AI-Driven Exploration and Prediction of Company Registration Trends with (RoC)

phase 4 project

BY:

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Introduction

AI-Driven Exploration and Prediction of Company Registration Trends with the Registrar of Companies (RoC) involves leveraging artificial intelligence (AI) methodologies to analyze data related to company registrations maintained by the Registrar of Companies. The Registrar of Companies is an authoritative entity responsible for overseeing and maintaining the registry of companies within a specific jurisdiction.

By employing AI algorithms, this approach aims to extract valuable insights and forecast patterns from the data compiled by the RoC. These insights can aid in understanding trends, emerging patterns, and other significant aspects of company registrations, empowering stakeholders to make informed decisions in the business landscape.

Overview

For Phase 4

1.Data collecting

2.Exploratory Data Analysis (EDA)

Univariate Analysis

Bivariate Analysis

Multivariate Analysis

3.Feature Engineering

4.Model Training

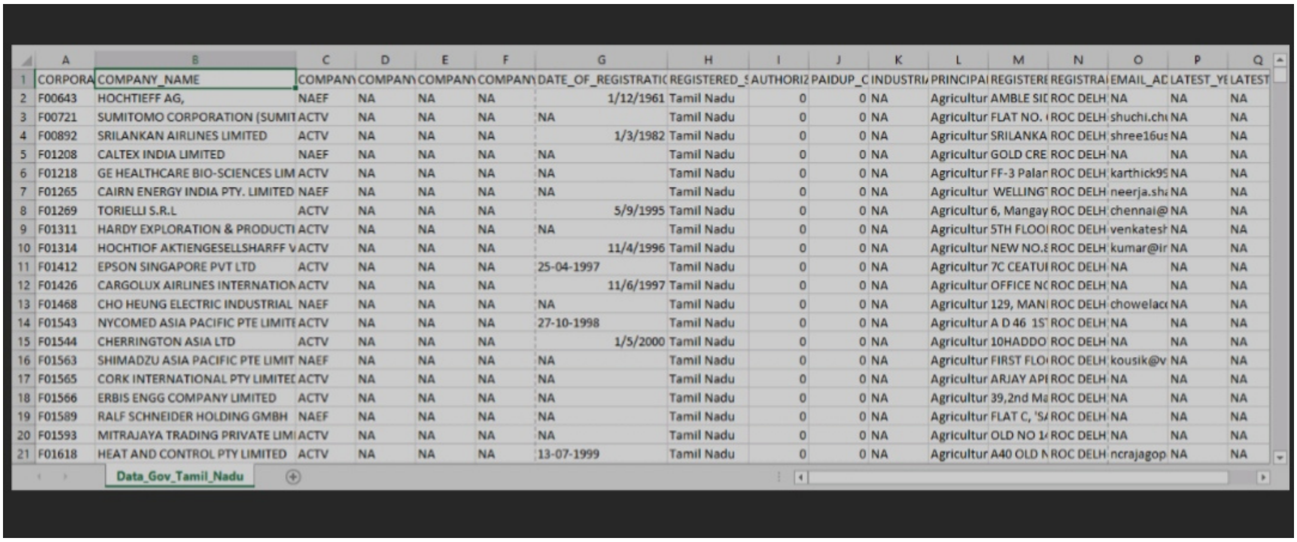
Random Forest Algorithm

Xgboost Algorithm

Data Collecting

AI-Driven Exploration and Prediction of Company Registration Trends with the Registrar of Companies (RoC), the process of collecting data involves gathering relevant information from given sources to create a comprehensive dataset for analysis and modeling

Given Data



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	CORPORA	COMPANY_NAME	COMPANY	COMPANY	COMPANY	COMPANY	DATE_OF_REGISTRATIO	REGISTERED_S	AUTHORIZ	PAIDUP_C	INDUSTRI	PRINCIPAL	REGISTERE	REGISTRA	EMAIL_AD	LATEST_YE	LATEST
2	F00643	HOCHTIEFF AG,	NAEF	NA	NA	NA	1/12/1961	Tamil Nadu	0	0	NA	Agricultur	AMBLE SIE	ROC DELH	NA	NA	NA
3	F00721	SUMITOMO CORPORATION (SUMIT	ACTV	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	FLAT NO. (	ROC DELH	shuchi.ch	NA	NA
4	F00892	SRILANKAN AIRLINES LIMITED	ACTV	NA	NA	NA	1/3/1982	Tamil Nadu	0	0	NA	Agricultur	SRILANKA	ROC DELH	shree16us	NA	NA
5	F01208	CALTEX INDIA LIMITED	NAEF	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	GOLD CRE	ROC DELH	NA	NA	NA
6	F01218	GE HEALTHCARE BIO-SCIENCES LIM	ACTV	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	FF-3 Palan	ROC DELH	karthick9S	NA	NA
7	F01265	CAIRN ENERGY INDIA PTY. LIMITED	NAEF	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	WELLINGT	ROC DELH	neerja.sha	NA	NA
8	F01269	TORIELLI S.R.L	ACTV	NA	NA	NA	5/9/1995	Tamil Nadu	0	0	NA	Agricultur	6, Mangay	ROC DELH	chennai@	NA	NA
9	F01311	HARDY EXPLORATION & PRODUCTI	ACTV	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	5TH FLOO	ROC DELH	venkatesh	NA	NA
10	F01314	HOCHTIOF AKTIENGESELLSHARFF V	ACTV	NA	NA	NA	11/4/1996	Tamil Nadu	0	0	NA	Agricultur	NEW NO.8	ROC DELH	kumar@ir	NA	NA
11	F01412	EPSON SINGAPORE PVT LTD	ACTV	NA	NA	NA	25-04-1997	Tamil Nadu	0	0	NA	Agricultur	7C CEATUI	ROC DELH	NA	NA	NA
12	F01426	CARGOLUX AIRLINES INTERNATION	ACTV	NA	NA	NA	11/6/1997	Tamil Nadu	0	0	NA	Agricultur	OFFICE NC	ROC DELH	NA	NA	NA
13	F01468	CHO HEUNG ELECTRIC INDUSTRIAL	NAEF	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	129, MANI	ROC DELH	chowelac	NA	NA
14	F01543	NYCOMED ASIA PACIFIC PTE LIMITE	ACTV	NA	NA	NA	27-10-1998	Tamil Nadu	0	0	NA	Agricultur	A D 46 1ST	ROC DELH	NA	NA	NA
15	F01544	CHERRINGTON ASIA LTD	ACTV	NA	NA	NA	1/5/2000	Tamil Nadu	0	0	NA	Agricultur	10HADDO	ROC DELH	NA	NA	NA
16	F01563	SHIMADZU ASIA PACIFIC PTE LIMIT	NAEF	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	FIRST FLO	ROC DELH	kousik@v	NA	NA
17	F01565	CORK INTERNATIONAL PTY LIMITED	ACTV	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	ARJAY APE	ROC DELH	NA	NA	NA
18	F01566	ERBIS ENGG COMPANY LIMITED	ACTV	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	39,2nd Ma	ROC DELH	NA	NA	NA
19	F01589	RALF SCHNEIDER HOLDING GMBH	NAEF	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	FLAT C, 'SA	ROC DELH	NA	NA	NA
20	F01593	MITRAJAYA TRADING PRIVATE LIMI	ACTV	NA	NA	NA	NA	Tamil Nadu	0	0	NA	Agricultur	OLD NO 14	ROC DELH	NA	NA	NA
21	F01618	HEAT AND CONTROL PTY LIMITED	ACTV	NA	NA	NA	13-07-1999	Tamil Nadu	0	0	NA	Agricultur	A40 OLD N	ROC DELH	ncrajagop	NA	NA

Exploratory Data Analysis

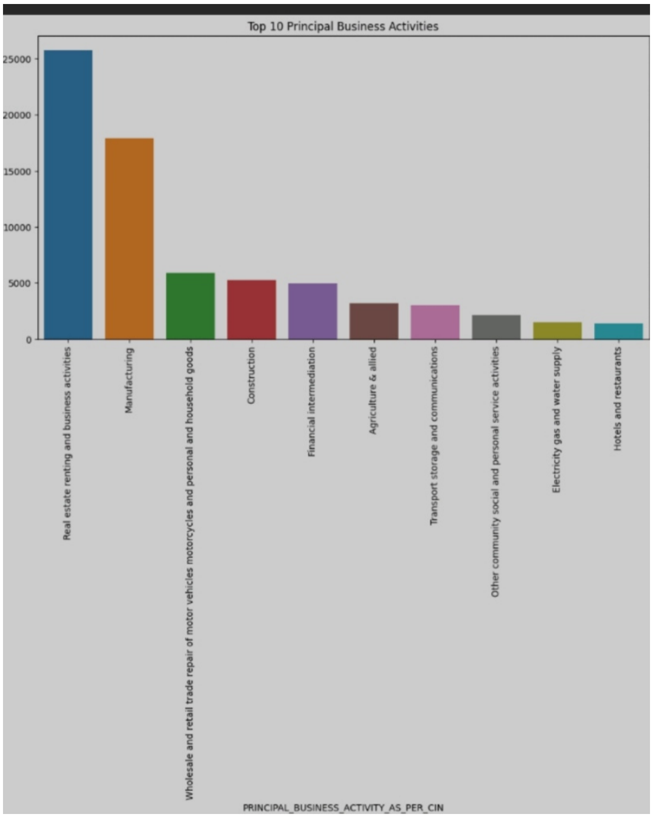
Exploratory Data Analysis refers to the crucial process of performing initial investigations on data to discover patterns to check assumptions with the help of summary statistics and graphical representations.

EDA can be leveraged to check for outliers, patterns, and trends in the given data.

EDA helps to find meaningful patterns in data.

EDA provides in-depth insights into the data sets to solve our business problems.

EDA gives a clue to impute missing values in the dataset



EDA Univariate Analysis

Analyzing the dataset by taking one variable at a time

Program :

```
# Select the specified columns for analysis

columns_for_analysis = ['CORPORATE_IDENTIFICATION_NUMBER', 'COMPANY_NAME', 'COMPANY_STATUS','COMPANY_CLASS', 'COMPANY_CATEGORY','COMPANY_SUB_CATEGORY','DATE_OF_REGISTRATION','REGISTERED_STATE','AUTHORIZED_CAP','PAIDUP_CAPITAL','INDUSTRIAL_CLASS','PRINCIPAL_BUSINESS_ACTIVITY_AS_PER_CIN','REGISTERED_OFFICE_ADDRESS','REGISTRAR_OF_COMPANIES','EMAIL_ADDR','LATEST_YEAR_ANNUAL_RETURN','LATEST_YEAR_FINANCIAL_STATEMENT']


# Subset the DataFrame with the selected columns

selected_df = df[columns_for_analysis]


# Display basic statistical summaries for numerical columns

print(selected_df.describe())
```

```
# Univariate analysis for categorical columns

for col in selected_df.select_dtypes(include='object'):

   print(f'\n{col} Value Counts:\n{selected_df[col].value_counts()}\n')
```

```
OUTPUT :

     AUTHORIZED_CAP  PAIDUP_CAPITAL

count   1.508710e+05   1.508710e+05

mean    3.522781e+07   2.328824e+07

std     1.408554e+09   1.072458e+09

min     0.000000e+00   0.000000e+00

25%     1.000000e+05   1.000000e+05

50%     8.000000e+05   1.000000e+05

75%     2.000000e+06   6.857450e+05

max     3.000000e+11   2.461235e+11


CORPORATE_IDENTIFICATION_NUMBER Value Counts:

CORPORATE_IDENTIFICATION_NUMBER

F00643               1

U72900TN2008PTC067545   1

U72900TN2008PTC067391   1

U72900TN2008PTC067393   1

U72900TN2008PTC067405   1

                    ..

U93090TZ2010PTC016187   1

U93090TZ2011PTC017199   1

U93090TZ2014PTC020864   1

U93090TZ2016NPL027599   1
```

```
U74997TZ2019PTC032491    1

Name: count, Length: 150871, dtype: int64



COMPANY_NAME Value Counts:

COMPANY_NAME

PATSEN BIOTEC PRIVATE LIMITED                3

PEARL PLANTATIONS PRIVATE LIMITED            3

SUPER ANALYSERS PRIVATE LIMITED              3

SRI VISHNU MARKETING PRIVATE LIMITED         3

TITAN WIRES PRIVATE LIMITED                  3

                              ..

YARYA SEKUR MARK PRIVATE LIMITED             1

ASSORT ENTERPRISES PRIVATE LIMITED           1

JUVAGO PRIVATE LIMITED                       1

VGROW FACILITY SERVICES PRIVATE LIMITED      1

NROOT TECHNOLOGIES PRIVATE LIMITED           1

Name: count, Length: 150560, dtype: int64



COMPANY_STATUS Value Counts:

COMPANY_STATUS

ACTV    78689

STOF    64058

UPSO     3531

AMAL     1635

DISD      851

NAEF      732
```

```
ULQD    408
LIQD    389
CLLP    291
D455    164
CLLD    123
Name: count, dtype: int64
```

```
COMPANY_CLASS Value Counts:
COMPANY_CLASS
Private                    137173
Public                      11237
Private(One Person Company)      2127
Name: count, dtype: int64
```

```
COMPANY_CATEGORY Value Counts:
COMPANY_CATEGORY
Company limited by Shares      149924
Company Limited by Guarantee      598
Unlimited Company                15
Name: count, dtype: int64
```

```
COMPANY_SUB_CATEGORY Value Counts:
COMPANY_SUB_CATEGORY
Non-govt company              149181
Subsidiary of Foreign Company      1083
```

```
Guarantee and Association comp      140
State Govt company               109
Union Govt company                24
Name: count, dtype: int64
```

```
DATE_OF_REGISTRATION Value Counts:
DATE_OF_REGISTRATION
01-04-1956    190
20-09-2018    144
26-03-2019     91
26-02-2016     73
24-03-2016     71
              ...
23-09-1967      1
27-05-1968      1
07-02-1968      1
15-04-1968      1
06-05-2006      1
Name: count, Length: 13540, dtype: int64
```

```
REGISTERED_STATE Value Counts:
REGISTERED_STATE
Tamil Nadu    150871
Name: count, dtype: int64
```

```
INDUSTRIAL_CLASS Value Counts:

INDUSTRIAL_CLASS

74999   14809

72900    8121

72200    6093

74900    5232

65991    3934

      ...

17254       1

15315       1

31504       1

34209       1

24130       1

Name: count, Length: 1562, dtype: int64
```

```
PRINCIPAL_BUSINESS_ACTIVITY_AS_PER_CIN Value Counts:

PRINCIPAL_BUSINESS_ACTIVITY_AS_PER_CIN

Real estate renting and business activities                                             48697

Manufacturing                                                                  35757

Financial intermediation                                                           13772

Wholesale and retail trade repair of motor vehicles motorcycles and personal and household goods
13681

Construction                                                                   9079

Agriculture & allied                                                             7496

Transport storage and communications                                                     6231

Other community social and personal service activities                                          4725

Hotels and restaurants                                                             2673
```

```
Electricity gas and water supply                                    2459
Health and social work                                          2270
Education                                                   1822
Mining and quarrying                                            1377
Extraterritorial organizations and bodies                                781
Public administration and defence compulsory social security                        27
Activities of private households as employers and undifferentiated production activities of private
households      19
Unclassified                                                  5
Name: count, dtype: int64



REGISTERED_OFFICE_ADDRESS Value Counts:
REGISTERED_OFFICE_ADDRESS
MADRAS                                              211
Sri sai subhodhaya ApartmentsNo.57/2B, East Coast Road, Thiruvanmiyur      58
Flat No 6J, Century Plaza, 560-562, Anna Salai,Teynampet              54
Times Partner No: 58Perambur Barracks Road                        45
"R R LANDMARK"NO.1E-1 NAVA INDIA ROAD                            44
                                         ...
NO.47,  SOUTH REDDY STREET,ATHIPET, AMBATTUR                          1
FLAT NO.10, SRI NARAYANA FLATS25, TILAK STREET, T.NAGAR               1
Plot No.52Sidco Industrial Estate,Alathur                        1
22/160-AThengapattanam Road                                    1
139/1BPUDHUKOTTAI ROAD, MAPILLAI NAYAKKANPATTI                       1
Name: count, Length: 142910, dtype: int64
```

```
REGISTRAR_OF_COMPANIES Value Counts:

REGISTRAR_OF_COMPANIES

ROC CHENNAI      122233

ROC COIMBATORE    28153

ROC DELHI           310

ROC HYDERABAD         1

Name: count, dtype: int64
```

```
EMAIL_ADDR Value Counts:

EMAIL_ADDR

ganravi@gmail.com              182

compliance@kanakkupillai.com   176

secretarial@stjohntrack.com    161

smrajunaidu@gmail.com          144

pcschn1@gmail.com              133

                              ...

info@skymaxlogistics.com         1

vishnu2444@yahoo.com             1

rashahuljob@gmail.com            1

baskar.mrl@gmail.com             1

nroottechnologies@gmail.com      1

Name: count, Length: 79940, dtype: int64
```

```
LATEST_YEAR_ANNUAL_RETURN Value Counts:

LATEST_YEAR_ANNUAL_RETURN

31-03-2019    44168
```

```
31-03-2018    8816

31-03-2017    3149

31-03-2013    2514

31-03-2014    2329

           ...

24-03-2008       1

15-06-2009       1

30-03-2011       1

30-06-2016       1

31-01-2015       1

Name: count, Length: 169, dtype: int64



LATEST_YEAR_FINANCIAL_STATEMENT Value Counts:

LATEST_YEAR_FINANCIAL_STATEMENT

31-03-2019   44171

31-03-2018    9008

31-03-2017    3122

31-03-2013    2585

31-03-2014    2175

           ...

10-04-2009       1

24-05-2006       1

31-07-2006       1

24-03-2008       1

31-01-2015       1

Name: count, Length: 138, dtype: int64
```

Random Forest Algorithm

Program :

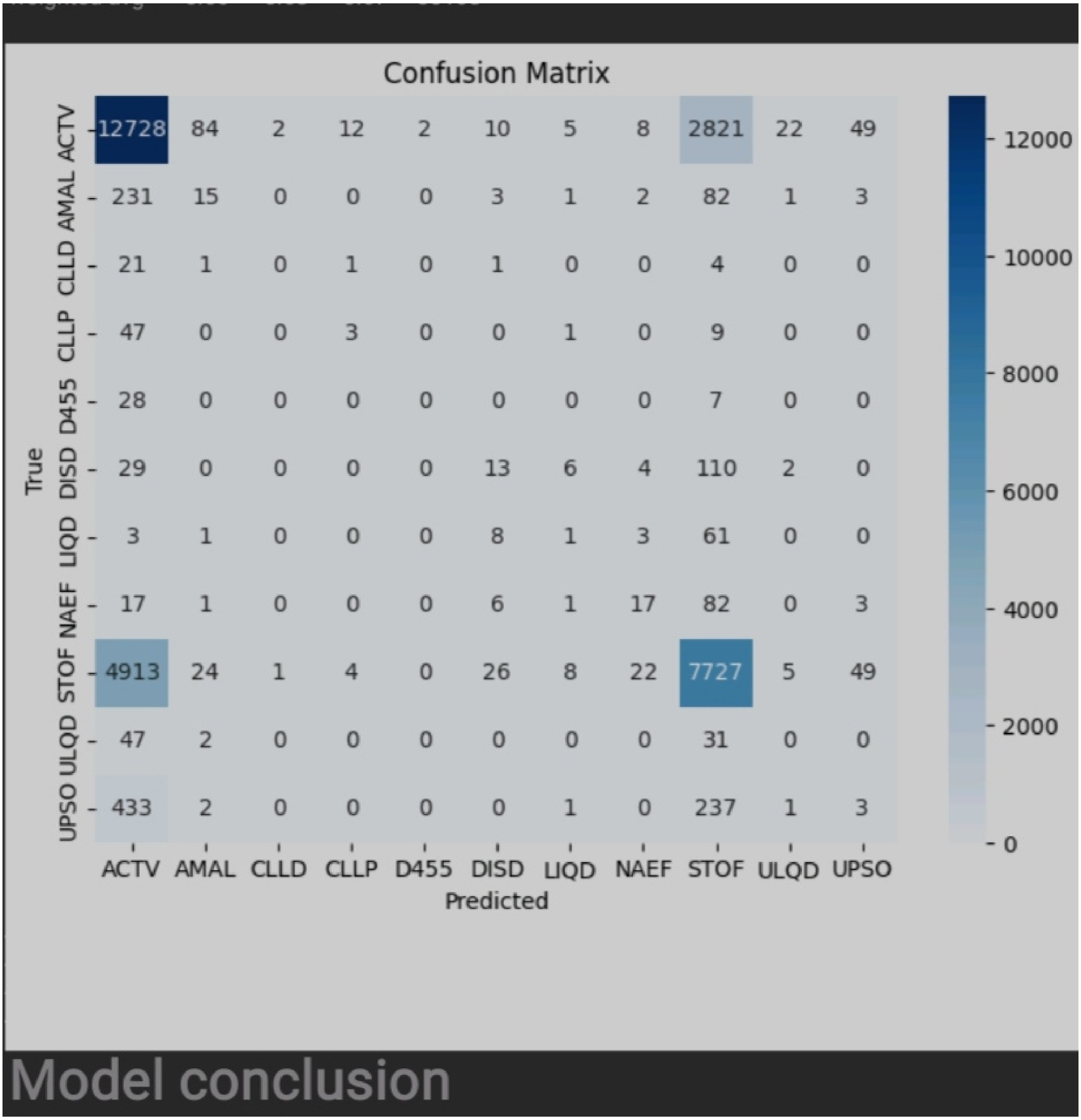
```
# Import necessary libraries
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
import matplotlib.pyplot as plt
import seaborn as sns

# Load the dataset
data = pd.read_csv("D://Course/AI IBM/Data_Gov_Tamil_Nadu.csv",encoding='latin-1')

# Data Preprocessing
# Drop irrelevant columns
data = data[['COMPANY_STATUS', 'COMPANY_CLASS', 'COMPANY_CATEGORY', 'AUTHORIZED_CAP',
        'PAIDUP_CAPITAL', 'PRINCIPAL_BUSINESS_ACTIVITY_AS_PER_CIN']]

# Handle missing values if necessary
data.dropna(inplace=True)

# Encode categorical features
label_encoders = {}
categorical_columns = ['COMPANY_CLASS', 'COMPANY_CATEGORY',
'PRINCIPAL_BUSINESS_ACTIVITY_AS_PER_CIN']

for column in categorical_columns:
    label_encoders[column] = LabelEncoder()
    data[column] = label_encoders[column].fit_transform(data[column])

# Encode the target variable 'COMPANY_STATUS'
label_encoder_y = LabelEncoder()
data['COMPANY_STATUS'] = label_encoder_y.fit_transform(data['COMPANY_STATUS'])

# Split the dataset into features (X) and target (y)
X = data.drop('COMPANY_STATUS', axis=1)
y = data['COMPANY_STATUS']

# Split the dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Model Training (Random Forest)
model = RandomForestClassifier()
model.fit(X_train, y_train)

# Model Evaluation
y_pred = model.predict(X_test)

# Decode the encoded target variable back to its original form
y_pred_decoded = label_encoder_y.inverse_transform(y_pred)

# Calculate accuracy
accuracy = accuracy_score(y_test, y_pred)
print(f"Accuracy: {accuracy}")
```

```
# Classification Report

report = classification_report(y_test, y_pred, target_names=label_encoder_y.classes_)

print("Classification Report:\n", report)


# Confusion Matrix

cm = confusion_matrix(y_test, y_pred)

plt.figure(figsize=(8, 6))

sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=label_encoder_y.classes_,

        yticklabels=label_encoder_y.classes_)

plt.xlabel('Predicted')

plt.ylabel('True')

plt.title('Confusion Matrix')

plt.show()
```

Output :

```
Accuracy: 0.6811146539125814

Classification Report:

          precision   recall  f1-score   support


     ACTV     0.69     0.81     0.74    15743

     AMAL      0.12     0.04     0.06      338

     CLLD     0.00     0.00     0.00       28

     CLLP     0.15     0.05     0.07       60

     D455     0.00     0.00     0.00       35

     DISD     0.19     0.08     0.11      164

     LIQD     0.04     0.01     0.02       77

     NAEF      0.30     0.13     0.19      127

     STOF     0.69     0.60     0.65    12779

     ULQD      0.00     0.00     0.00       80
```

```
      UPSO      0.03      0.00      0.01      677


  accuracy                          0.68    30108

 macro avg      0.20      0.16      0.17    30108

weighted avg      0.66      0.68      0.67    30108
```



Confusion Matrix

True \ Predicted	ACTV	AMAL	CLLD	CLLP	D455	DISD	LIQD	NAEF	STOF	ULQD	UPSO
ACTV	12728	84	2	12	2	10	5	8	2821	22	49
AMAL	231	15	0	0	0	3	1	2	82	1	3
CLLD	21	1	0	1	0	1	0	0	4	0	0
CLLP	47	0	0	3	0	0	1	0	9	0	0
D455	28	0	0	0	0	0	0	0	7	0	0
DISD	29	0	0	0	0	13	6	4	110	2	0
LIQD	3	1	0	0	0	8	1	3	61	0	0
NAEF	17	1	0	0	0	6	1	17	82	0	3
STOF	4913	24	1	4	0	26	8	22	7727	5	49
ULQD	47	2	0	0	0	0	0	0	31	0	0
UPSO	433	2	0	0	0	0	1	0	237	1	3

Model conclusion

1. Exploratory Data Analysis (EDA):

EDA is a crucial first step to understand your data. You can use Python libraries like Pandas, Matplotlib, and Seaborn to perform the following tasks:

- Load your dataset.
- Examine basic statistics like mean, median, standard deviation, etc.
- Visualize data distributions, relationships, and outliers using histograms, scatter plots, and box plots.
- Identify missing data and decide on handling strategies (imputation or removal).
- Perform correlation analysis to understand feature relationships.

2. Feature Engineering:

Feature engineering involves creating new features or transforming existing ones to improve model performance. Some common techniques include:

- Encoding categorical variables (one-hot encoding, label encoding).
- Scaling and normalizing numerical features.
- Creating interaction features, aggregations, or statistical features.
- Handling time-related data if applicable (e.g., extracting day of the week, month, etc.).
- Feature selection to choose the most relevant features.

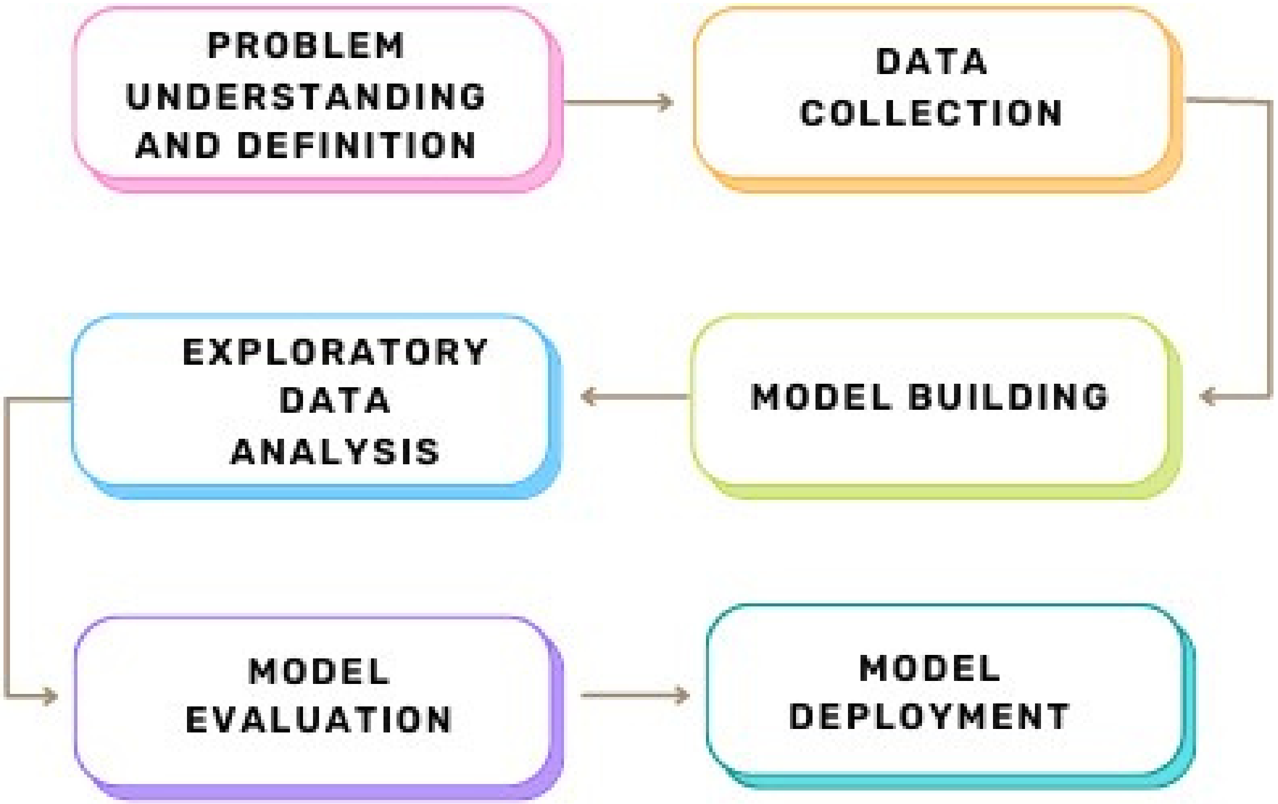
3. Predictive Modeling:

Building predictive models depends on the nature of your problem (classification, regression, etc.). You can use machine learning libraries like scikit-learn or deep learning frameworks like TensorFlow or PyTorch. Here are the steps to follow:

- Split your dataset into training and testing sets for model evaluation.
- Select appropriate algorithms (e.g., linear regression, decision trees, neural networks) and train them on the training data.
- Tune hyperparameters to optimize model performance using techniques like grid search or random search.
- Evaluate models using appropriate metrics (e.g., accuracy, mean squared error) and choose the best-performing one.
- Validate the model on the testing data to assess its generalization performance.
- Interpret the model results to gain insights into the problem.

Remember to iterate on these steps, refine your model, and potentially consider more advanced techniques like cross-validation, ensemble methods, and deep learning architectures if needed. The effectiveness of your project greatly depends on the quality of your EDA and feature engineering, so

invest time in those stages●


PROBLEM UNDERSTANDING AND DEFINITION
DATA COLLECTION
EXPLORATORY DATA ANALYSIS
MODEL BUILDING
MODEL EVALUATION
MODEL DEPLOYMENT

EXAMPLES WITH PROGRAM:..

Certainly, I can provide some code examples for each stage of building your AI-driven exploration and prediction project:

1. Exploratory Data Analysis (EDA):

Here's an example using Python and the Pandas library for EDA:

```python

import pandas as pd

import matplotlib.pyplot as plt

import seaborn as sns
```

```
# Load your dataset
data = pd.read_csv('your_dataset.csv')

# Basic statistics
print(data.describe())

# Data visualization
plt.figure(figsize=(10, 6))
sns.histplot(data['feature1'], bins=20)
plt.title('Distribution of Feature 1')
plt.show()

# Identify missing data
missing_data = data.isnull().sum()
print(missing_data)

# Correlation analysis
correlation_matrix = data.corr()
sns.heatmap(correlation_matrix, annot=True)
plt.show()
```

2. Feature Engineering:

Feature engineering depends on your dataset and problem. Here's a general example:

```python
# Encoding categorical variables
data = pd.get_dummies(data, columns=['categorical_feature'])
```

```
# Scaling numerical features
from sklearn.preprocessing import StandardScaler
scaler = StandardScaler()
data['numerical_feature'] = scaler.fit_transform(data['numerical_feature'])

# Creating interaction features
data['interaction_feature'] = data['feature1'] * data['feature2']

# Feature selection
from sklearn.feature_selection import SelectKBest, f_regression
X = data.drop('target', axis=1)
y = data['target']
X_new = SelectKBest(f_regression, k=5).fit_transform(X, y)
```

3. Predictive Modeling:

Let's use scikit-learn to create a simple linear regression model as an example:

```python
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# Create and train the model
```

```
model = LinearRegression()

model.fit(X_train, y_train)


# Make predictions

y_pred = model.predict(X_test)


# Evaluate the model

mse = mean_squared_error(y_test, y_pred)

print(f"Mean Squared Error: {mse}")
```

These are simplified examples. In a real project, you would need to adapt the code to your specific dataset and problem. Additionally, you may explore more advanced models and techniques based on the characteristics of your data and the performance of your initial models.