HR Analytics : Job change

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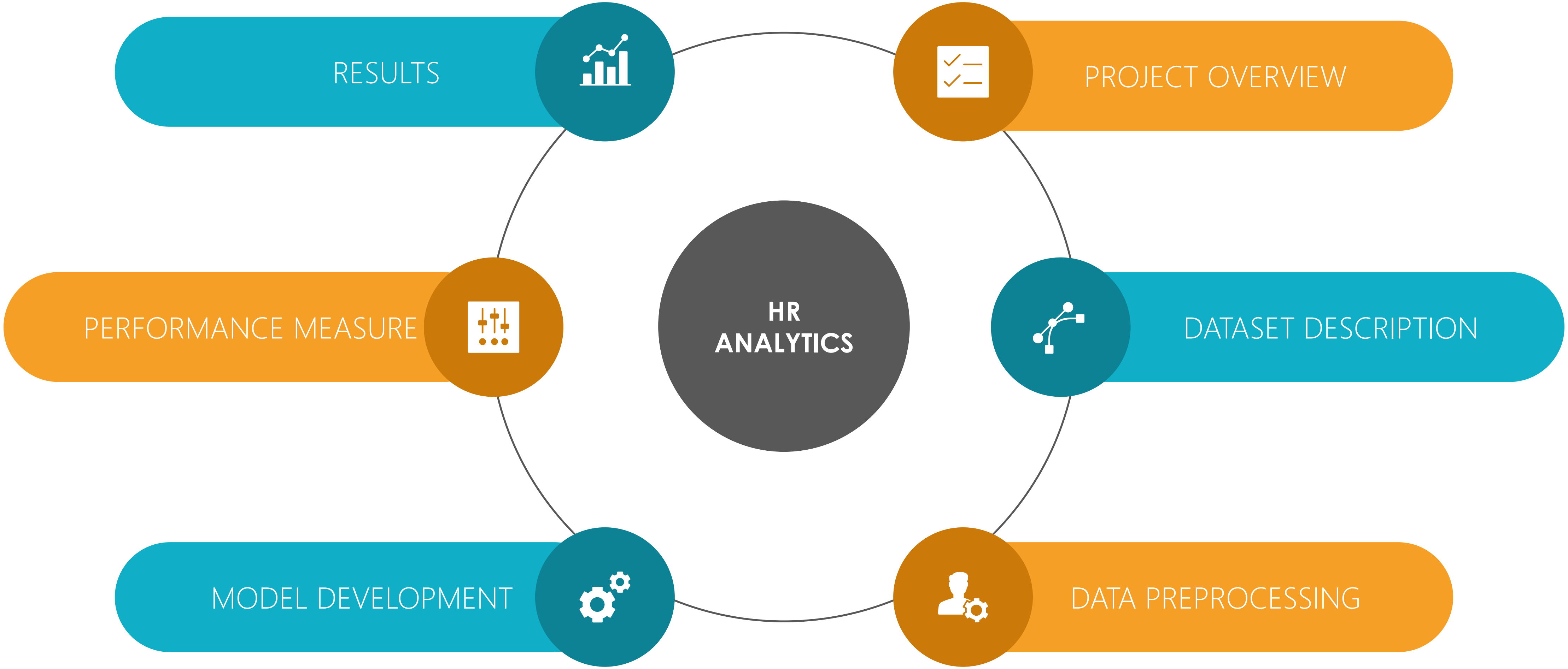
DATS 6103

Presentation Outline



HR ANALYTICS

PROJECT OVERVIEW

DATASET DESCRIPTION

DATA PREPROCESSING

MODEL DEVELOPMENT

PERFORMANCE MEASURE

RESULTS

Project Overview

- The focus of this project is to predict the probability of a candidate to look for a new job or who will continue to work for the company

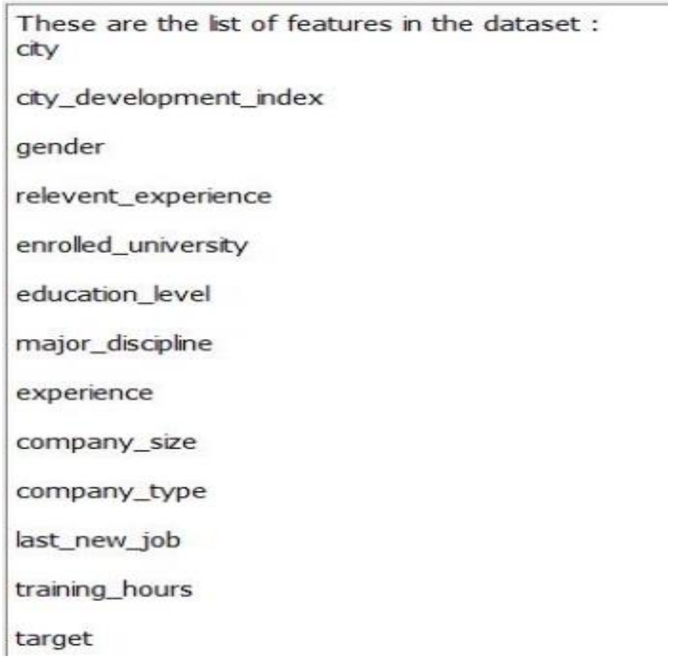
- It will be demonstrated using three machine learning algorithms:
    - Decision Tree Classifier
    - Random Forest Classifier
    - Support Vector Classifier

- Developed a GUI based application to display the end-to-end modelling

Dataset Description

- The dataset used has educational and professional records of various candidates who have completed training in a company
- The dataset has 19158 observations and 14 features, most of them are categorical

  Source: https://www.kaggle.com/arashnic/hr-analytics-job-change-of-data-scientists
- 8 amongst 14 features have missing values



These are the list of features in the dataset :
city

city_development_index

gender

relevent_experience

enrolled_university

education_level

major_discipline

experience

company_size

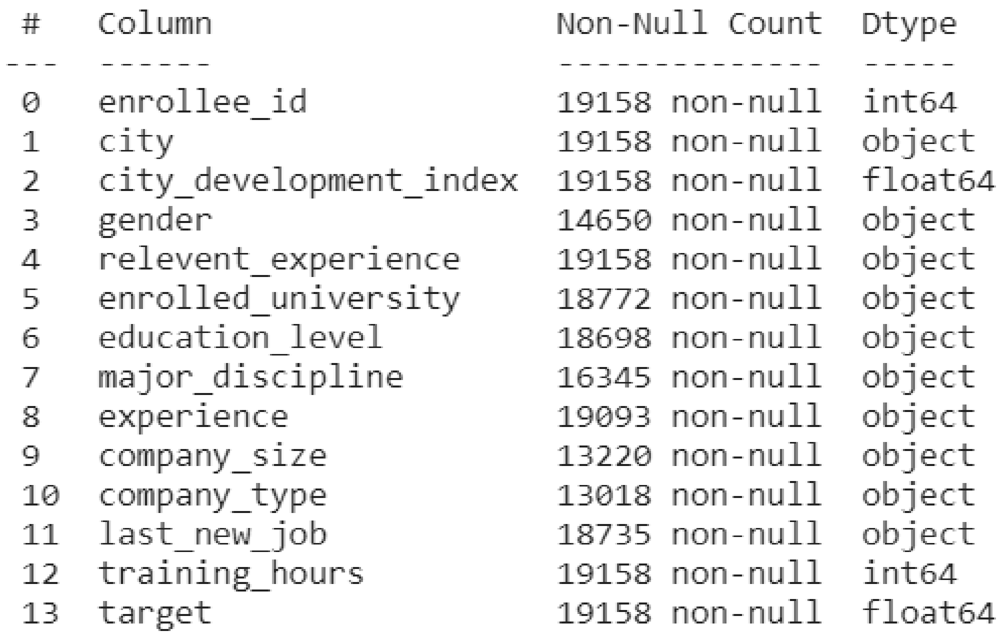
company_type

last_new_job

training_hours

target

Data Preprocessing

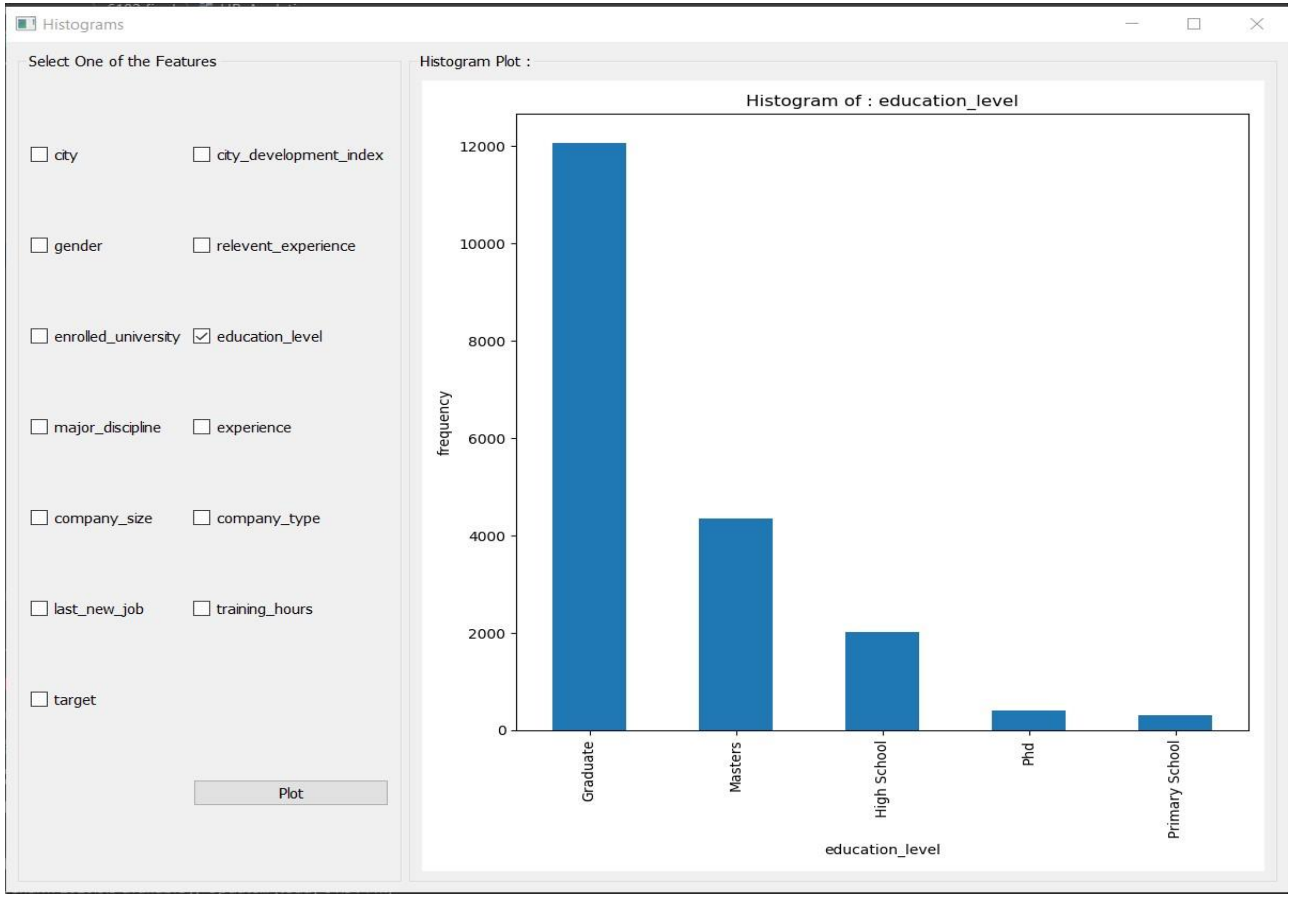


```
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   enrollee_id             19158 non-null  int64
 1   city                    19158 non-null  object
 2   city_development_index  19158 non-null  float64
 3   gender                  14650 non-null  object
 4   relevent_experience     19158 non-null  object
 5   enrolled_university     18772 non-null  object
 6   education_level         18698 non-null  object
 7   major_discipline        16345 non-null  object
 8   experience              19093 non-null  object
 9   company_size            13220 non-null  object
 10  company_type            13018 non-null  object
 11  last_new_job            18735 non-null  object
 12  training_hours          19158 non-null  int64
 13  target                  19158 non-null  float64
```

- Features with null values are updated with maximum value count of their respective columns
- The column enrollee_id is dropped , since it doesn't have much influence on target
- Label Encoder is applied to the features as our use case being the classification problem
- Encoding is done to decide in a better way on how these labels must be operated and labels are converted into numeric form

EDA Analysis

- EDA analysis option allows user to visualize histograms and scatter plots of variables



Histograms

Select One of the Features

☐ city ☐ city_development_index

☐ gender ☐ relevent_experience

☐ enrolled_university ☑ education_level

☐ major_discipline ☐ experience

☐ company_size ☐ company_type

☐ last_new_job ☐ training_hours

☐ target

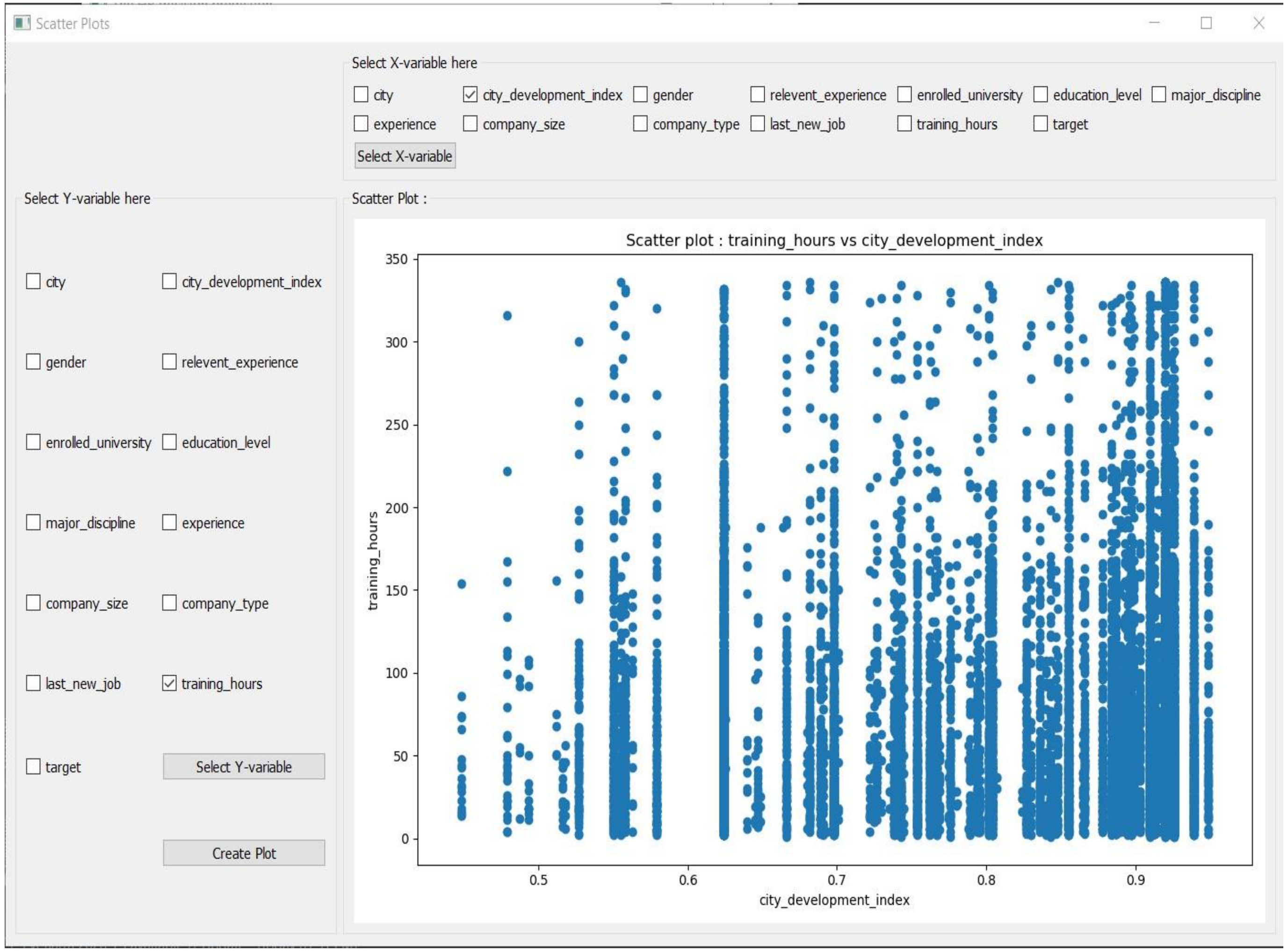
Plot

Histogram Plot :

- This histogram sample provides the distribution of employee's based on their education level
- Likewise, the user can view the distribution of other variables

EDA Analysis

Scatter Plot



Scatter Plots

Select X-variable here

□ city ☑ city_development_index □ gender □ relevent_experience □ enrolled_university □ education_level □ major_discipline
□ experience □ company_size □ company_type □ last_new_job □ training_hours □ target

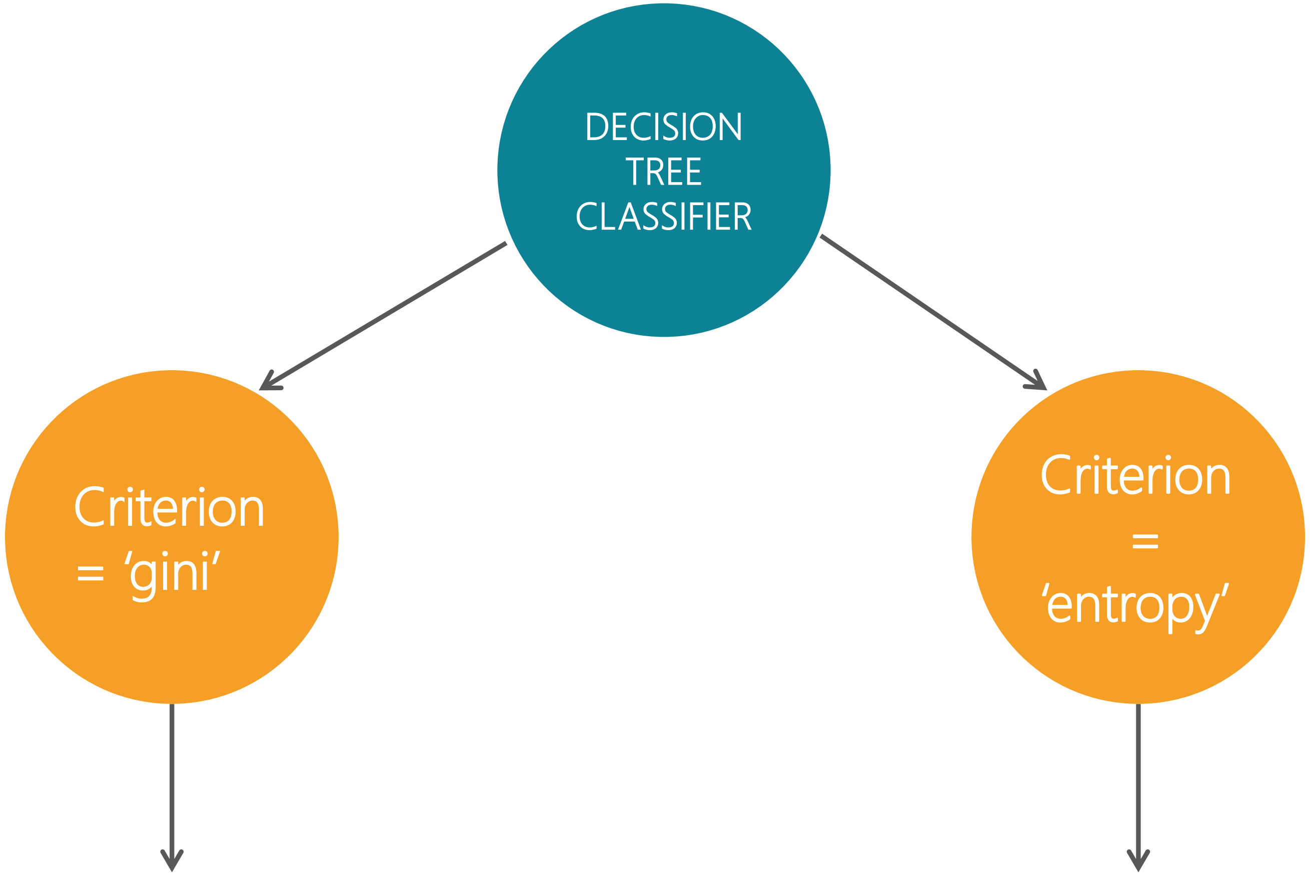
Select Y-variable here

□ city □ city_development_index
□ gender □ relevent_experience
□ enrolled_university □ education_level
□ major_discipline □ experience
□ company_size □ company_type
□ last_new_job ☑ training_hours
□ target

Scatter Plot :

The scatterplot sample visualizes the training hours of employee against the city development index

Model Development



DECISION TREE CLASSIFIER

Criterion = 'gini'

Criterion = 'entropy'

```
self.clf_df_gini =
DecisionTreeClassifier(criterion="gini",
random_state=100, max_depth=vmax_depth,
min_samples_leaf=5)
```

```
self.clf_df_entropy =
DecisionTreeClassifier(criterion="entropy",
random_state=100, max_depth=vmax_depth,
min_samples_leaf=5)
```

Model Development

RANDOM FOREST CLASSIFIER

- The dashboard is populated using the parameters chosen by user
- The parameters are processed to execute in Sci-Kit learn Random Forest algorithm

Model 1

```
self.clf_rf_gini =
RandomForestClassifier(n_estimators=
n_esti, criterion='gini',
random_state=100)
```

Model 2

```
self.clf_rf_entropy =
RandomForestClassifier(n_estimators=
n_esti, criterion='entropy',
random_state=100)
```

Model Development

SUPPORT VECTOR CLASSIFIER

- The kernel preference and test size can be provided by the user
- SVC model constructed uses radial basis function kernel in default

Model

```
self.clf_svc = SVC(kernel=kernel1)

self.clf_svc.fit(X_train, y_train)

y_pred = self.clf_svc.predict(X_test)

y_pred_score = self.clf_svc. decision_function(X_test)
```

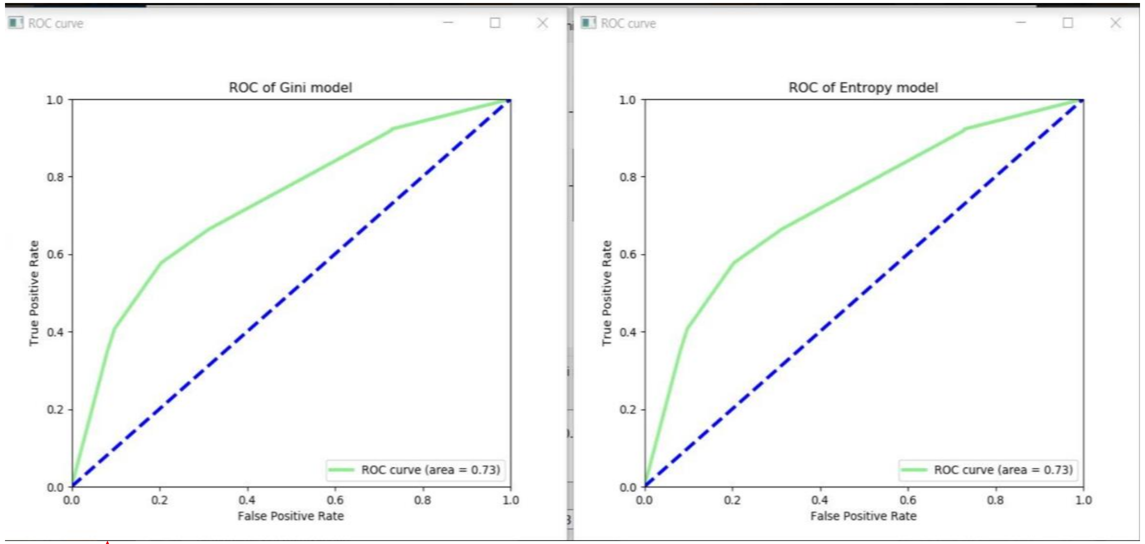
Performance Measure

The performance of the models are measured by :

- Confusion matrix
- Classification report
- Accuracy score
- Roc_auc curve

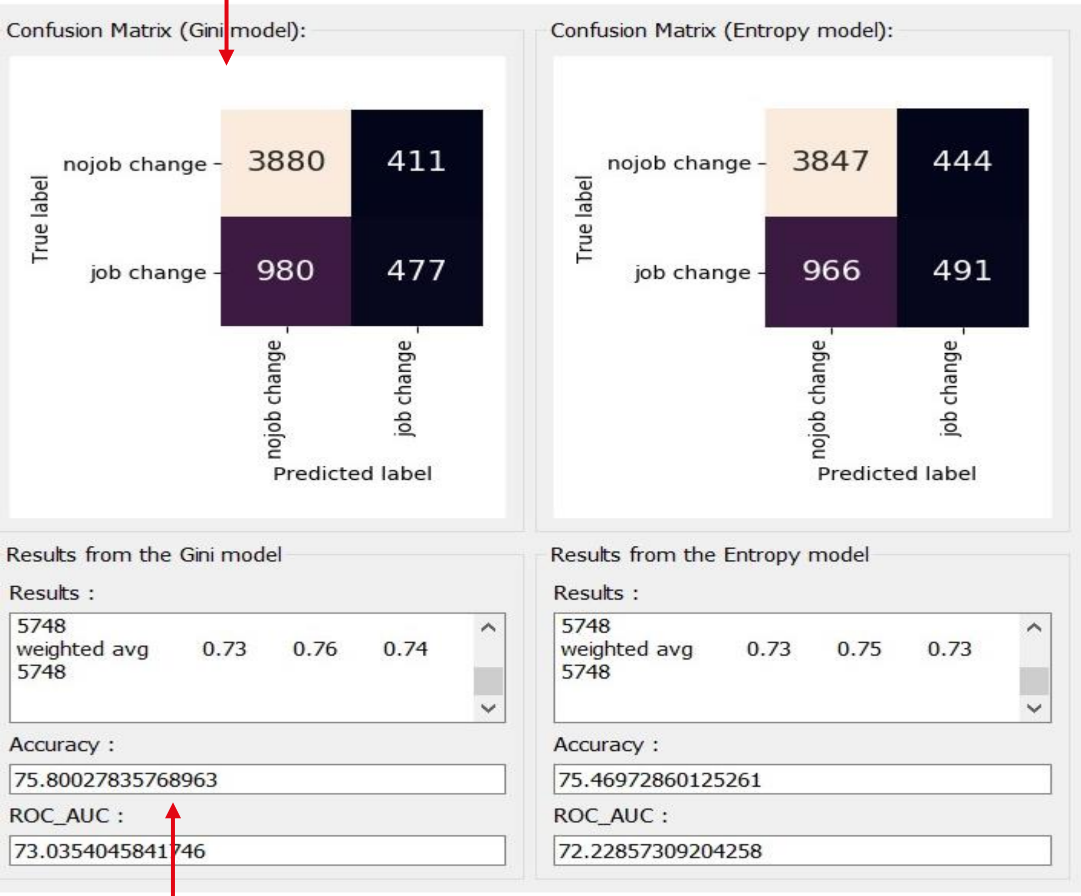
Performance Measure

The number of correct and incorrect predictions are summarized with count values and broken down by each class



ROC is a probability curve and AUC represents the degree or measure of separability

The report shows the main classification metrics precision, recall and f1-score on a per-class basis



Confusion Matrix (Gini model):

True label	nojob change	job change
nojob change	3880	411
job change	980	477

Predicted label

Confusion Matrix (Entropy model):

True label	nojob change	job change
nojob change	3847	444
job change	966	491

Predicted label

Results from the Gini model

Results :

```
5748
weighted avg       0.73      0.76      0.74
5748
```

Accuracy :

75.80027835768963

ROC_AUC :

73.0354045841746

Results from the Entropy model

Results :

```
5748
weighted avg       0.73      0.75      0.73
5748
```

Accuracy :

75.46972860125261

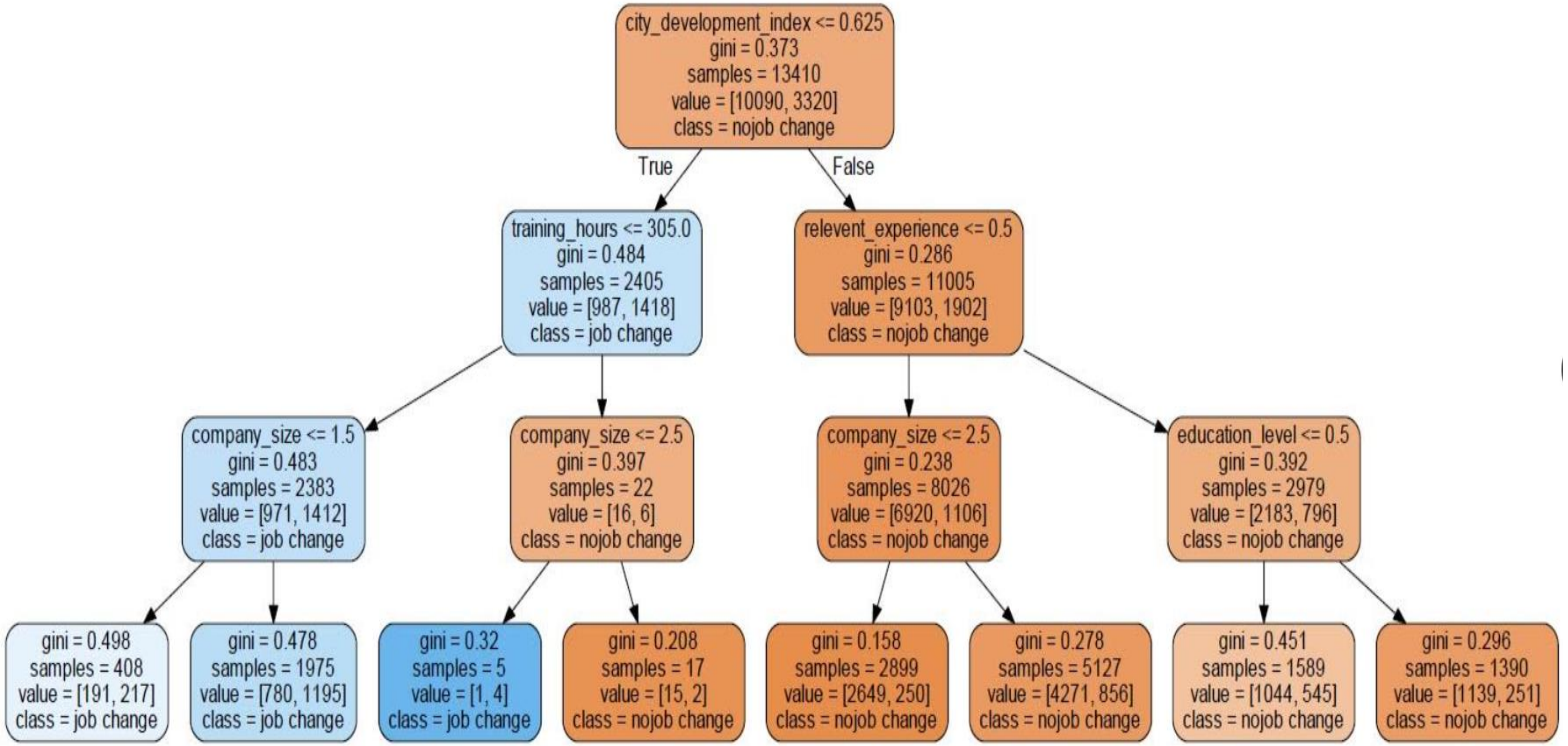
ROC_AUC :

72.22857309204258

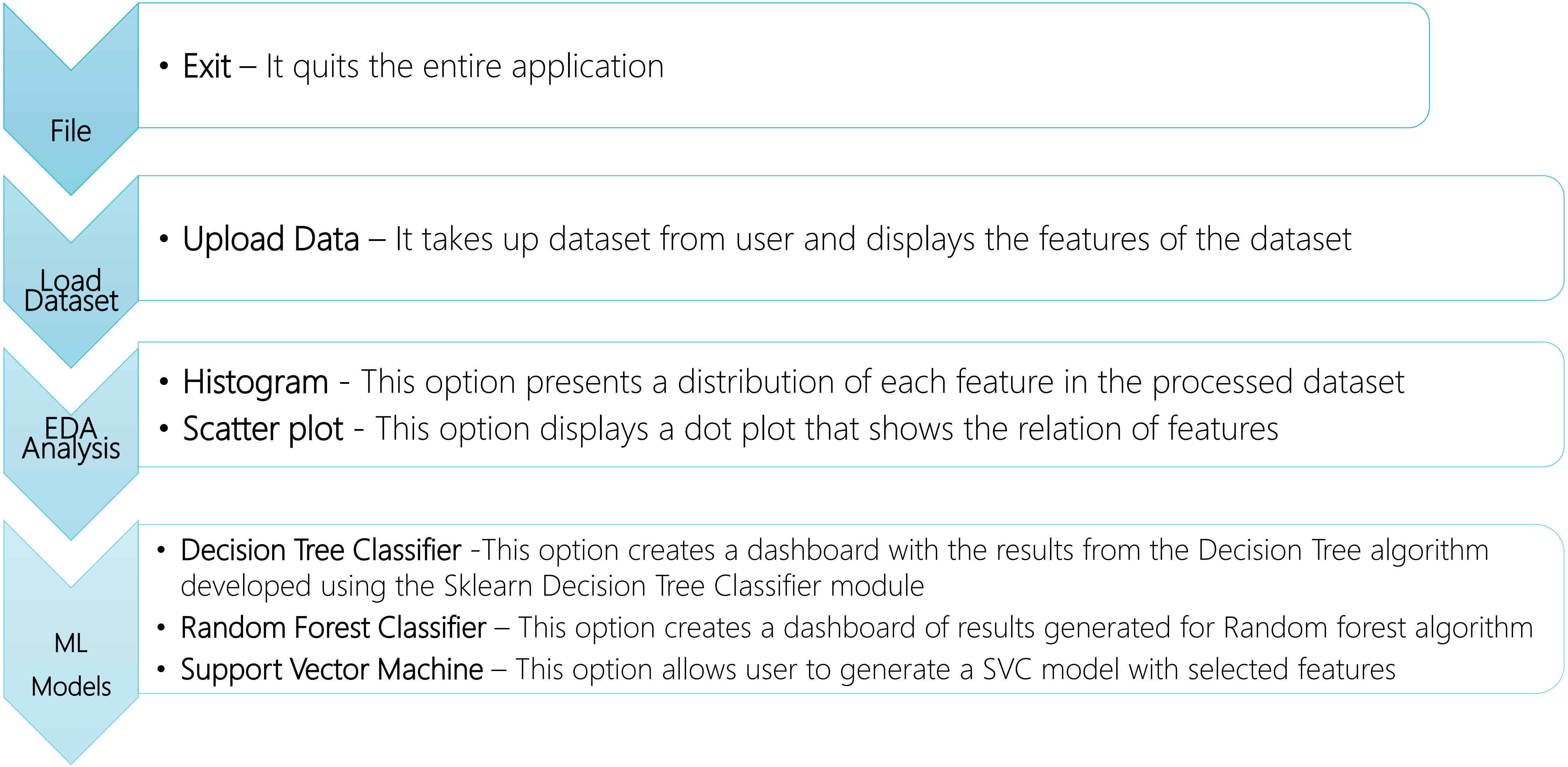
Accuracy is the fraction of predictions our model got right

Performance Measure

Decision tree is visualized by using Graphviz



Structure of the Application



File

- **Exit** – It quits the entire application

Load Dataset

- **Upload Data** – It takes up dataset from user and displays the features of the dataset

EDA Analysis

- **Histogram** - This option presents a distribution of each feature in the processed dataset
- **Scatter plot** - This option displays a dot plot that shows the relation of features

ML Models

- **Decision Tree Classifier** -This option creates a dashboard with the results from the Decision Tree algorithm developed using the Sklearn Decision Tree Classifier module
- **Random Forest Classifier** – This option creates a dashboard of results generated for Random forest algorithm
- **Support Vector Machine** – This option allows user to generate a SVC model with selected features

Results

Decision Tree Classifier:

- Accuracy of model = 77.6% (Test size=30%, Max_depth=3)
- ROC_AUC value = 73.01
- The gini and entropy models have similar accuracy

Random Forest Classifier:

- Accuracy of model = 75.80% (Test size=30, No. of estimators = 10, Criterion = Gini)
- ROC_AUC value = 73.03
- Gini model has better accuracy than the entropy model

Support Vector Classifier:

- Accuracy of model = 74.65%
- ROC_AUC value = 71.64

Conclusion

- Comparing the results of models, almost all the three models has accuracy value more than 70%
- Decision Tree Classifier tops the list by having the highest accuracy of 77%
- The decision tree and random forest models suffer when their parameter values like depth and estimators are changed
- The models in future enhancement needs to be tuned to predict the job change class correctly

Demo

Video link:
https://drive.google.com/file/d/1Y_u4un0_inFmVXfVGb4GQ2kmbNNgqJ7d/view?usp=sharing

Any Questions?

GitHub Link: https://github.com/adingankar/FINAL_PROJECT_GROUP7