Attrition Rate Analysis Decision Tree

```
import pandas as pd

import numpy as np

from sklearn import preprocessing

from sklearn import tree
```

Loading Data and Data Treatment:

```
Attrition_dataset = pd.read_csv("general_data.csv")

Attrition_dataset.head(2)

Out[28]:

   Age Attrition  ... YearsSinceLastPromotion YearsWithCurrManager

0   51       No  ...                       0                    0

1   31      Yes  ...                       1                    4


[2 rows x 24 columns]


Attrition_dataset.isnull().sum()

Out[29]:

Age                        0

Attrition                  0

BusinessTravel             0

Department                 0

DistanceFromHome           0

Education                  0

EducationField             0

EmployeeCount              0

EmployeeID                 0

Gender                     0

JobLevel                   0

JobRole                    0
```

```
MaritalStatus            0
MonthlyIncome            0
NumCompaniesWorked       19
Over18                   0
PercentSalaryHike        0
StandardHours            0
StockOptionLevel         0
TotalWorkingYears        9
TrainingTimesLastYear    0
YearsAtCompany           0
YearsSinceLastPromotion  0
YearsWithCurrManager     0
dtype: int64
```

```
Attrition_dataset.dtypes
Out[30]:
Age                      int64
Attrition                object
BusinessTravel           object
Department               object
DistanceFromHome         int64
Education                int64
EducationField           object
EmployeeCount            int64
EmployeeID               int64
Gender                   object
JobLevel                 int64
JobRole                  object
MaritalStatus            object
MonthlyIncome            int64
NumCompaniesWorked       float64
```

```
Over18                  object
PercentSalaryHike          int64
StandardHours             int64
StockOptionLevel          int64
TotalWorkingYears        float64
TrainingTimesLastYear       int64
YearsAtCompany            int64
YearsSinceLastPromotion     int64
YearsWithCurrManager       int64
dtype: object
```

```
Attrition_dataset['NumCompaniesWorked'].mean()
Out[31]: 2.6948303347756775
```

```
Attrition_dataset['TotalWorkingYears'].mean()
Out[32]: 11.279936378095888
```

```
Attrition_dataset = Attrition_dataset.fillna(Attrition_dataset.mean().round())
```

Encoding Categorical Variables

```
label_encoder = preprocessing.LabelEncoder()

Attrition_dataset['Attrition']= label_encoder.fit_transform(Attrition_dataset['Attrition'])

Attrition_dataset['BusinessTravel']= label_encoder.fit_transform(Attrition_dataset['BusinessTravel'])

Attrition_dataset['Department']= label_encoder.fit_transform(Attrition_dataset['Department'])

Attrition_dataset['EducationField']= label_encoder.fit_transform(Attrition_dataset['EducationField'])

Attrition_dataset['Gender']= label_encoder.fit_transform(Attrition_dataset['Gender'])
```

```
Attrition_dataset['JobRole']= label_encoder.fit_transform(Attrition_dataset['JobRole'])

Attrition_dataset['MaritalStatus']= label_encoder.fit_transform(Attrition_dataset['MaritalStatus'])
```

Random Forest Algorithm to find imp Variables

```
Attrition_dataset.columns
Out[53]:
Index(['Age', 'Attrition', 'BusinessTravel', 'Department', 'DistanceFromHome',
       'Education', 'EducationField', 'EmployeeCount', 'EmployeeID', 'Gender',
       'JobLevel', 'JobRole', 'MaritalStatus', 'MonthlyIncome',
       'NumCompaniesWorked', 'Over18', 'PercentSalaryHike', 'StandardHours',
       'StockOptionLevel', 'TotalWorkingYears', 'TrainingTimesLastYear',
       'YearsAtCompany', 'YearsSinceLastPromotion', 'YearsWithCurrManager'],
      dtype='object')

features = ['Age', 'BusinessTravel', 'Department', 'DistanceFromHome',
       'Education', 'EducationField', 'Gender',
       'JobLevel', 'JobRole', 'MaritalStatus', 'MonthlyIncome',
       'NumCompaniesWorked', 'PercentSalaryHike',
       'StockOptionLevel', 'TotalWorkingYears', 'TrainingTimesLastYear',
       'YearsAtCompany', 'YearsSinceLastPromotion', 'YearsWithCurrManager']

from sklearn.ensemble import RandomForestClassifier

rf_model = RandomForestClassifier(n_estimators= 1000, max_features= 2, oob_score=True)

rf_model.fit(X= Attrition_dataset[features], y= Attrition_dataset['Attrition'])
Out[57]:
RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, class_weight=None,
                       criterion='gini', max_depth=None, max_features=2,
                       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=1000,
                       n_jobs=None, oob_score=True, random_state=None,
                       verbose=0, warm_start=False)
```

```
print("RF Model Accuracy:", rf_model.oob_score_)
```

RF Model Accuracy: 1.0

```
for feature,imp in zip(features,rf_model.feature_importances_):
    print(feature,imp)
```

```
Age 0.09702916713419754
BusinessTravel 0.028383175530811103
Department 0.02594778942540104
DistanceFromHome 0.0699537185410984
Education 0.04114250396800288
EducationField 0.04093127319538544
Gender 0.01875959921256577
JobLevel 0.03775469477514371
JobRole 0.05576471744208975
MaritalStatus 0.03957036297807382
MonthlyIncome 0.0942158017621201
NumCompaniesWorked 0.05594751802014477
PercentSalaryHike 0.0651308855684338
StockOptionLevel 0.034040045428423114
TotalWorkingYears 0.08463252503226504
TrainingTimesLastYear 0.04473475267255931
YearsAtCompany 0.06923680257829705
YearsSinceLastPromotion 0.0432388041164298
```

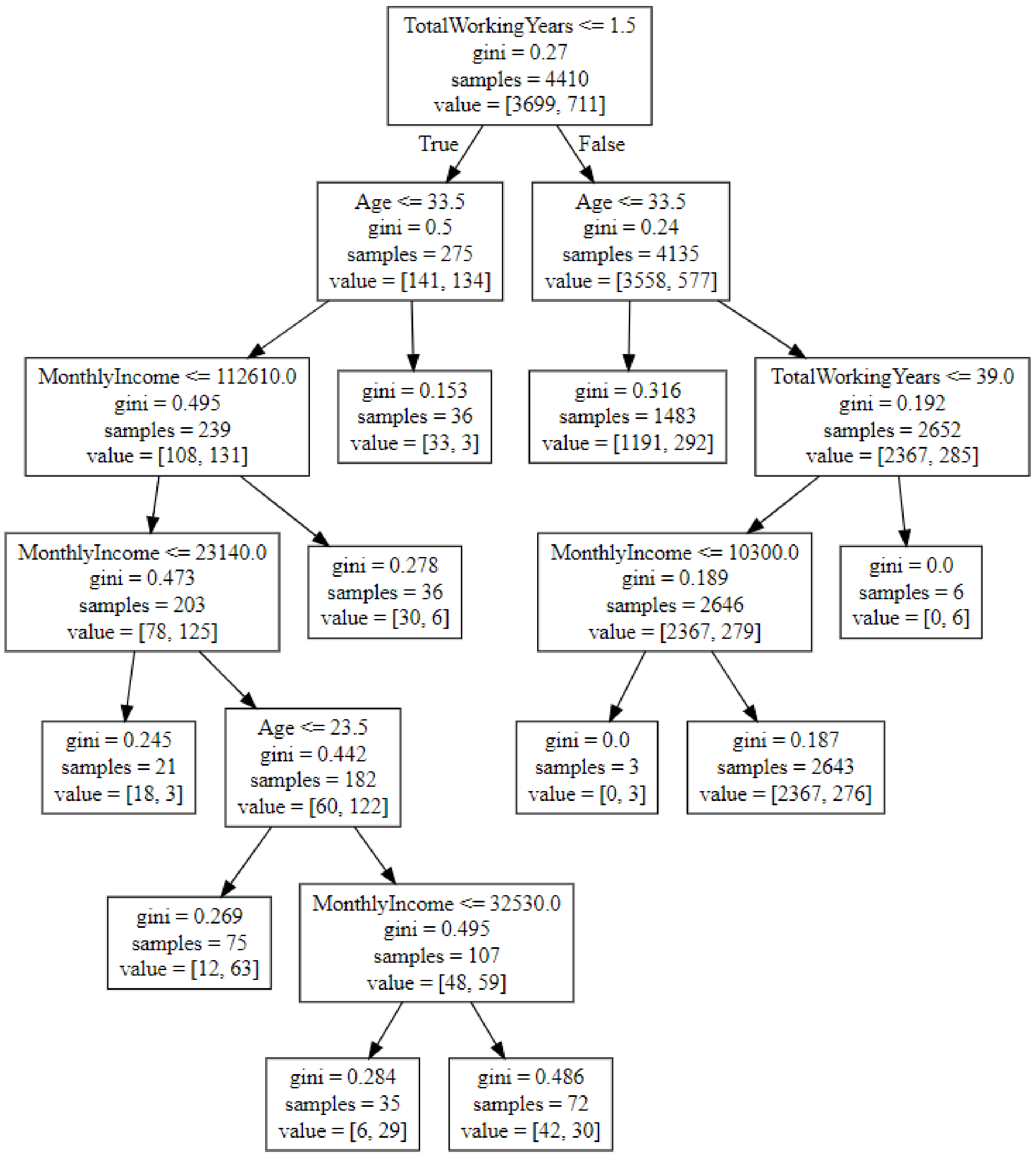
```
YearsWithCurrManager 0.05358586261855765
```

<u>Generating Decision Tree Model</u>

```
predictors = ['Age', 'MonthlyIncome', 'TotalWorkingYears']


tree_model = tree.DecisionTreeClassifier(max_depth= 6, max_leaf_nodes= 10)


tree_model.fit(X= Attrition_dataset[predictors], y= Attrition_dataset['Attrition'])
Out[49]:
DecisionTreeClassifier(ccp_alpha=0.0, class_weight=None, criterion='gini',
                       max_depth=6, max_features=None, max_leaf_nodes=10,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, presort='deprecated',
                       random_state=None, splitter='best')


with open("Attrition_DTree1.dot","w") as f:
    f = tree.export_graphviz(tree_model,feature_names= ['Age', 'MonthlyIncome', 'TotalWorkingYears'] , out_file=f)


print("DTree Model Accuracy:", tree_model.score(X= Attrition_dataset[predictors], y= Attrition_dataset['Attrition']))
```

DTree Model Accuracy: 0.8575963718820862

Decision Tree:



Rules:

Attrition- NO

1. If Total Working years is less than 1.5 and age is greater than 33.5, then there is low probability of Attrition
2. If Total Working years is less than 1.5, age is less than 33.5 and Monthly Income greater than 112610, then there is low probability of Attrition
3. If Total Working years is less than 1.5, age is less than 33.5 and Monthly Income less than 23140, then there is low probability of Attrition
4. If Total Working years is less than 1.5, age is in range 23.5 to 33.5 and Monthly Income is in range 32530 to 112610, then there is low probability of Attrition
5. If Total Working years is greater than 1.5 and age is less than 33.5, then there is low probability of Attrition
6. If Total Working years is in range of 1.5 to 39, age is greater than 33.5 and Monthly income greater than 10300, then there is low probability of Attrition

Attrition- YES

1. If Total Working years is greater than 39 and age is greater than 33.5, then there is high probability of Attrition
2. If Total Working years is in range of 1.5 to 39, age is greater than 33.5 and Monthly income less than 10300, then there is high probability of Attrition
3. If Total Working years is less than 1.5, age is less than 23.5 and Monthly Income is in range 23140 to 112160, then there is high probability of Attrition
4. If Total Working years is less than 1.5, age is in range 23.5 to 33.5 and Monthly Income is in range 23140 to 32530, then there is high probability of Attrition

<u>Inference:</u>

1. Based on the importance value generated with Random forest algorithm, it is seen that the features **'Age', 'MonthlyIncome', and 'TotalWorkingYears'** are more significant for decision tree generation.
2. Increasing the no. of significant features and max-depth, increases the accuracy of the model. But the Decision tree becomes complex and overfitted.
3. Decision tree generated with these features and max-depth of 6 and 10 leaf nodes provides **85.76%** accuracy in classifying the record as Attrition(Y/N)