HR rentention

August 7, 2022

0.0.1 Questions & Answers

1:Now do some exploratory data analysis to figureout which variables have direct and clear impact on employee retention(i.e whether they leave the company or continue to work)

2::plot bar chats showing impact of employee salaries on retention

3:plot bar chats showing corelation between department and employee retention

4:Now buld logistic regression model using varibales that were narrowed down in step 1

5:Measure the accuracy of Model

0.0.2 import libraries

[2]:
```
import pandas as pd
```

[3]:
```
from matplotlib import pyplot as plt
```

[4]:
```
%matplotlib inline
```

0.0.3 Loading The Data

- Look at some information about data & the columns
- fix any missing or incorrect values
- maximum satisfaction_level
- maximum / minimum number of projects

[5]:
```
df = pd.read_csv("../../datasets/retention.csv")
```

[11]:
```
df.head()
```

[11]:

	satisfaction_level	last_evaluation	number_project	average_montly_hours	\
0	0.38	0.53	2	157	
1	0.80	0.86	5	262	
2	0.11	0.88	7	272	
3	0.72	0.87	5	223	
4	0.37	0.52	2	159	

```
   time_spend_company  Work_accident  left  promotion_last_5years Department  \
0                   3              0     1                      0      sales
1                   6              0     1                      0      sales
2                   4              0     1                      0      sales
3                   5              0     1                      0      sales
4                   3              0     1                      0      sales

   salary
0     low
1  medium
2  medium
3     low
4     low
```

0.0.4 Data Preparation and Cleaning

[13]:
```
df.columns
```

[13]:
```
Index(['satisfaction_level', 'last_evaluation', 'number_project',
       'average_montly_hours', 'time_spend_company', 'Work_accident', 'left',
       'promotion_last_5years', 'Department', 'salary'],
      dtype='object')
```

[14]:
```
len(df.columns)
```

[14]:
```
10
```

[16]:
```
len(df)
```

[16]:
```
14999
```

[18]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 14999 entries, 0 to 14998
Data columns (total 10 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   satisfaction_level     14999 non-null  float64
 1   last_evaluation        14999 non-null  float64
 2   number_project         14999 non-null  int64
 3   average_montly_hours   14999 non-null  int64
 4   time_spend_company     14999 non-null  int64
 5   Work_accident          14999 non-null  int64
 6   left                   14999 non-null  int64
```

```
 7   promotion_last_5years  14999 non-null  int64
 8   Department             14999 non-null  object
 9   salary                 14999 non-null  object
dtypes: float64(2), int64(6), object(2)
memory usage: 1.1+ MB
```

[21]:
```
##lets see statistic of the data
df.describe()
```

[21]:

	satisfaction_level	last_evaluation	number_project	average_montly_hours	time_spend_company	Work_accident	left	promotion_last_5years
count	14999.000000	14999.000000	14999.000000	14999.000000	14999.000000	14999.000000	14999.000000	14999.000000
mean	0.612834	0.716102	3.803054	201.050337	3.498233	0.144610	0.238083	0.021268
std	0.248631	0.171169	1.232592	49.943099	1.460136	0.351719	0.425924	0.144281
min	0.090000	0.360000	2.000000	96.000000	2.000000	0.000000	0.000000	0.000000
25%	0.440000	0.560000	3.000000	156.000000	3.000000	0.000000	0.000000	0.000000
50%	0.640000	0.720000	4.000000	200.000000	3.000000	0.000000	0.000000	0.000000
75%	0.820000	0.870000	5.000000	245.000000	4.000000	0.000000	0.000000	0.000000
max	1.000000	1.000000	7.000000	310.000000	10.000000	1.000000	1.000000	1.000000

[26]:
```
#finding missing values
df.isnull().sum()
```

[26]:
```
satisfaction_level       0
last_evaluation          0
number_project           0
average_montly_hours     0
time_spend_company       0
```

```
Work_accident            0
left                     0
promotion_last_5years    0
dtype: int64
```

[25]:
```
# finding numeric columns

numerics = ['int16', 'int32', 'int64', 'float16', 'float32', 'float64']

numeric_df = df.select_dtypes(include=numerics)
len(numeric_df.columns)
```

[25]:
```
8
```

[38]:
```
#checking all data in ascending order values
df.sum().sort_values(ascending=False)
```

[38]:
```
average_montly_hours     3015554.00
number_project             57042.00
time_spend_company         52470.00
last_evaluation            10740.81
satisfaction_level          9191.89
left                        3571.00
Work_accident               2169.00
promotion_last_5years        319.00
dtype: float64
```

[41]:
```
#lets check missing percentages
missing_percentages = df.sum().sort_values(ascending=False)/len(df)
missing_percentages
```

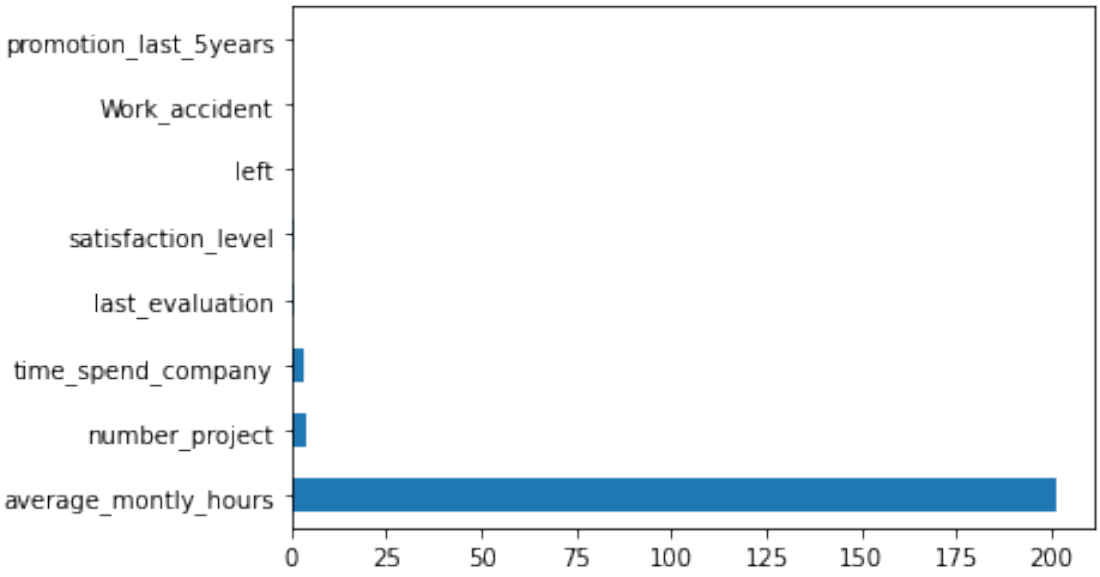
[41]:
```
average_montly_hours     201.050337
number_project             3.803054
time_spend_company         3.498233
last_evaluation            0.716102
satisfaction_level         0.612834
left                       0.238083
Work_accident              0.144610
promotion_last_5years      0.021268
dtype: float64
```

[43]:
```
#finding the type
type(missing_percentages)
```

[43]:
```
pandas.core.series.Series
```

[47]:
```
#lets see these missing percentages in graph
missing_percentages.plot(kind='barh')
```

[47]: <AxesSubplot:>



[50]:
```
#lets remove zeros values
df[df!=0]
```

[50]:

	satisfaction_level	last_evaluation	number_project	\
0	0.38	0.53	2	
1	0.80	0.86	5	
2	0.11	0.88	7	
3	0.72	0.87	5	
4	0.37	0.52	2	
…	…	…	…	
14994	0.40	0.57	2	
14995	0.37	0.48	2	
14996	0.37	0.53	2	
14997	0.11	0.96	6	
14998	0.37	0.52	2	

	average_montly_hours	time_spend_company	Work_accident	left	\
0	157	3	NaN	1.0	
1	262	6	NaN	1.0	
2	272	4	NaN	1.0	
3	223	5	NaN	1.0	
4	159	3	NaN	1.0	
…	…	…	…	…	

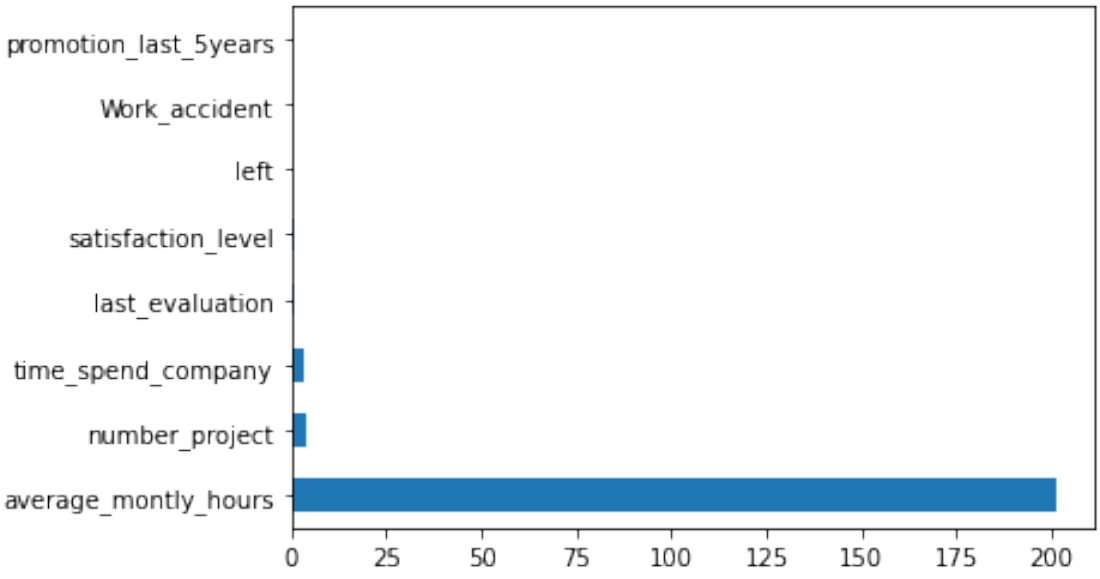
```
14994                  151                  3            NaN   1.0
14995                  160                  3            NaN   1.0
14996                  143                  3            NaN   1.0
14997                  280                  4            NaN   1.0
14998                  158                  3            NaN   1.0

       promotion_last_5years
0                        NaN
1                        NaN
2                        NaN
3                        NaN
4                        NaN
…                        …
14994                    NaN
14995                    NaN
14996                    NaN
14997                    NaN
14998                    NaN

[14999 rows x 8 columns]
```

[55]:
```
missing_percentages[missing_percentages !=0].plot(kind='barh')
```

[55]:
```
<AxesSubplot:>
```



[76]:
```
df.columns
```

[76]:
```
Index(['satisfaction_level', 'last_evaluation', 'number_project',
       'average_montly_hours', 'time_spend_company', 'Work_accident', 'left',
       'promotion_last_5years'],
      dtype='object')
```

0.0.5 columns we will analyze

- number_project
- work_accident
- left
- promotion_last_5_years

[62]:
```
df.number_project
```

[62]:
```
0        2
1        5
2        7
3        5
4        2
        ..
14994    2
14995    2
14996    2
14997    6
14998    2
Name: number_project, Length: 14999, dtype: int64
```

[66]:
```
df.number_project.unique()
```

[66]:
```
array([2, 5, 7, 6, 4, 3])
```

[68]:
```
len('number_project') #unique number of projects
```

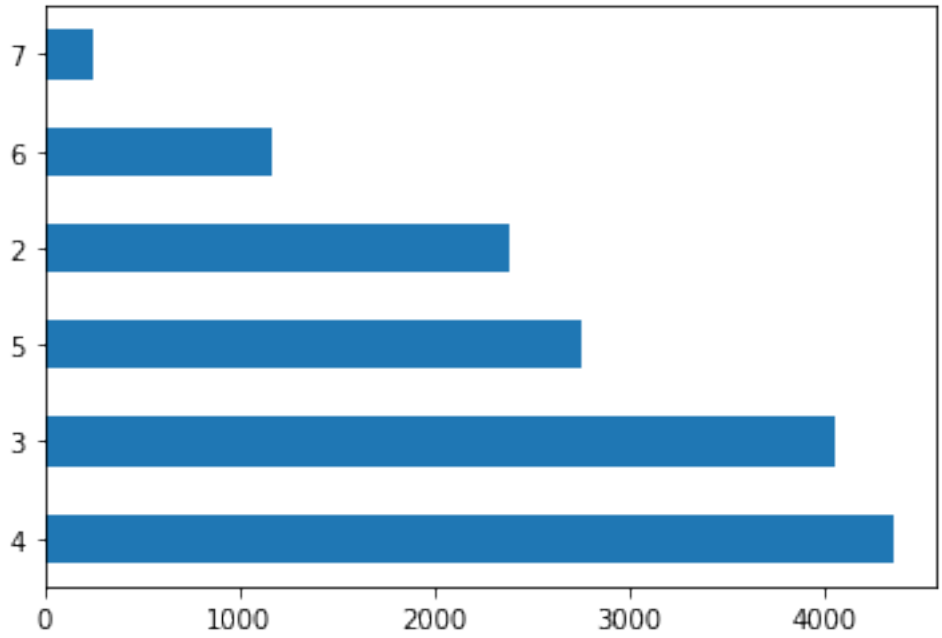
[68]:
```
14
```

[70]:
```
number_project = df.number_project.value_counts()
number_project
```

[70]:
```
4    4365
3    4055
5    2761
2    2388
6    1174
7     256
Name: number_project, dtype: int64
```

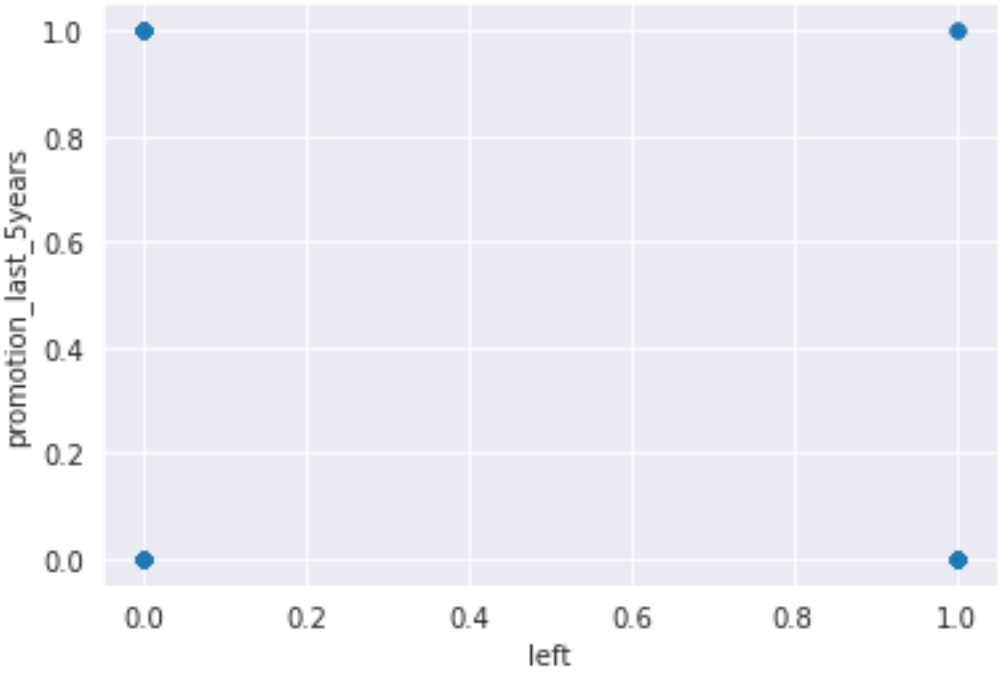
[72]:
```
number_project.plot(kind='barh')
```

[72]: <AxesSubplot:>



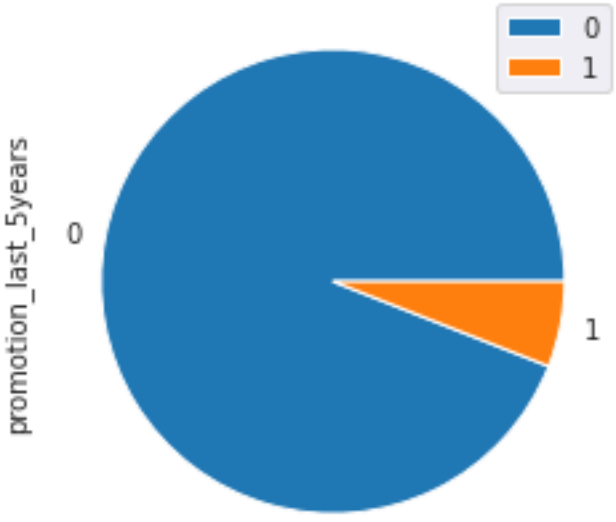
[97]:
```
df.plot.scatter(x="left", y="promotion_last_5years", alpha=0.5)
```

[97]: <AxesSubplot:xlabel='left', ylabel='promotion_last_5years'>



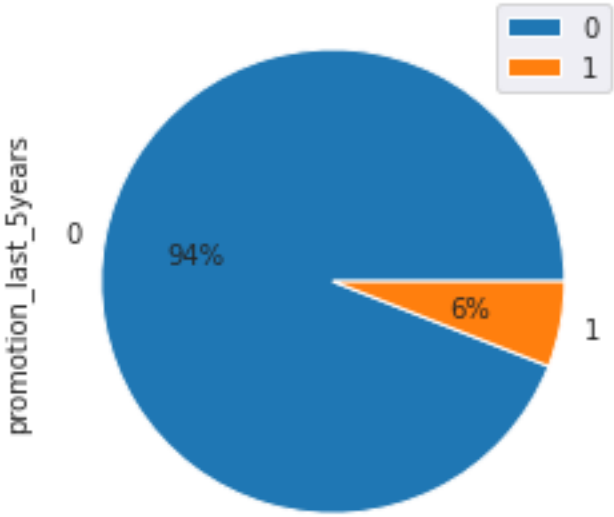
[100]:
```
df.groupby(['left']).sum().plot(kind='pie', y='promotion_last_5years')
```

[100]: <AxesSubplot:ylabel='promotion_last_5years'>



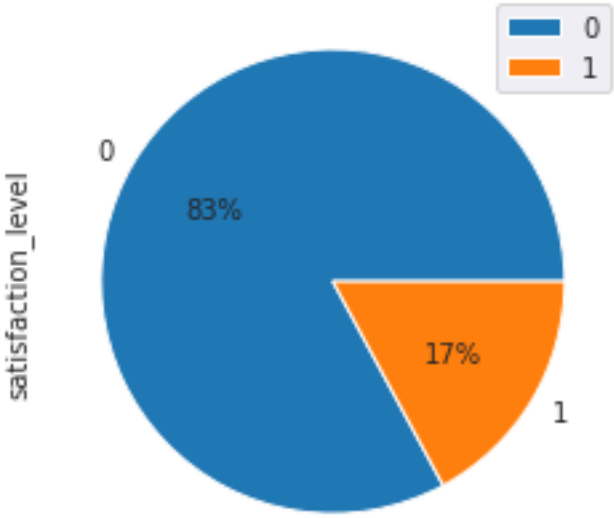
[102]:
```
df.groupby(['left']).sum().plot(
    kind='pie', y='promotion_last_5years', autopct='%1.0f%%')
```

[102]: <AxesSubplot:ylabel='promotion_last_5years'>



[108]:
```
df.groupby(['left']).sum().plot(
    kind='pie', y='satisfaction_level', autopct='%1.0f%%')
```

[108]: <AxesSubplot:ylabel='satisfaction_level'>



[111]:
```
df.satisfaction_level
```

[111]:
```
0        0.38
1        0.80
2        0.11
3        0.72
4        0.37
         …
14994    0.40
14995    0.37
14996    0.37
14997    0.11
14998    0.37
Name: satisfaction_level, Length: 14999, dtype: float64
```

[113]:
```
maxvalue_satisfaction=df.satisfaction_level.max()
```

[114]:
```
maxvalue_satisfaction
```

[114]:
```
1.0
```

[117]:
```
df.satisfaction_level.value_counts()
```

[117]:
```
0.10    358
0.11    335
0.74    257
0.77    252
0.84    247
       …
0.25     34
0.28     31
0.27     30
0.26     30
0.12     30
Name: satisfaction_level, Length: 92, dtype: int64
```

[119]:
```
df.satisfaction_level.unique()
```

[119]:
```
array([0.38, 0.8 , 0.11, 0.72, 0.37, 0.41, 0.1 , 0.92, 0.89, 0.42, 0.45,
       0.84, 0.36, 0.78, 0.76, 0.09, 0.46, 0.4 , 0.82, 0.87, 0.57, 0.43,
       0.13, 0.44, 0.39, 0.85, 0.81, 0.9 , 0.74, 0.79, 0.17, 0.24, 0.91,
       0.71, 0.86, 0.14, 0.75, 0.7 , 0.31, 0.73, 0.83, 0.32, 0.54, 0.27,
       0.77, 0.88, 0.48, 0.19, 0.6 , 0.12, 0.61, 0.33, 0.56, 0.47, 0.28,
       0.55, 0.53, 0.59, 0.66, 0.25, 0.34, 0.58, 0.51, 0.35, 0.64, 0.5 ,
       0.23, 0.15, 0.49, 0.3 , 0.63, 0.21, 0.62, 0.29, 0.2 , 0.16, 0.65,
```

```
       0.68, 0.67, 0.22, 0.26, 0.99, 0.98, 1.  , 0.52, 0.93, 0.97, 0.69,
       0.94, 0.96, 0.18, 0.95])
```

[121]:
```
from sklearn.model_selection import train_test_split
```

[154]:
```
x_train,x_test,y_train,y_test = train_test_split(df[['satisfaction_level']],df.
↪left,test_size=0.25)
```

[155]:
```
x_train
```

[155]:
```
       satisfaction_level
13374                0.77
9398                 0.92
9056                 0.74
3094                 0.74
11133                0.62
…                     …
6588                 0.47
7723                 1.00
12399                0.10
2463                 0.79
4326                 0.50

[11249 rows x 1 columns]
```

[156]:
```
x_test
```

[156]:
```
       satisfaction_level
813                  0.15
7023                 0.52
7263                 0.72
3805                 0.68
9457                 0.75
…                     …
11668                0.62
9910                 0.96
3271                 0.55
7296                 0.53
12386                0.10

[3750 rows x 1 columns]
```

[157]:
```
from sklearn.linear_model import LogisticRegression
```

[158]:
```
model = LogisticRegression()
```

[159]:
```
model.fit(x_train,y_train)
```

[159]:
```
LogisticRegression()
```

[160]:
```
x_test
```

[160]:
```
       satisfaction_level
813                  0.15
7023                 0.52
7263                 0.72
3805                 0.68
9457                 0.75
…                     …
11668                0.62
9910                 0.96
3271                 0.55
7296                 0.53
12386                0.10

[3750 rows x 1 columns]
```

[161]:
```
model.predict(x_test)
```

[161]:
```
array([1, 0, 0, …, 0, 0, 1])
```

[162]:
```
model.predict_proba(x_test)
```

[162]:
```
array([[0.40044968, 0.59955032],
       [0.73168926, 0.26831074],
       [0.85366541, 0.14633459],
       …,
       [0.75348294, 0.24651706],
       [0.73908762, 0.26091238],
       [0.35578631, 0.64421369]])
```

[165]:
```
model.score(x_test,y_test)
```

[165]:
```
0.772
```

0.0.6 Conclusion: our model show 77% score which is good enough for a model

[ ]:
```

```