```
# Importing Required Libraries
import warnings
warnings.filterwarnings('ignore')
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

```
data=pd.read_excel("/content/drive/MyDrive/Colab Notebooks/HR_Data.xlsb",engine='pyxlsb')
```

```
data.sample(5)
```

	satisfaction_level	last_evaluation	number_project	average_montly_hours	time_
11668	0.62	0.73	3	144	
4247	0.86	0.82	4	252	
2405	0.18	0.75	3	250	
2480	0.56	0.90	3	235	
7728	0.73	0.51	3	244	

```
data.shape
```

```
(14999, 10)
```

```
# check for null values
data.isnull().sum()
```

```
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
Department               0
salary                   0
dtype: int64
```

```
data.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
```

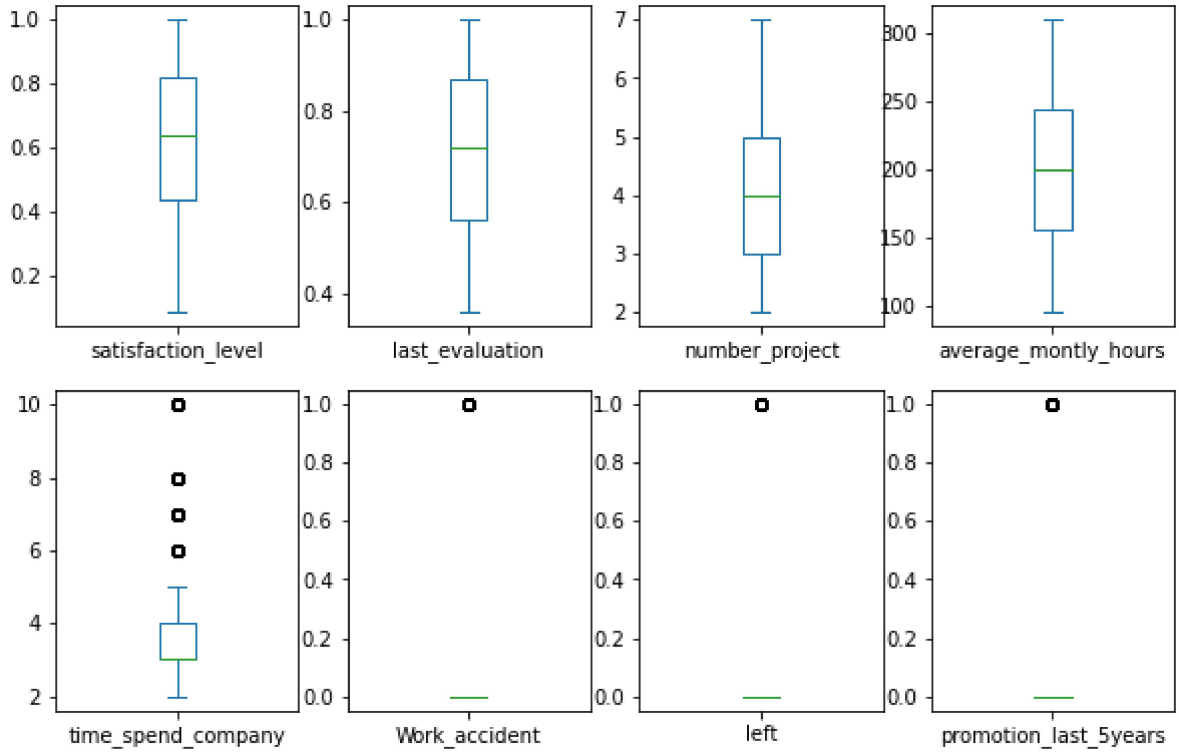
```
data.describe()
```

	satisfaction_level	last_evaluation	number_project	average_montly_hours	time_
count	14999.000000	14999.000000	14999.000000	14999.000000	
mean	0.612834	0.716102	3.803054	201.050337	
std	0.248631	0.171169	1.232592	49.943099	
min	0.090000	0.360000	2.000000	96.000000	
25%	0.440000	0.560000	3.000000	156.000000	
50%	0.640000	0.720000	4.000000	200.000000	
75%	0.820000	0.870000	5.000000	245.000000	
max	1.000000	1.000000	7.000000	310.000000	

```
# correlation of independent features with dependent features
sns.heatmap(data.corr(),annot=True);
```

1. EDA

```
# Handling the outliers
data.plot(kind='box', subplots=True, figsize=(10,10),layout=(3,4))
plt.show()
```



Very few outliers are detected, So there is no need to handle the outliers

```
chr_=data.select_dtypes("object")
chr_.columns
```

```
Index(['Department', 'salary'], dtype='object')
```

```
print(data["Department"].unique())
```

```
print()
print("unique_val :",data["Department"].nunique())
```

```
['sales' 'accounting' 'hr' 'technical' 'support' 'management' 'IT'
 'product_mng' 'marketing' 'RandD']

unique_val : 10
```

```
print(data["salary"].unique())
print()
print("unique_val :",data["salary"].nunique())
```

```
['low' 'medium' 'high']

unique_val : 3
```

Handling The Categorical Data

```
data['salary']= data['salary'].map({'high':2, 'medium':1, 'low':0})
```

```
data['salary'].unique()
```

```
array([0, 1, 2])
```

```
data['Department']=data['Department'].map({'sales':0, 'accounting':1, 'hr':2,
'technical':3, 'support':4, 'management':5,'IT':6, 'product_mng':7,
                                'marketing':8, 'RandD':9})
```

```
data['Department'].unique()
```

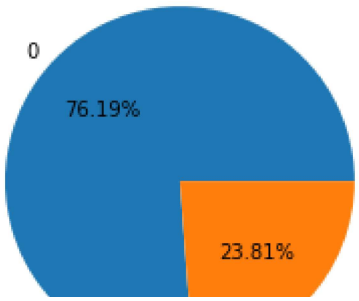
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

Analysis of Dependent Feature

```
data['left'].value_counts()
```

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

```
plt.pie(data["left"].value_counts(),labels=data['left'].value_counts().index,autopct='%1.2f%%
```

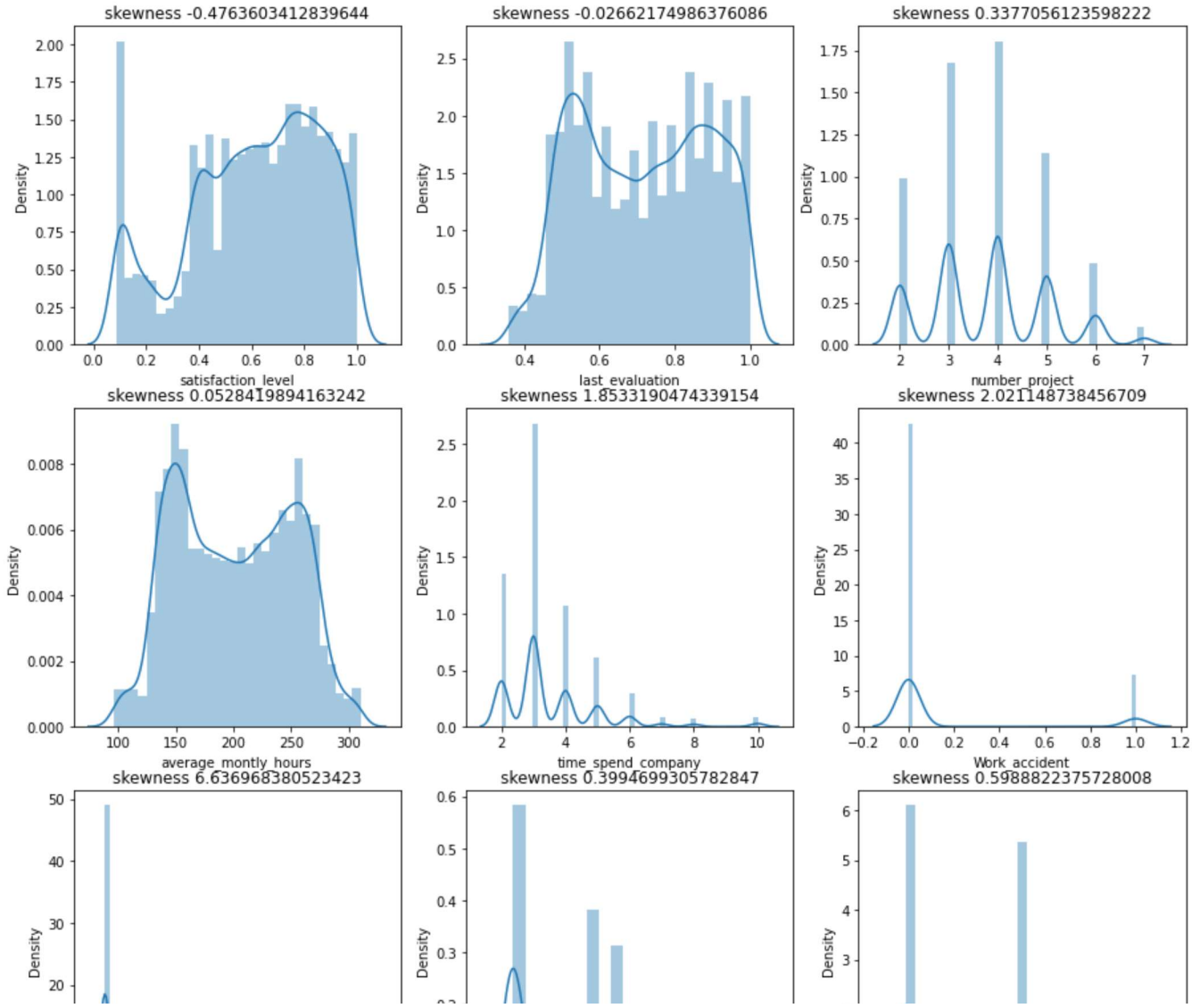



```
data.head(3)
```

	satisfaction_level	last_evaluation	number_project	average_montly_hours	time_spen
0	0.38	0.53	2	157	
1	0.80	0.86	5	262	
2	0.11	0.88	7	272	

```
from scipy.stats import skew


k=0
plt.figure(figsize=(15,15))
for col in data.drop('left',axis=1):
    k=k+1
    plt.subplot(3,3,k)
    sns.distplot(data[col])
    plt.title("skewness"+' '+str(data[col].skew()))
```




```
# visualization of correlation of features & label
sns.pairplot(data,hue='left');
```

2. Model Building

```
X = data.drop("left",axis=1)
y= data.left
```

```
from sklearn.model_selection import train_test_split
```

```
from sklearn.metrics import *
```

LogisticRegression

```
from sklearn.linear_model import LogisticRegression
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.3,random_state=0)
lr=LogisticRegression()
lr.fit(X_train,y_train)
```

```
LogisticRegression()
```

```
y_pred=lr.predict(X_test)
```

```
lr.score(X_train,y_train)
```

```
0.7917896942565958
```

```
lr.score(X_test,y_test)
```

```
0.792
```

GridSearchCV

```
from sklearn.model_selection import GridSearchCV,cross_val_score,StratifiedKFold

lr=LogisticRegression()
solvers = ['lbfgs', 'liblinear','newton-cg']
penalty = ['l2',"l1"]
c_values = [100, 10, 1.0, 0.1, 0.01]


fold=StratifiedKFold(n_splits=5,shuffle=True,random_state=0)
grid = dict(solver=solvers,penalty=penalty,C=c_values)

model=GridSearchCV(estimator=lr,
                   param_grid=grid,
                   scoring='accuracy',
                   verbose=1,cv=fold)

model.fit(X_train, y_train)

print(model.best_params_)
print(model.best_score_)
print(model.best_estimator_)
```

```
Fitting 5 folds for each of 30 candidates, totalling 150 fits
{'C': 100, 'penalty': 'l2', 'solver': 'lbfgs'}
0.7969326890355952
LogisticRegression(C=100)
```

```
new_lr=LogisticRegression(C=100, solver='liblinear')
new_lr.fit(X_train,y_train)
y_pred=new_lr.predict(X_test)
```

```
lr_score=new_lr.score(X_test,y_test)
precision_score_lr=(precision_score(y_test,y_pred))
recall_score_lr=(recall_score(y_test,y_pred))
f1_score_lr=(f1_score(y_test,y_pred))
roc_auc_score_lr=(roc_auc_score(y_test,y_pred))
```

```
print("logistic_accuracy_score :",lr_score)
print("pricision :",precision_score_lr)
print("recall :",recall_score_lr)
print("f1_score :",f1_score_lr)
print("roc_auc_score :",roc_auc_score_lr)
```

```
logistic_accuracy_score : 0.7917777777777778
pricision : 0.5790297339593115
recall : 0.35645472061657035
f1_score : 0.4412641621943948
roc_auc_score : 0.639376984802797
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	370	668
not left	269	3193

```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           0       0.83      0.92      0.87      3462
           1       0.58      0.36      0.44      1038

    accuracy                           0.79      4500
   macro avg       0.70      0.64      0.66      4500
weighted avg       0.77      0.79      0.77      4500
```

Support Vector

```
from sklearn.svm import SVC
svc = SVC().fit(X_train,y_train)


y_pred=svc.predict(X_test)


svc_score=accuracy_score(y_test,y_pred)
svc_score
```

```
0.7902222222222223
```

GridSearchCV

```
 # fold=StratifiedKFold(n_splits=5,shuffle=True,random_state=0)
 kernel=['linear', 'rbf']
 C=[0.1,0.01,0.001,1]
 grid = dict(kernel=kernel ,C=C)
 gs_model=GridSearchCV(estimator=SVC(),param_grid=grid,cv=fold,verbose=1,return_train_score=True)
 gs_model.fit(X_train,y_train)
 print(gs_model.best_score_)
 print(gs_model.best_params_)
 print(gs_model.best_estimator_)
```

```
svc=SVC(C=100, kernel='rbf').fit(X_train,y_train)
y_pred=svc.predict(X_test)
svc_score=accuracy_score(y_test,y_pred)
print(svc_score)
```

```
0.9051111111111111
```

```
precision_score_svc=(precision_score(y_test,y_pred))
recall_score_svc=(recall_score(y_test,y_pred))
f1_score_svc=(f1_score(y_test,y_pred))
roc_auc_score_svc=(roc_auc_score(y_test,y_pred))


print("SVC_accuracy_score :",svc_score)
print("pricision :",precision_score_svc)
print("recall :",recall_score_svc)
print("f1_score :",f1_score_svc)
print("roc_auc_score :",roc_auc_score_svc)
```

```
SVC_accuracy_score : 0.9051111111111111
pricision : 0.8375690607734807
recall : 0.7302504816955684
f1_score : 0.7802367472979927
roc_auc_score : 0.8438947382481308
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	758	280
not left	147	3315

```
print(classification_report(y_test,y_pred))
```

```
                  precision    recall  f1-score   support

               0       0.92      0.96      0.94      3462
               1       0.84      0.73      0.78      1038

        accuracy                           0.91      4500
       macro avg       0.88      0.84      0.86      4500
    weighted avg       0.90      0.91      0.90      4500
```

KNeighborsClassifier

```
from sklearn.neighbors import KNeighborsClassifier
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=42)

n_neighbors=[5,10,15,20,25,50,75,100]
params=dict(n_neighbors=n_neighbors)
gs_model=GridSearchCV(estimator=KNeighborsClassifier(),param_grid=params,scoring='accuracy',c
gs_model.fit(X_train,y_train)
print(gs_model.best_score_)
print(gs_model.best_params_)
print(gs_model.best_estimator_)
```

```
Fitting 5 folds for each of 8 candidates, totalling 40 fits
0.930660066694456
{'n_neighbors': 5}
KNeighborsClassifier()
```

```
knn=KNeighborsClassifier().fit(X_train,y_train)
y_pred=knn.predict(X_test)
```

```
knn_score=accuracy_score(y_test,y_pred)
knn_score
```

```
0.926
```

```
precision_score_knn=(precision_score(y_test,y_pred))
recall_score_knn=(recall_score(y_test,y_pred))
f1_score_knn=(f1_score(y_test,y_pred))
roc_auc_score_knn=(roc_auc_score(y_test,y_pred))
```

```
print("knn_accuracy_score :",knn_score)
print("pricision :",precision_score_knn)
print("recall :",recall_score_knn)
print("f1_score :",f1_score_knn)
print("roc_auc_score :",roc_auc_score_knn)
```

```
knn_accuracy_score : 0.926
pricision : 0.8047858942065491
recall : 0.9050991501416431
f1_score : 0.8520000000000001
roc_auc_score : 0.9187657912870377
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	639	67
not left	155	2139

```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           0       0.97      0.93      0.95      2294
           1       0.80      0.91      0.85       706

    accuracy                           0.93      3000
   macro avg       0.89      0.92      0.90      3000
weighted avg       0.93      0.93      0.93      3000
```

NaiveBayes

```
from sklearn.naive_bayes import GaussianNB
```

```
nb=GaussianNB().fit(X_train,y_train)
y_pred_=nb.predict(X_test)
nb_score=accuracy_score(y_test,y_pred_)
nb_score
```

```
0.792
```

```
precision_score_nb=(precision_score(y_test,y_pred_))
recall_score_nb=(recall_score(y_test,y_pred_))
f1_score_nb=(f1_score(y_test,y_pred_))
roc_auc_score_nb=(roc_auc_score(y_test,y_pred_))
```

```
print("nb_accuracy_score :",nb_score)
print("pricision :",precision_score_nb)
print("recall :",recall_score_nb)
print("f1_score :",f1_score_nb)
print("roc_auc_score :",roc_auc_score_nb)
```

```
nb_accuracy_score : 0.792
pricision : 0.5441810344827587
recall : 0.7152974504249292
f1_score : 0.6181150550795593
roc_auc_score : 0.7654516894670418
```

```
cm = np.array(confusion_matrix(y_test, y_pred_, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	505	201
not left	423	1871

```
print(classification_report(y_test,y_pred_))
```

```
              precision    recall  f1-score   support

           0       0.90      0.82      0.86      2294
           1       0.54      0.72      0.62       706

    accuracy                           0.79      3000
   macro avg       0.72      0.77      0.74      3000
weighted avg       0.82      0.79      0.80      3000
```

DecisionTree

```
from sklearn.tree import DecisionTreeClassifier
dt=DecisionTreeClassifier().fit(X_train,y_train)
dt.score(X_test,y_test)
```

```
0.976
```

GridSearchCV

```
dt=DecisionTreeClassifier()
param_grid = {'max_features': ['auto', 'sqrt', 'log2'],
              'ccp_alpha': [0.1, .01, .001],
              'max_depth' : [2,4,6,8,10],
              'criterion' :['gini', 'entropy'],
              'min_samples_split':[2,4,6],
              'min_samples_leaf':[1,2,3]
             }
gs_model=GridSearchCV(estimator=dt,param_grid=param_grid,scoring='accuracy',verbose=1,cv=fold
gs_model.fit(X_train,y_train)
print(gs_model.best_score_)
print(gs_model.best_estimator_)
```

```
Fitting 5 folds for each of 810 candidates, totalling 4050 fits
0.97699732527442
DecisionTreeClassifier(ccp_alpha=0.001, criterion='entropy', max_depth=10,
                       max_features='log2', min_samples_leaf=2)
```

```
dtree=DecisionTreeClassifier(ccp_alpha=0.001, criterion='entropy', max_depth=10,max_features=
dtree.fit(X_train,y_train)
y_pred=dtree.predict(X_test)
```

```
dtree_score=accuracy_score(y_test,y_pred)
dtree_score
```

```
0.9656666666666667
```

```
precision_score_dt=(precision_score(y_test,y_pred))
recall_score_dt=(recall_score(y_test,y_pred))
f1_score_dt=(f1_score(y_test,y_pred))
roc_auc_score_dt=(roc_auc_score(y_test,y_pred))
```

```
print("dt_accuracy_score :",dtree_score)
print("pricision :",precision_score_dt)
print("recall :",recall_score_dt)
print("f1_score :",f1_score_dt)
print("roc_auc_score :",roc_auc_score_dt)
```

```
dt_accuracy_score : 0.9656666666666667
pricision : 0.886685552407932
```

```
recall : 0.886685552407932
f1_score : 0.886685552407932
roc_auc_score : 0.925905984573626
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	626	80
not left	80	2214

```
print(classification_report(y_test,y_pred))
```

```
                  precision    recall  f1-score   support

               0       0.97      0.97      0.97      2294
               1       0.89      0.89      0.89       706

        accuracy                           0.95      3000
       macro avg       0.93      0.93      0.93      3000
    weighted avg       0.95      0.95      0.95      3000
```

RandomForest

```
from sklearn.ensemble import RandomForestClassifier
rf=RandomForestClassifier().fit(X_train,y_train)
rf.score(X_test,y_test)
```

```
0.9886666666666667
```

GridSearchCV

```
rf=RandomForestClassifier()
param_grid = {'max_features': ['auto', 'sqrt'],
              'n_estimators': [100,150],
              'max_depth' : [2,6,10],
              'criterion' :['gini', 'entropy'],
              'min_samples_split':[2,4,6],
              'min_samples_leaf':[1,2,3]
             }
```

```
gs_model=GridSearchCV(estimator=rf,param_grid=param_grid,scoring='accuracy',verbose=1,cv=fold
gs_model.fit(X_train,y_train)
```

```
print(gs_model.best_score_)
print(gs_model.best_params_)
print(gs_model.best_estimator_)
```

```
Fitting 5 folds for each of 216 candidates, totalling 1080 fits
0.9815815270251494
{'criterion': 'gini', 'max_depth': 10, 'max_features': 'auto', 'min_samples_leaf': 1, 'm
RandomForestClassifier(max_depth=10)
```

```
rforest=RandomForestClassifier(criterion='gini', max_depth=10, max_features='auto',
                       min_samples_split=2, n_estimators=100).fit(X_train,y_train)


y_pred=rforest.predict(X_test)


rf_score=accuracy_score(y_test,y_pred)
rf_score
```

```
0.979
```

```
precision_score_rf=(precision_score(y_test,y_pred))
recall_score_rf=(recall_score(y_test,y_pred))
f1_score_rf=(f1_score(y_test,y_pred))
roc_auc_score_rf=(roc_auc_score(y_test,y_pred))


print("rf_accuracy_score :",rf_score)
print("pricision :",precision_score_rf)
print("recall :",recall_score_rf)
print("f1_score :",f1_score_rf)
print("roc_auc_score :",roc_auc_score_rf)
```

```
rf_accuracy_score : 0.979
pricision : 0.989345509893455
recall : 0.9206798866855525
f1_score : 0.9537784299339692
roc_auc_score : 0.9588142240751214
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	650	56
not left	7	2287

```
print(classification_report(y_test,y_pred))
```

```
                   precision    recall  f1-score   support

                0       0.98      1.00      0.99      2294
                1       0.99      0.92      0.95       706

         accuracy                           0.98      3000
        macro avg       0.98      0.96      0.97      3000
     weighted avg       0.98      0.98      0.98      3000
```

AdaBoostClassifier

```
from sklearn.ensemble import AdaBoostClassifier
ada_clf = AdaBoostClassifier(RandomForestClassifier())
ada_clf.fit(X_train, y_train)
```

```
AdaBoostClassifier(base_estimator=RandomForestClassifier())
```

```
y_pred=ada_clf.predict(X_test)
```

```
ada_score=accuracy_score(y_test,y_pred)
ada_score
```

```
0.988
```

```
precision_score_ada=(precision_score(y_test,y_pred))
recall_score_ada=(recall_score(y_test,y_pred))
f1_score_ada=(f1_score(y_test,y_pred))
roc_auc_score_ada=(roc_auc_score(y_test,y_pred))
```

```
print("ada_accuracy_score :",ada_score)
print("pricision :",precision_score_ada)
print("recall :",recall_score_ada)
print("f1_score :",f1_score_ada)
print("roc_auc_score :",roc_auc_score_ada)
```

```
ada_accuracy_score : 0.988
pricision : 0.9883720930232558
recall : 0.9631728045325779
f1_score : 0.9756097560975608
roc_auc_score : 0.9798427231032549
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	680	26
not left	8	2286

```
print(classification_report(y_test,y_pred))
```

```
                  precision    recall  f1-score   support

               0       0.99      1.00      0.99      2294
               1       0.99      0.96      0.98       706

        accuracy                           0.99      3000
       macro avg       0.99      0.98      0.98      3000
    weighted avg       0.99      0.99      0.99      3000
```

XGBoost

```
 from xgboost import XGBClassifier
xgb_clf =XGBClassifier(max_depth=5, n_estimators=10000, learning_rate=0.3,n_jobs=-1)
xgb_clf.fit(X_train, y_train)
```

```
    XGBClassifier(learning_rate=0.3, max_depth=5, n_estimators=10000, n_jobs=-1)
```

```
y_pred=xgb_clf.predict(X_test)
```

```
xgb_score=accuracy_score(y_test,y_pred)
xgb_score
```

```
    0.9846666666666667
```

```
precision_score_xgb=(precision_score(y_test,y_pred))
recall_score_xgb=(recall_score(y_test,y_pred))
f1_score_xgb=(f1_score(y_test,y_pred))
roc_auc_score_xgb=(roc_auc_score(y_test,y_pred))
```

```
print("xgb_accuracy_score :",xgb_score)
print("pricision :",precision_score_xgb)
print("recall :",recall_score_xgb)
print("f1_score :",f1_score_xgb)
print("roc_auc_score :",roc_auc_score_xgb)
```

```
    xgb_accuracy_score : 0.9846666666666667
    pricision : 0.9714285714285714
    recall : 0.9631728045325779
```

```
f1_score : 0.9672830725462305
roc_auc_score : 0.977227204358704
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	680	26
not left	20	2274

```
print(classification_report(y_test,y_pred))
```

```
                  precision    recall  f1-score   support

               0       0.99      0.99      0.99      2294
               1       0.97      0.96      0.97       706

        accuracy                           0.98      3000
       macro avg       0.98      0.98      0.98      3000
    weighted avg       0.98      0.98      0.98      3000
```

Voting_Classifier

```
from sklearn.ensemble import VotingClassifier
log_clf = LogisticRegression(random_state=42)
rnd_clf = RandomForestClassifier(random_state=42)
svm_clf = SVC(random_state=42, probability=True)

voting_clf = VotingClassifier(
    estimators=[('lr', log_clf), ('rf', rnd_clf), ('svc', svm_clf)],
    voting='soft')

voting_clf.fit(X_train, y_train)
```

```
VotingClassifier(estimators=[('lr', LogisticRegression(random_state=42)),
                             ('rf', RandomForestClassifier(random_state=42)),
                             ('svc', SVC(probability=True, random_state=42))],
                 voting='soft')
```

```
for clf in (log_clf, rnd_clf, svm_clf, voting_clf):
    clf.fit(X_train, y_train)
    y_pred = clf.predict(X_test)
    print(clf.__class__.__name__, accuracy_score(y_test, y_pred))
```

```
LogisticRegression 0.7776666666666666
```

```
RandomForestClassifier 0.988
SVC 0.7846666666666666
VotingClassifier 0.925
```

```
voting_clf.fit(X_train, y_train)
y_pred = voting_clf.predict(X_test)
vtc_score=accuracy_score(y_test, y_pred)
vtc_score
```

```
0.925
```

```
precision_score_vtc=(precision_score(y_test,y_pred))
recall_score_vtc=(recall_score(y_test,y_pred))
f1_score_vtc=(f1_score(y_test,y_pred))
roc_auc_score_vtc=(roc_auc_score(y_test,y_pred))
```

```
print("vtc_accuracy_score :",vtc_score)
print("pricision :",precision_score_vtc)
print("recall :",recall_score_vtc)
print("f1_score :",f1_score_vtc)
print("roc_auc_score :",roc_auc_score_vtc)
```

```
vtc_accuracy_score : 0.925
pricision : 0.9461966604823747
recall : 0.7223796033994334
f1_score : 0.8192771084337348
roc_auc_score : 0.8548689647337184
```

```
cm = np.array(confusion_matrix(y_test, y_pred, labels=[1,0]))
confusion = pd.DataFrame(cm, index=['left', 'not left'],columns=['predicted left','predicted
confusion
```

	predicted left	predicted not left
left	510	196
not left	29	2265

```
print(classification_report(y_test,y_pred))
```

```
              precision    recall  f1-score   support

           0       0.92      0.99      0.95      2294
           1       0.95      0.72      0.82       706

    accuracy                           0.93      3000
   macro avg       0.93      0.85      0.89      3000
weighted avg       0.93      0.93      0.92      3000
```

Result Table

```
result=pd.DataFrame({
'model':['LogisticRegression','SVC','KNeighborsClassifier','GaussianNB',
'DecisionTree','RandomForest','AdaBoostClassifier','XGBoost','Voting_Classifier'],

'Accuracy_score':[lr_score,svc_score,knn_score,nb_score,dtree_score,rf_score,ada_score,xgb_sc

'Precision_score':[precision_score_lr,precision_score_svc,precision_score_knn,precision_score
                   precision_score_dt,precision_score_rf,precision_score_ada,precision_score_

'recall_score':[recall_score_lr,recall_score_svc,recall_score_knn,recall_score_nb,recall_scor
                recall_score_rf,recall_score_ada,recall_score_xgb,recall_score_vtc],

'f1_score':[f1_score_lr,f1_score_svc,f1_score_knn,f1_score_nb,f1_score_dt,f1_score_rf,f1_scor

'roc_auc_score':[roc_auc_score_lr,roc_auc_score_svc,roc_auc_score_knn,roc_auc_score_nb,
             roc_auc_score_dt,roc_auc_score_rf,roc_auc_score_ada,roc_auc_score_xgb,roc_auc_s

},index=range(1,10))


result = result.round(decimals = 4)
result
```

	model	Accuracy_score	Precision_score	recall_score	f1_score	roc_auc_
1	LogisticRegression	0.7918	0.5790	0.3565	0.4413	0
2	SVC	0.9051	0.8376	0.7303	0.7802	0
3	KNeighborsClassifier	0.9260	0.8048	0.9051	0.8520	0
4	GaussianNB	0.7920	0.5442	0.7153	0.6181	0
5	DecisionTree	0.9657	0.8867	0.8867	0.8867	0
6	RandomForest	0.9790	0.9893	0.9207	0.9538	0
7	AdaBoostClassifier	0.9880	0.9884	0.9632	0.9756	0
8	XGBoost	0.9847	0.9714	0.9632	0.9673	0
9	Voting_Classifier	0.9250	0.9462	0.7224	0.8193	0

```
# Maximum scores from  all models
max_score =result.iloc[:,1:6].max()
max_score
```

```
Accuracy_score     0.9880
Precision_score    0.9893
```

```
recall_score       0.9632
f1_score           0.9756
roc_auc_score      0.9798
dtype: float64
```

Base on the above maximum scores,Final Best Model for these Dataset is AdaBoostClassifier

```
from sklearn.ensemble import AdaBoostClassifier
ada_clf = AdaBoostClassifier(RandomForestClassifier())
ada_clf.fit(X_train, y_train)
y_pred=ada_clf.predict(X_test)
```

3. Prediction on Test Data

```
# comparing actual values with predicted values
result=pd.DataFrame({'Actual':y_test,"Predicted":y_pred})
result.sample(10)
```

	Actual	Predicted
11346	0	0
14578	1	1
13379	0	0
4863	0	0
4921	0	0
9808	0	0
4062	0	0
1783	1	1
4192	0	0
14041	0	0

By observing the above prediction we can say that our Mode is Best for the Accurate Prediction

Also, I can conclude that our model gives the almost 99% correct prediction

4. Prediction on new features

```
data.head(1)
```

	satisfaction_level	last_evaluation	number_project	average_montly_hours	time_spend
0	0.38	0.53	2	157	

```
data.columns
```

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

```
def prediction(satisfaction_level,last_evaluation,number_project,average_montly_hours,time_sp
    corr_pred=int(ada_clf.predict([[satisfaction_level,last_evaluation,number_project,average
    if corr_pred == 0:
        print("Employee will not Left")
    else:
        print("Employee will Left")
```

```
prediction(0.77,0.76,4,250,4,5,0,3,0)
```

```
Employee will not Left
```

```
prediction(0.10,0.1,5,250,1,10,0,0,0)
```

```
Employee will Left
```