company_X_employee_attrition

April 20, 2020

```
[46]: #import required packages
      import pandas  as pd
      import matplotlib.pyplot as plt
      import seaborn as sns
      %matplotlib inline
      from sklearn.feature_selection import RFE
      from sklearn.linear_model import LogisticRegression






      #load data
      #Existing employee data in sheet1 into data1
      data1 = pd.read_excel('Hash-Analytic-Python-Analytics-Problem-case-study-1.
       ↪xlsx',sheet_name=1)
      #employees who left into data2
      data2 = pd.read_excel('Hash-Analytic-Python-Analytics-Problem-case-study-1.
       ↪xlsx',sheet_name=2)
      #introduce column 'Attrition' to indicate attrition if the  employees left or␣
       ↪stayed
      data1.insert(1, 'Attrition', 0)

      data2.insert(1, 'Attrition', 1)
```

```
[47]: #combine the two dataframes
      full_data = pd.concat([data1,data2])
      #the a look at the first few records of the data
      full_data.head(5)
```

```
[47]:    Emp ID  Attrition  satisfaction_level  last_evaluation  number_project  \
      0    2001          0                0.58             0.74               4
      1    2002          0                0.82             0.67               2
      2    2003          0                0.45             0.69               5
      3    2004          0                0.78             0.82               5
      4    2005          0                0.49             0.60               3
```

```
   average_montly_hours  time_spend_company  Work_accident  \
0                   215                   3              0
1                   202                   3              0
2                   193                   3              0
3                   247                   3              0
4                   214                   2              0

   promotion_last_5years   dept salary
0                      0  sales    low
1                      0  sales    low
2                      0  sales    low
3                      0  sales    low
4                      0  sales    low
```

[48]:
```
#peak at the last few records of data
full_data.tail(5)
```

[48]:
```
      Emp ID  Attrition  satisfaction_level  last_evaluation  number_project  \
3566   14995          1                0.40             0.57               2
3567   14996          1                0.37             0.48               2
3568   14997          1                0.37             0.53               2
3569   14998          1                0.11             0.96               6
3570   14999          1                0.37             0.52               2

      average_montly_hours  time_spend_company  Work_accident  \
3566                   151                   3              0
3567                   160                   3              0
3568                   143                   3              0
3569                   280                   4              0
3570                   158                   3              0

      promotion_last_5years     dept salary
3566                      0  support    low
3567                      0  support    low
3568                      0  support    low
3569                      0  support    low
3570                      0  support    low
```

[49]:
```
#check for missing values
full_data.isnull().any()
```

[49]:
```
Emp ID                   False
Attrition                False
satisfaction_level       False
last_evaluation          False
number_project           False
average_montly_hours     False
```

```
time_spend_company       False
Work_accident            False
promotion_last_5years    False
dept                     False
salary                   False
dtype: bool
```

[50]:

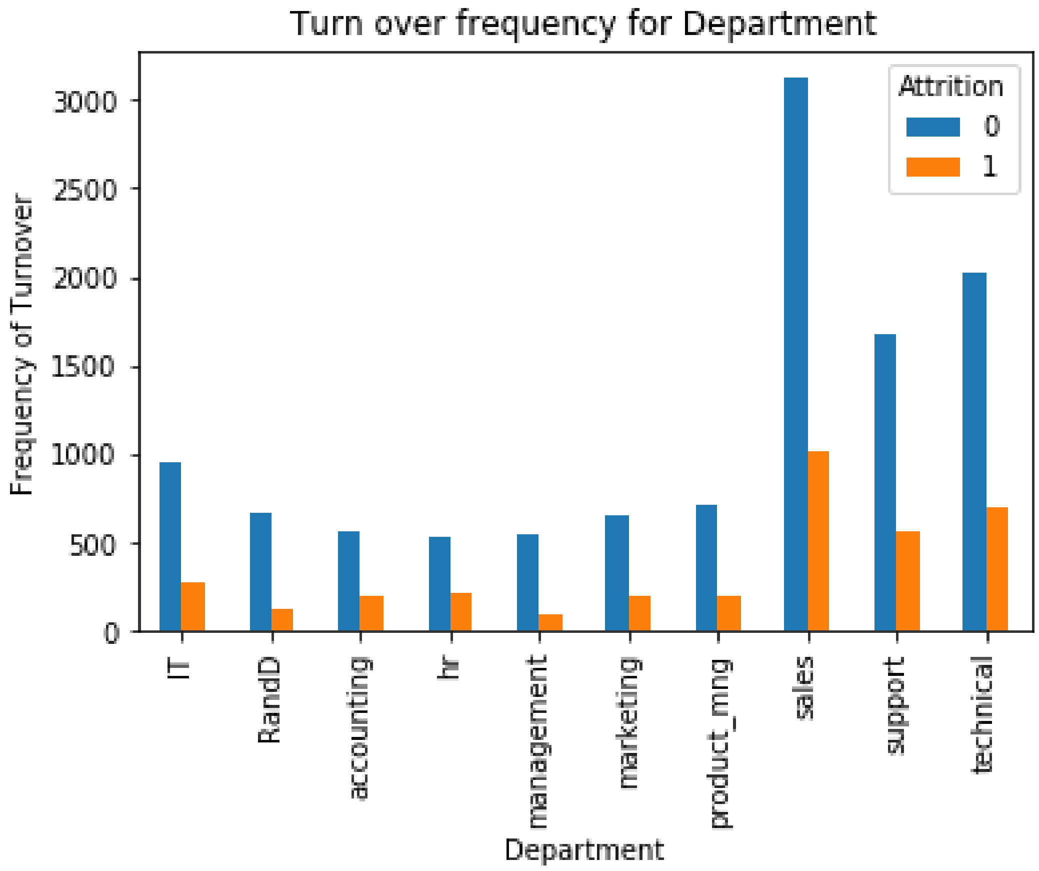
```
#check the number who left and those who did not
full_data["Attrition"].value_counts()
```

[50]:

```
0    11428
1     3571
Name: Attrition, dtype: int64
```

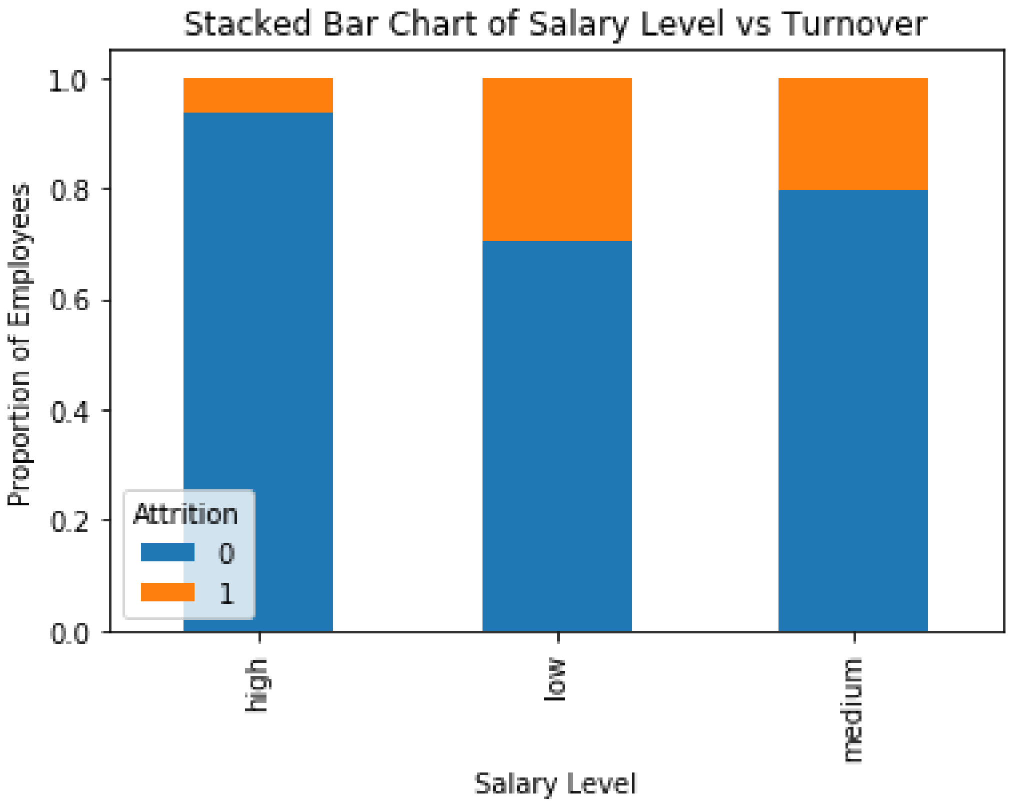
[51]:

```
#do visualitions
pd.crosstab(full_data.dept,full_data.Attrition).plot(kind='bar')
plt.title('Turn over frequency for Department')
plt.xlabel('Department')
plt.ylabel('Frequency of Turnover')
plt.savefig('department_bar_chart')
```



[52]:

```
#Bar chart for employee salary level and the frequency of turnover
table=pd.crosstab(full_data.salary, full_data.Attrition)
table.div(table.sum(1).astype(float), axis=0).plot(kind='bar', stacked=True)
plt.title('Stacked Bar Chart of Salary Level vs Turnover')
plt.xlabel('Salary Level')
plt.ylabel('Proportion of Employees')
plt.savefig('salary_bar_chart')
```



[53]:

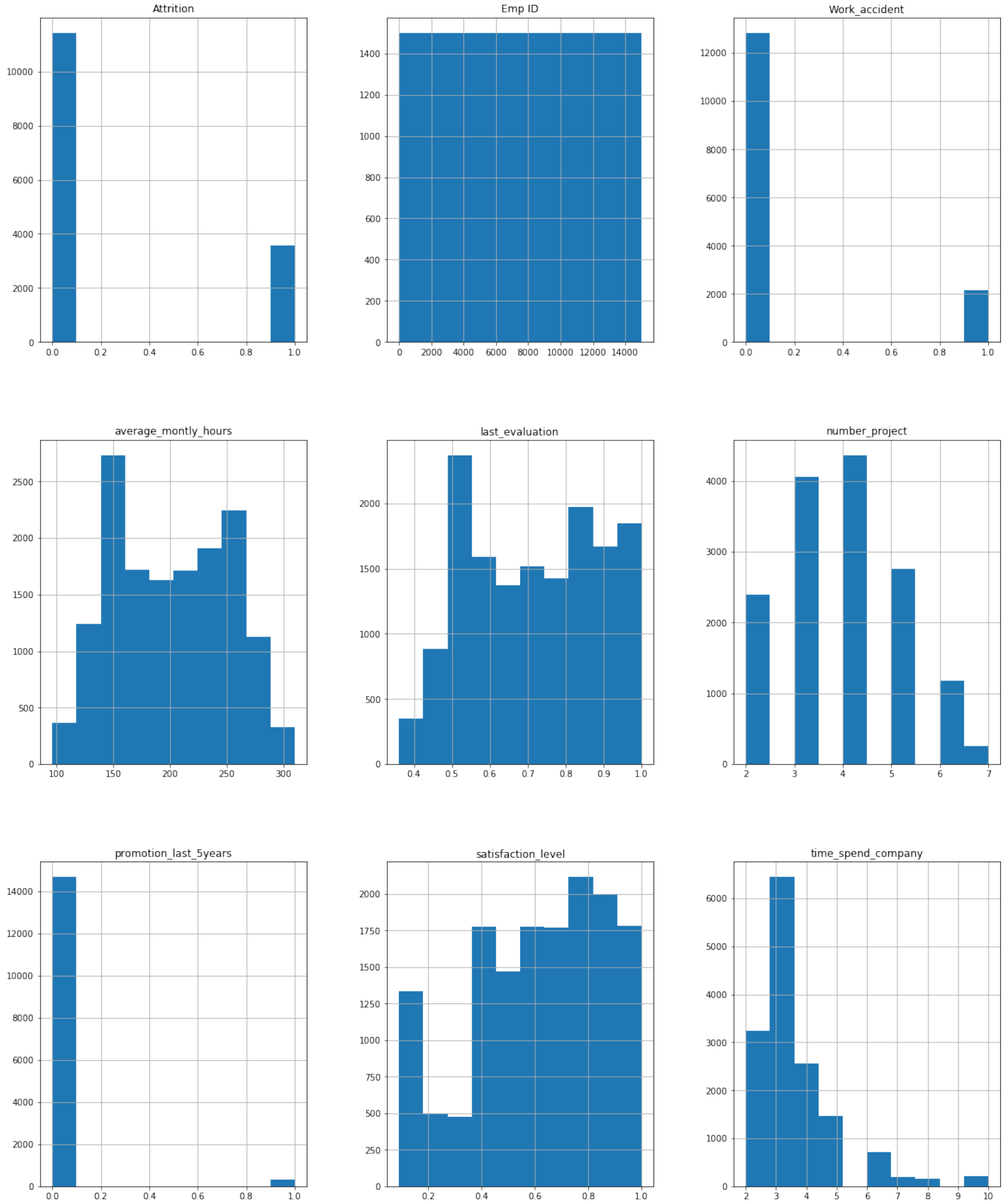
```
#Proportion of employees who left by department
pd.crosstab(full_data.dept,full_data.Attrition)
```

[53]:

```
Attrition      0    1
dept
IT           954  273
RandD        666  121
accounting   563  204
hr           524  215
management   539   91
marketing    655  203
product_mng  704  198
```

```
sales         3126   1014
support       1674    555
technical     2023    697
```

[54]:
```
#Histogram of numerical variables
num_bins = 10
full_data.hist(bins=num_bins,figsize=(20,25))
plt.savefig("hr_histogram_plots")
plt.show()
```



[55]:

```
#create dummy variables for categorical variables
categorical_variables = ['dept','salary']
for var in categorical_variables:
    cat_list = 'var' + '_' + var
    cat_list = pd.get_dummies(full_data[var],prefix=var)
    full_data1 = full_data.join(cat_list)
    full_data = full_data
```

[56]:

```
full_data.drop(full_data.columns[[9,10]],axis=1,inplace=True)
```

[57]:

```
full_data.columns.values
```

[57]:

```
array(['Emp ID', 'Attrition', 'satisfaction_level', 'last_evaluation',
       'number_project', 'average_montly_hours', 'time_spend_company',
       'Work_accident', 'promotion_last_5years'], dtype=object)
```

[58]:

```
full_data_vars = full_data.columns.values.tolist()
y=['Attrition']
X=[i for i in full_data_vars if i not in y]
X
```

[58]:

```
['Emp ID',
 'satisfaction_level',
 'last_evaluation',
 'number_project',
 'average_montly_hours',
 'time_spend_company',
 'Work_accident',
 'promotion_last_5years']
```

[59]:

```
from sklearn.feature_selection import RFE
from sklearn.linear_model import LogisticRegression

#Recursive feature elimination (RFE)
model = LogisticRegression()
rfe = RFE(model,10)
rfe = rfe.fit(full_data[X],full_data[y])
print(rfe.support_)
print(rfe.ranking_)
```

```
/home/none/.local/lib/python3.8/site-packages/sklearn/utils/validation.py:760:
DataConversionWarning: A column-vector y was passed when a 1d array was
expected. Please change the shape of y to (n_samples, ), for example using
ravel().
```

```
  y = column_or_1d(y, warn=True)

[ True  True  True  True  True  True  True  True]
[1 1 1 1 1 1 1 1]

/home/none/.local/lib/python3.8/site-
packages/sklearn/linear_model/_logistic.py:938: ConvergenceWarning: lbfgs failed
to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(
```

[60]:

```
cols = [ 'satisfaction_level',
 'last_evaluation',
 'number_project',
 'average_montly_hours',
 'time_spend_company',
 'Work_accident',
 'promotion_last_5years']
X = full_data[cols]
y = full_data['Attrition']
```

[65]:

```
#Logistic regression model
#split the data into training and test samples
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.
 ↪3,random_state=0)
```

[69]:

```
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score
#create a model and train
model = RandomForestClassifier()
model.fit(X_train,y_train)
```

[69]:

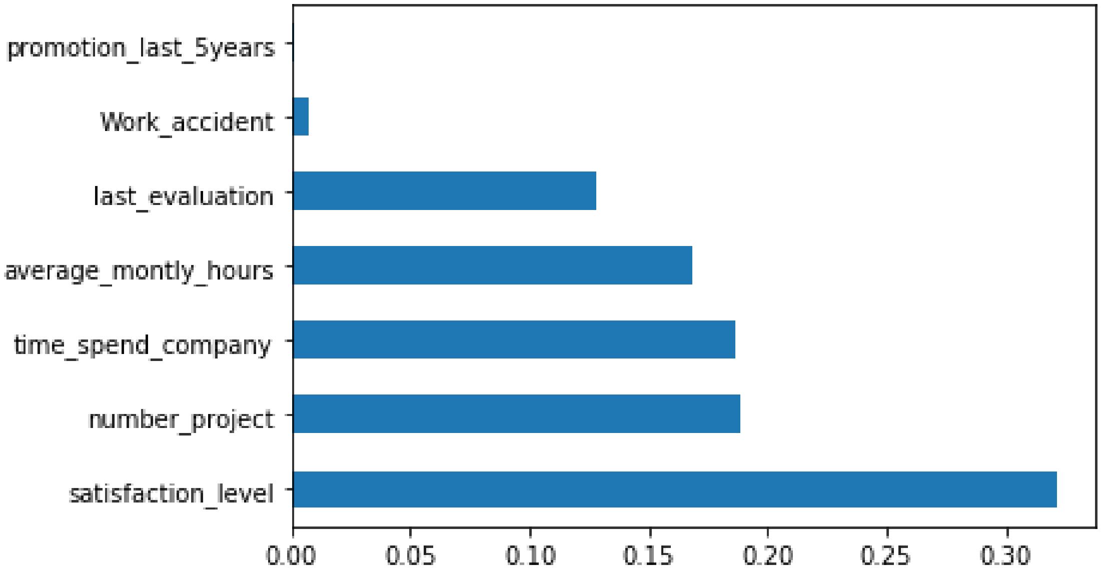
```
RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, class_weight=None,
                       criterion='gini', max_depth=None, max_features='auto',
                       max_leaf_nodes=None, max_samples=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, n_estimators=100,
                       n_jobs=None, oob_score=False, random_state=None,
                       verbose=0, warm_start=False)
```

```
[70]: #predict the results for the test
      test_pred = model.predict(X_test)

      #test the accuracy
      accuracy_score(y_test,test_pred)
```

```
[70]: 0.9915555555555555
```

```
[72]: feat_importances = pd.Series(model.feature_importances_,index=X.columns)
      feat_importances= feat_importances.nlargest(20)
      feat_importances.plot(kind='barh')
      plt.savefig('feat_importances_barh')
      plt.show()
```



```
[ ]:
```