NumCompaniesWorked' 'WorkLifeBalance'
 'YearsAtCompany']

[17]: # histogram for age
```

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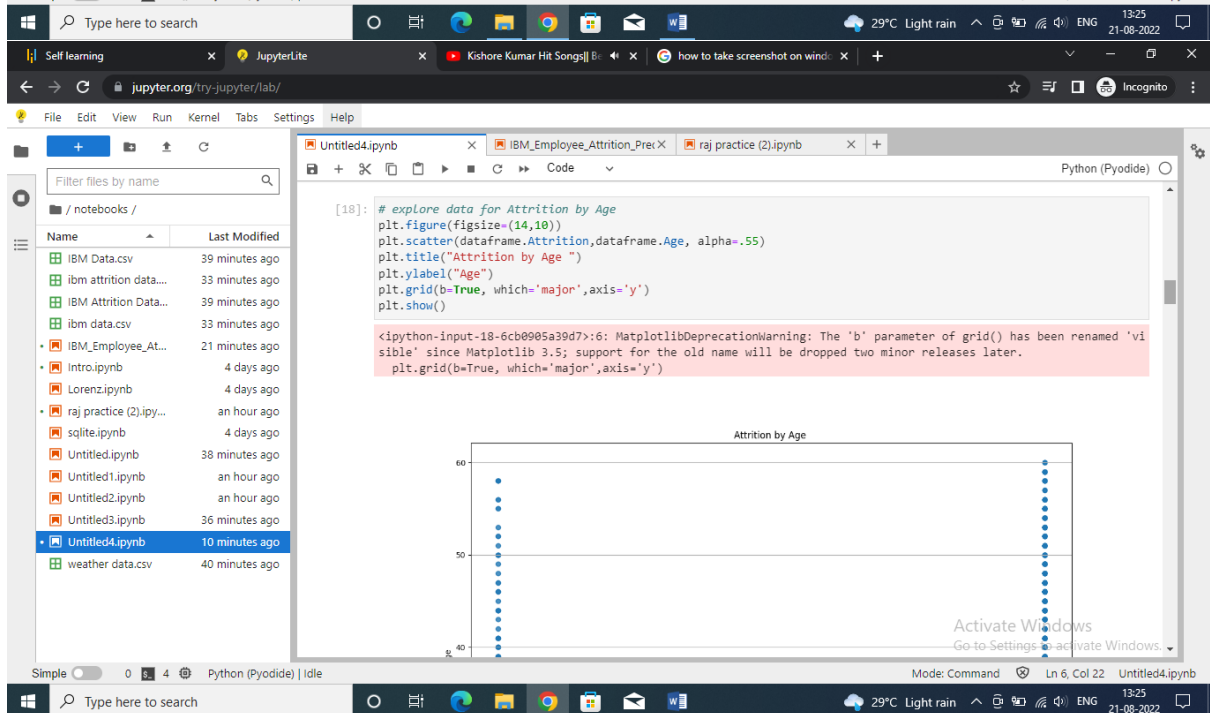
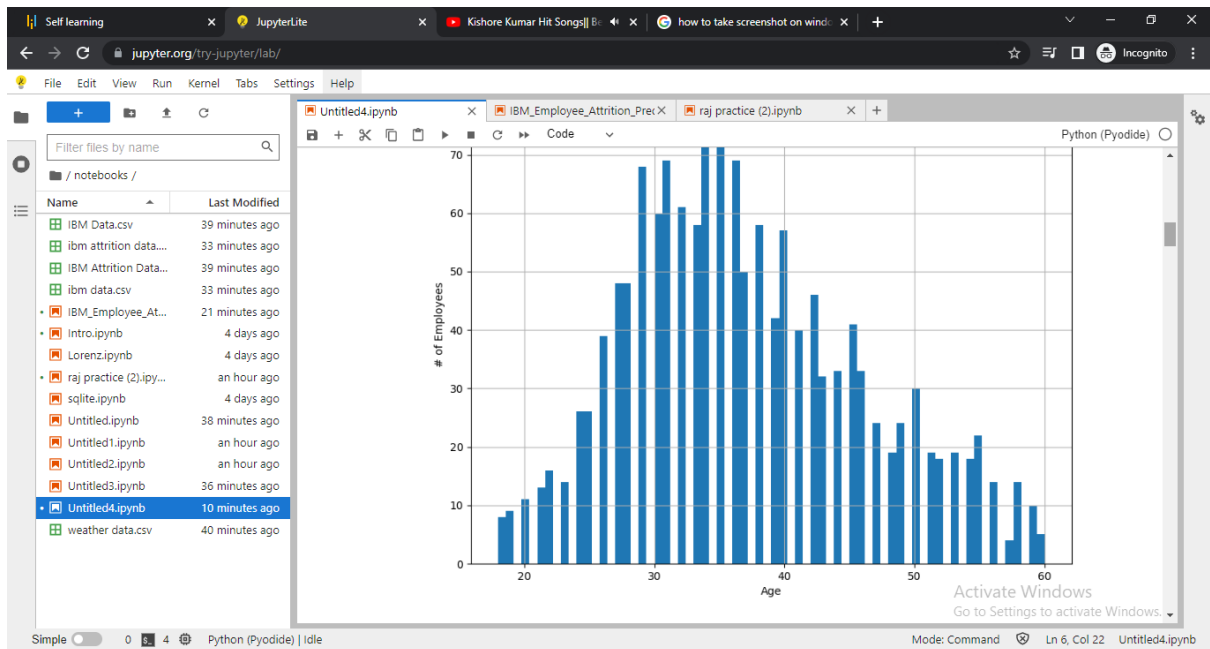
Untitled4.ipynb

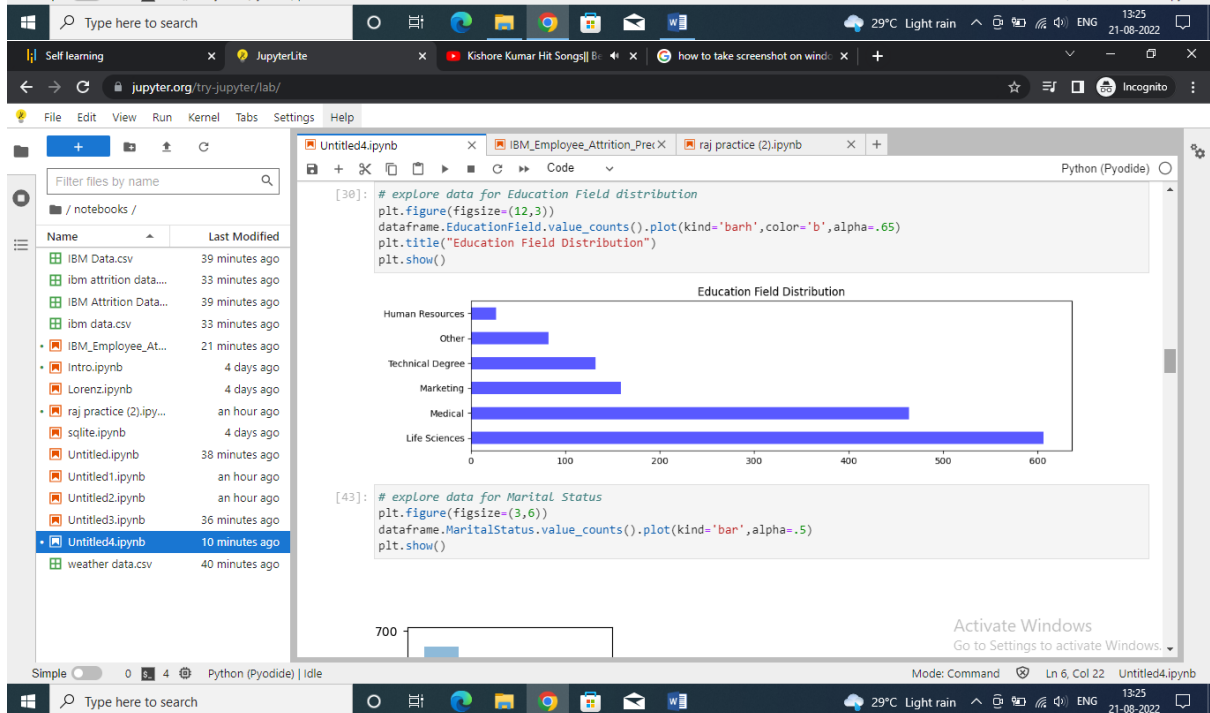
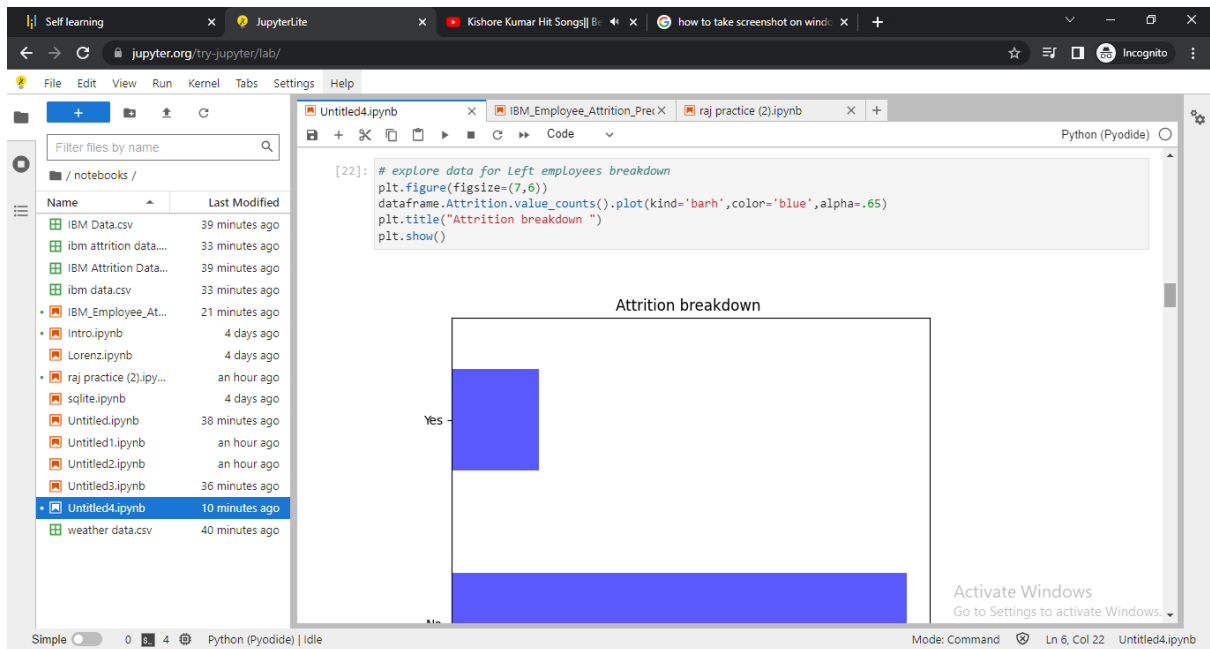
```
[17]: # histogram for age
import matplotlib.pyplot as plt
plt.figure(figsize=(10,8))
dataframe['Age'].hist(bins=70)
plt.title("Age distribution of Employees")
plt.xlabel("Age")
plt.ylabel("# of Employees")
plt.show()
```

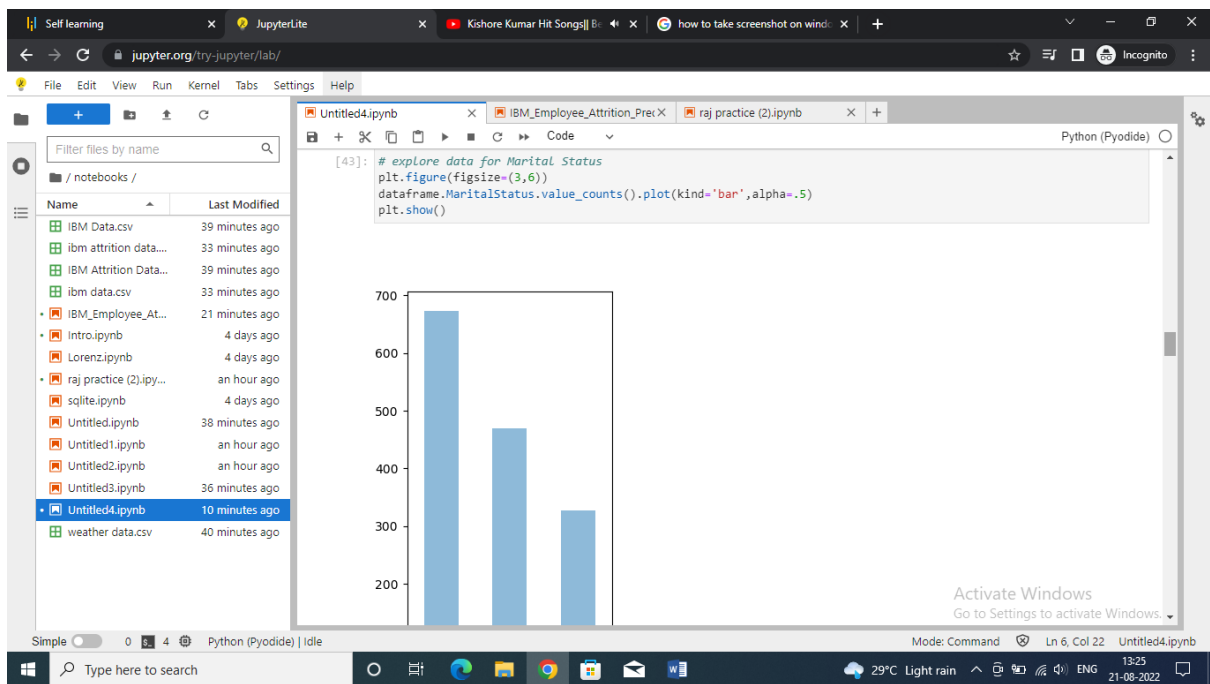
Age distribution of Employees

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Untitled3.ipynb	36 minutes ago
Untitled4.ipynb	10 minutes ago
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Untitled4.ipynb

```
[44]: dataframe.describe()
```

	Age	DistanceFromHome	Education	EnvironmentSatisfaction	JobSatisfaction	MonthlyIncome	NumCompaniesWorked
count	1470.000000	1470.000000	1470.000000	1470.000000	1470.000000	1470.000000	1470.000000
mean	36.923810	9.192517	2.912925	2.721769	2.728571	6502.931293	2.69319
std	9.135373	8.106864	1.024165	1.093082	1.102846	4707.956783	2.49800
min	18.000000	1.000000	1.000000	1.000000	1.000000	1009.000000	0.00000
25%	30.000000	2.000000	2.000000	2.000000	2.000000	2911.000000	1.00000
50%	36.000000	7.000000	3.000000	3.000000	3.000000	4919.000000	2.00000
75%	43.000000	14.000000	4.000000	4.000000	4.000000	8379.000000	4.00000
max	60.000000	29.000000	5.000000	4.000000	4.000000	19999.000000	9.00000

```
[45]: dataframe.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 13 columns):
#   Column                Non-Null Count  Dtype
---  -
0   Age                   1470 non-null  int64
1   Attrition             1470 non-null  object
2   Department            1470 non-null  object
```

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Untitled4.ipynb	11 minutes ago
weather data.csv	42 minutes ago

Untitled4.ipynb

```
[45]: dataframe.info()
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1470 entries, 0 to 1469
Data columns (total 13 columns):
 #   Column              Non-Null Count  Dtype  
---  -
 0   Age                 1470 non-null  int64  
 1   Attrition           1470 non-null  object  
 2   Department          1470 non-null  object  
 3   DistanceFromHome    1470 non-null  int64  
 4   Education            1470 non-null  int64  
 5   EducationField       1470 non-null  object  
 6   EnvironmentSatisfaction 1470 non-null  int64  
 7   JobSatisfaction     1470 non-null  int64  
 8   MaritalStatus       1470 non-null  object  
 9   MonthlyIncome       1470 non-null  int64  
10   NumCompaniesWorked  1470 non-null  int64  
11   WorkLifeBalance     1470 non-null  int64  
12   YearsAtCompany      1470 non-null  int64  
dtypes: int64(9), object(4)
memory usage: 126.4+ KB

[46]: dataframe.columns
Index(['Age', 'Attrition', 'Department', 'DistanceFromHome', 'Education',
       'EducationField', 'EnvironmentSatisfaction', 'JobSatisfaction',
       'MaritalStatus', 'MonthlyIncome', 'NumCompaniesWorked',
       'WorkLifeBalance', 'YearsAtCompany'],
      dtype='object')
```

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Untitled2.ipynb	an hour ago
Untitled3.ipynb	38 minutes ago
Untitled4.ipynb	11 minutes ago
weather data.csv	42 minutes ago

Untitled4.ipynb

```
[46]: dataframe.columns
Index(['Age', 'Attrition', 'Department', 'DistanceFromHome', 'Education',
       'EducationField', 'EnvironmentSatisfaction', 'JobSatisfaction',
       'MaritalStatus', 'MonthlyIncome', 'NumCompaniesWorked',
       'WorkLifeBalance', 'YearsAtCompany'],
      dtype='object')

[47]: dataframe.std()
<ipython-input-47-90bdd6cc73ba>:1: FutureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError. Select only valid columns before calling the reduction.
  dataframe.std()
Age                9.135373
DistanceFromHome   8.106864
Education          1.024165
EnvironmentSatisfaction 1.093082
JobSatisfaction    1.102846
MonthlyIncome      4707.956783
NumCompaniesWorked 2.498009
WorkLifeBalance    0.706476
YearsAtCompany     6.126525
dtype: float64

[48]: dataframe['Attrition'].value_counts()
[48]: No    1233
```

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Untitled4.ipynb	19 minutes ago
weather data.csv	an hour ago

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Python (Pyodide)

```
[49]: dtype('O')
```

```
[51]: dataframe['Attrition'].replace('Yes',1, inplace=True)
dataframe['Attrition'].replace('No',0, inplace=True)
```

```
[52]: dataframe.head(10)
```

```
[52]:
```

	Age	Attrition	Department	DistanceFromHome	Education	EducationField	EnvironmentSatisfaction	JobSatisfaction	MaritalStatus
0	41	1	Sales	1	2	Life Sciences	2	4	Single
1	49	0	Research & Development	8	1	Life Sciences	3	2	Married
2	37	1	Research & Development	2	2	Other	4	3	Single
3	33	0	Research & Development	3	4	Life Sciences	4	3	Married
4	27	0	Research & Development	2	1	Medical	1	2	Married
5	32	0	Research & Development	2	2	Life Sciences	4	4	Single
6	59	0	Research & Development	3	3	Medical	3	1	Married
7	30	0	Research & Development	24	1	Life Sciences			Divorced

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Untitled4.ipynb | IBM\_Employee\_Attrition\_Pre... | raj practice (2).ipynb

Python (Pyodide)

Development

```
[53]: # building up a Logistic regression model
X = dataframe.drop(['Attrition'],axis=1)
X.head()
Y = dataframe['Attrition']
Y.head()
```

```
[53]:
```

0	1
1	0
2	1
3	0
4	0

Name: Attrition, dtype: int64

```
[54]: dataframe['EducationField'].replace('Life Sciences',1, inplace=True)
dataframe['EducationField'].replace('Medical',2, inplace=True)
dataframe['EducationField'].replace('Marketing', 3, inplace=True)
dataframe['EducationField'].replace('Other',4, inplace=True)
dataframe['EducationField'].replace('Technical Degree',5, inplace=True)
dataframe['EducationField'].replace('Human Resources', 6, inplace=True)
```

```
[55]: dataframe['EducationField'].value_counts()
```

```
[55]:
```

1	606
2	464
3	159
5	132

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Untitled3.ipynb	an hour ago
Untitled4.ipynb	20 minutes ago
weather data.csv	an hour ago

Untitled4.ipynb

```
[55]: dataframe['EducationField'].value_counts()

[55]: 1    606
      2    464
      3    159
      5    132
      4     82
      6     27
      Name: EducationField, dtype: int64

[56]: dataframe['Department'].value_counts()

[56]: Research & Development    961
      Sales                  446
      Human Resources         63
      Name: Department, dtype: int64

[57]: dataframe['Department'].replace('Research & Development',1, inplace=True)
      dataframe['Department'].replace('Sales',2, inplace=True)
      dataframe['Department'].replace('Human Resources', 3, inplace=True)

[58]: dataframe['Department'].value_counts()

[58]: 1    961
      2    446
      3     63
      Name: Department, dtype: int64
```

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weather data.csv	an hour ago

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```
[58]: dataframe['Department'].value_counts()

[58]: 1    961
      2    446
      3     63
      Name: Department, dtype: int64

[59]: dataframe['MaritalStatus'].value_counts()

[59]: Married    673
      Single   470
      Divorced 327
      Name: MaritalStatus, dtype: int64

[60]: dataframe['MaritalStatus'].replace('Married',1, inplace=True)
      dataframe['MaritalStatus'].replace('Single',2, inplace=True)
      dataframe['MaritalStatus'].replace('Divorced',3, inplace=True)

[61]: dataframe['MaritalStatus'].value_counts()

[61]: 1    673
      2    470
      3    327
      Name: MaritalStatus, dtype: int64

[62]: x=dataframe.select_dtypes(include=['int64'])
      x.dtypes

[62]: Age
      int64
```

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Untitled1.ipynb	an hour ago
Untitled2.ipynb	an hour ago
Untitled3.ipynb	an hour ago
Untitled4.ipynb	21 minutes ago
weather data.csv	an hour ago

Untitled4.ipynb

Python (Pyodide)

```
[62]: x=dataframe.select_dtypes(include=['int64'])
x.dtypes

[62]: Age                int64
Attrition              int64
Department            int64
DistanceFromHome      int64
Education             int64
EducationField         int64
EnvironmentSatisfaction int64
JobSatisfaction        int64
MaritalStatus         int64
MonthlyIncome         int64
NumCompaniesWorked    int64
WorkLifeBalance       int64
YearsAtCompany        int64
dtype: object

[63]: x.columns

[63]: Index(['Age', 'Attrition', 'Department', 'DistanceFromHome', 'Education',
        'EducationField', 'EnvironmentSatisfaction', 'JobSatisfaction',
        'MaritalStatus', 'MonthlyIncome', 'NumCompaniesWorked',
        'WorkLifeBalance', 'YearsAtCompany'],
        dtype='object')

[64]: y=dataframe['Attrition']
```

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Untitled3.ipynb	an hour ago
Untitled4.ipynb	21 minutes ago
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Python (Pyodide)

```
,Name: MaritalStatus, dtype: int64

[27]: x=dataframe.select_dtypes(include=['int64'])
x.dtypes

[27]: Age                int64
Attrition              int64
Department            int64
DistanceFromHome      int64
Education             int64
EducationField         int64
EnvironmentSatisfaction int64
JobSatisfaction        int64
MaritalStatus         int64
MonthlyIncome         int64
NumCompaniesWorked    int64
WorkLifeBalance       int64
YearsAtCompany        int64
dtype: object

[28]: x.columns

[28]: Index(['Age', 'Attrition', 'Department', 'DistanceFromHome', 'Education',
        'EducationField', 'EnvironmentSatisfaction', 'JobSatisfaction',
        'MaritalStatus', 'MonthlyIncome', 'NumCompaniesWorked',
        'WorkLifeBalance', 'YearsAtCompany'],
        dtype='object')

[29]: y=dataframe['Attrition']
```

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Untitled3.ipynb	an hour ago
Untitled4.ipynb	21 minutes ago
weather data.csv	an hour ago

Untitled4.ipynb | IBM\_Employee\_Attrition\_Pred... | raj practice (2).ipynb

```
[31]: y, x = dmtrixes("Attrition ~ Age + Department + \
,4
0
,Name: Attrition, dtype: int64

DistanceFromHome + Education + EducationField + YearsAtCompany",
dataframe, return_type="dataframe")
print(x.columns)

Index(['Intercept', 'Age', 'Department', 'DistanceFromHome', 'Education',
'EducationField', 'YearsAtCompany'],
dtype='object')

[32]: y = np.ravel(y)

[33]: from sklearn.linear_model import LogisticRegression

model = LogisticRegression()
model = model.fit(x, y)

# check the accuracy on the training set
model.score(x, y)

/opt/anaconda3/lib/python3.7/site-packages/sklearn/linear_model/logistic.py:433: FutureWarning: Default solver wi
ll be changed to 'lbfgs' in 0.22. Specify a solver to silence this warning.

FutureWarning)

[33]: 0.8408163265306122
```

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Simple 0 4 Python (Pyodide) | Idle Mode: Command Ln 2, Col 9 IBM\_Employee\_Attrition\_Prediction.ipynb

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Python (Pyodide)

```
[0.89162714 0.10837286]

[0.85619491 0.14380509]

[0.67747664 0.32252336]

[0.93182493 0.06817507]

[0.89944427 0.10055573]]

[38]: from sklearn import metrics

print (metrics.accuracy_score(y_test, predicted))
print (metrics.roc_auc_score(y_test, probs[:, 1]))

0.8435374149659864

0.6500577589526376

[39]: print (metrics.confusion_matrix(y_test, predicted))
print (metrics.classification_report(y_test, predicted))

[[371  0]

 [ 69  1]]

precision    recall  f1-score   support

precision    recall  f1-score   support
```

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Python (Pyodide)

```
weighted avg    0.87    0.84    0.77    441

[40]: print (X_train)

Intercept  Age  Department  DistanceFromHome  Education \

338      1.0  30.0         2.0             5.0         3.0

363      1.0  33.0         2.0             5.0         3.0

759      1.0  45.0         3.0            24.0         4.0

793      1.0  28.0         1.0            15.0         2.0

581      1.0  30.0         1.0             1.0         3.0

320      1.0  27.0         2.0             2.0         3.0

452      1.0  45.0         2.0             2.0         3.0

195      1.0  37.0         1.0            21.0         3.0

776      1.0  20.0         2.0             9.0         3.0

1295     1.0  41.0         2.0             4.0         1.0

70       1.0  59.0         2.0             1.0         1.0
```

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Python (Pyodide)

	EducationField	YearsAtCompany
684	1.0	40.0
338	3.0	10.0
363	3.0	1.0
759	2.0	6.0
793	1.0	4.0
581	1.0	2.0
320	1.0	5.0
452	4.0	8.0
195	1.0	8.0
776	3.0	2.0
1295	3.0	22.0
70	1.0	4.0

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Python (Pyodide)

```
[1029 rows x 7 columns]
[41]: #add random values to KK according to the parameters mentioned above to check the probabily of attrition of the em
kk=[[1.0, 23.0, 1.0, 500.0, 3.0, 24.0, 1.0]]
print(model.predict_proba(kk))
[[7.14139240e-07 9.99999286e-01]]
```

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