INTERNSHIP REPORT

A report submitted in partial fulfilment of the requirements for the Award of Degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

(DATA SCIENCE)

Submitted by

BRIJESH A

Reg. No.: 211011010

B.E. CSE (DS)

V Semester

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FACULTY OF ENGINEERING AND TECHNOLOGY

ANNAMALAI UNIVERSITY

ANNAMALAI NAGAR - 608002

NOVEMBER - 2023

ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the "**Internship Report"** submitted by **BRIJESH A** Reg.No.: 211011010 is the work done by him/ her and submitted during the academic year 2023 – 2024, in partial fulfillment of the requirements for the award of the degree of **BACHELOR OF ENGINEERING** in **COMPUTER SCIENCE AND ENGINEERING** at **INEURON.AI Pvt. Ltd.**

Internship Coordinator
Department of CSE

Professor & Head
Department of CSE

Internal Examiner

External Examiner

Place:

Date:

21ETIT510	INDUSTRIAL TRAINING / RURAL INTERNSHIP/ INNOVATION / ENTREPRENEURSHIP	L	TR	S	C
		0	1	2	4

Four weeks during the summer vacation after the IV semester / VI semester of the programme

COURSE OBJECTIVES:

- To expose the students to understand technical and professional skill requirements in IT industries.
- To impart professional skills for solving problems in industries.
- To train the students to design innovative solutions for a problem.
- To motivate the students to become an Entrepreneur.
- To develop communication and technical report writing skill.

The students will work for two periods per week guided by student counselor. They will be asked to present a seminar of not less than 15 minutes and not more than 30 minutes on any technical topic of student's choice related to Computer Science and Engineering and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counselor based on the technical presentation, the report and on the interaction shown during the seminar.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the seventh semester. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES:

At the end of this course, the students will be able to

1. Understand the day-to-day job in IT industries, and technical and professional skills needed for an industry.
2. Develop and refine technical and professional skills through hands-on work experience.
3. Design an innovative solution for an Industry requirement by applying the knowledge learned from industry and in academics.
4. Develop a startup for product or services based on the people or industry requirements.

Mapping of Course Outcomes with Programme Outcomes												
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	-	-	-	-	-	-	-	-	3
CO3	1	-	2	1	2	-	-	-	-	-	-	-
CO4	1	-	-	-	-	-	-	-	2	-	2	1
CO5	1	-	-	-	2	-	-	-	-	3	-	-

Internship Completion Certificate

iNeuron Intelligence Pvt Ltd

17th Floor Tower A, Brigade Signature Towers,
Sannatammanahalli, Bengaluru, Karnataka -
562129.

Internship Experience Letter

DATE: 15th July 2023

TO WHOM IT MAY CONCERN

This is to certify that Mr/Ms/Mrs Brijesh A has successfully completed internship program from 9th June 2023 to 15th July 2023 in **Campus Placement** at INEURON INTELLIGENCE PRIVATE LIMITED. During their internship programme with us, they demonstrated exceptional skills with a self-motivated attitude to learn new things and implement them end to end with all of our mentioned industrial standards. Their performance was excellent and was able to complete the project successfully on time.

We wish them all the best for future endeavours.

Regards,
Sudhanshu Kumar
CEO & Chief AI Engineer at iNeuron.ai

Internship Objectives

Internships are generally thought to be reserved for college students looking to gain experience in a particular field. However, a wide array of people can benefit from training internships in order to receive real-world experience and develop their skills.

Internships are utilized in a number of different career fields, including architecture, engineering, healthcare, economics, advertising, and many more.

Some internships are used to allow individuals to perform scientific research, while others are specifically designed to allow people to gain first-hand experience working.

Utilizing internships is a great way to build your resume and develop skills that can be emphasized in your resume for future jobs.

Internship learning objectives should be developed along four dimensions as follows:

1. **Skill development:** Learning and improving skills such as writing, verbal communication, research, technology, teamwork, and leadership. It is the development of these skills that often represent the major benefits of an internship.

2. **Understanding Real-World Application:** Understanding the workplace, operating procedures, the department/company, its products, and other organizational concepts. In addition, this would include knowledge added to existing classroom knowledge, such as new applications or new skills.

3. **Career Awareness:** Internships often provide the opportunity to take a peek at what working for a company or in an industry would be like. Objectives could include learning about career positions and occupations, along with the qualities and training required to obtain those positions.

4. **Personal Development:** One of the major benefits of an internship is how it helps you to develop self-confidence, assertiveness, and basic work habits

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Introduction

In the realm of campus placement prediction, the focus lies on utilizing advanced technology and smart algorithms to anticipate where a student is likely to be placed. My proficiency in AI and Machine Learning has equipped me with powerful tools that can be transformative in this context.

However, bridging the gap between theoretical knowledge and practical application is key. This is where campus placement prediction comes into play. It serves as the platform where these sophisticated concepts can be employed to address a real-world challenge that impacts a multitude of students.

During my internship, I delved into three distinct projects: a Campus Placement Estimator, a tool to discern enrollment trends, and a predictor for job demand. Each undertaking presented unique hurdles and bestowed invaluable insights, ultimately enhancing my prowess in predicting campus placements.

In this report, I will provide an in-depth account of these projects, detailing the methodologies I employed and the lessons I garnered. I aim to showcase my fervor for employing technology to address tangible problems, particularly in the domain of campus placement prediction. The objective is to effect a positive change in our interconnected educational landscape. So, let's delve into each project and witness how I'm leaving a mark in this dynamic field.

Abstract

- The "Enhancing Campus Placement Process through AI-driven Analytics and Personalized Recommendations" project stands at the forefront of transforming the traditional campus placement process. By leveraging advanced Artificial Intelligence (AI) techniques, this initiative addresses the persistent challenges faced by both students and recruiters in aligning skill sets and preferences effectively.

- This innovative system adopts a comprehensive approach, seamlessly integrating data analytics, machine learning algorithms, and natural language processing techniques. It commences with meticulous data collection, encompassing a wide array of student-centric attributes such as academic records, skill assessments, and career aspirations. Concurrently, it compiles in-depth job profiles and skill requirements from potential employers, forming a comprehensive database.

- One of the distinguishing features of this project is its adaptability. The system is engineered to continuously refine its recommendations through iterative machine learning processes. This involves the incorporation of invaluable feedback from both students and recruiters, ensuring a progressively accurate and efficient matching process over time.

- The anticipated outcomes of this endeavor are far-reaching. It aims to create a campus placement process that is not only streamlined but highly effective, offering substantial benefits to both students and recruiters. Students gain access to a thoughtfully curated selection of opportunities that resonate with their career aspirations and individual skill sets. Recruiters, in turn, receive a pool of candidates who not only possess the requisite skills but also exhibit attributes that closely align with the specific needs of their organizations.

- In conclusion, the "Enhancing Campus Placement Process through AI-driven Analytics and Personalized Recommendations" project embodies a significant stride towards optimizing the campus placement ecosystem. By harnessing the potential of AI and capitalizing on data-driven insights, this endeavor holds the promise of reshaping the student-recruiter connection within the domain of campus placements. It envisions a future where the placement process is characterized by precision, efficiency, and mutual satisfaction for both students and recruiters alike. This project represents a pioneering leap towards a more effective and equitable campus placement landscape.

Introduction to Data Science and Machine learning

Data science and artificial intelligence (AI) play a pivotal role in forecasting **campus placements** for **educational institutions.** These technologies empower institutions to analyze diverse sets of data, extract valuable insights, and make informed decisions to enhance placement strategies. Below is a concise overview of how data science and AI are utilized in predicting campus placements:

1. **Data Collection:** Educational institutions gather a wide array of data pertaining to their students, including academic records, extracurricular activities, internship experiences, and career preferences.
2. **Data Preprocessing:** Prior to applying AI techniques, the collected data needs to be cleaned, transformed, and prepared for analysis. This involves handling missing values, outliers, and standardizing the data.
3. **Feature Engineering:** Identifying and creating relevant features (variables) that have an impact on placements is crucial. This step lays the foundation for building accurate prediction models.
4. **Data Analysis:** Data scientists employ statistical and exploratory data analysis techniques to discern patterns, correlations, and trends in the data. This aids in identifying factors that influence campus placements.
5. **Machine Learning Models:** AI techniques, particularly machine learning, are employed to construct predictive models. Classification algorithms, such as logistic regression, support vector machines, and decision trees, are commonly used for placement prediction.
6. **Model Training**: The collected data is divided into training and testing sets. Machine learning models are trained on the training data to understand the relationships between the features and placement outcomes.
7. **Model Evaluation:** The trained models are evaluated using the testing data to assess their predictive accuracy. Metrics like accuracy, precision, recall, and F1-score are often used to measure model performance.
8. **Hyperparameter Tuning:** Data scientists fine-tune the model's hyperparameters to enhance its performance. This iterative process aids in optimizing the model's predictive capabilities.
9. **Deployment:** Once a satisfactory model is developed, it can be deployed in a real-world setting to predict campus placements. This can be integrated into the institution's placement strategy.

Problem Statements

to predict whether the student will be recruited in campus placements or not based on the available factors in the dataset.

Proposed Solutions

A Web UI that predicts the suitability of a candidate for a particular campus placement opportunity based on their provided information, which it has been trained on, is a valuable tool for guiding students towards optimal career choices. It offers educational institutions and students a powerful solution for making informed placement decisions effectively.

Software Requirements:

Campus placement prediction involves the application of various machine learning and statistical modeling techniques. To implement these techniques effectively, you can use a combination of programming languages and libraries specifically designed for data analysis and machine learning. Some commonly used tools for campus placement prediction include:

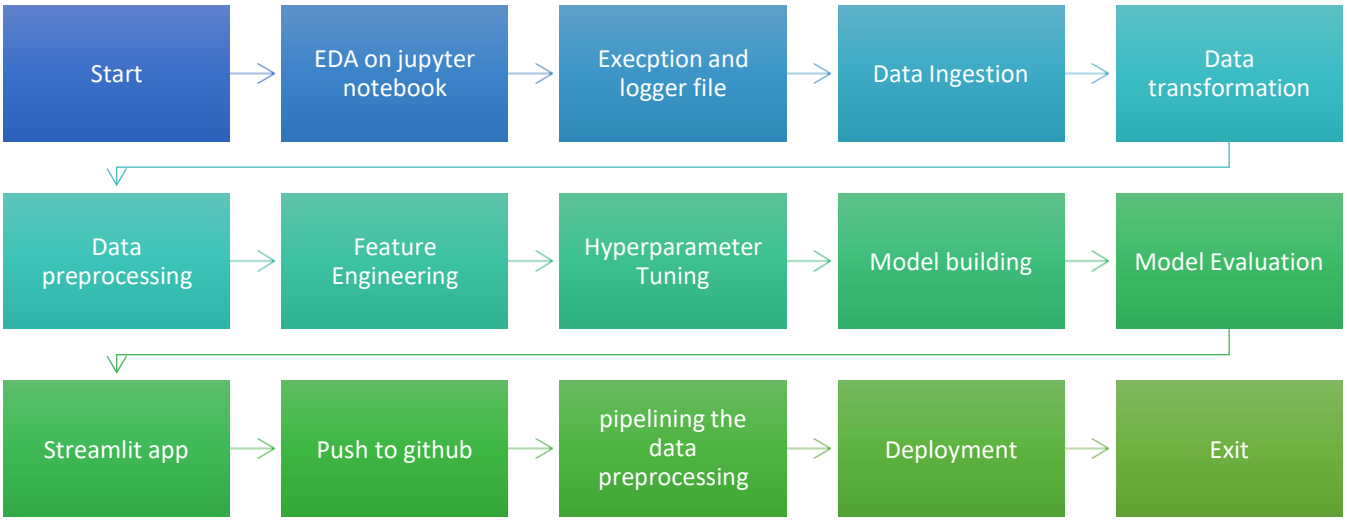
- **Python**: Python is a popular programming language for data science and machine learning. It offers a wide range of libraries and frameworks, such as NumPy, pandas, scikit-learn, and TensorFlow, that facilitate data manipulation, model building, and evaluation.
- **Jupyter Notebook**: Jupyter Notebook is an interactive development environment that allows you to combine code, visualizations, and explanatory text in a single document. It's commonly used for exploratory data analysis and model prototyping.
- **scikit-learn**: This is a powerful machine learning library for Python that provides various algorithms for regression, classification, clustering, and more. It's widely used for building predictive models, including sales price prediction.
- **Matplotlib**: Matplotlib is a widely-used data visualization library in Python. It provides a flexible and comprehensive set of functions to create various types of static, interactive, and animated plots.
- **Seaborn**: Seaborn is a Python data visualization library built on top of Matplotlib. It provides a high-level interface for creating aesthetically pleasing statistical graphics.

Project Scope And Methodologies

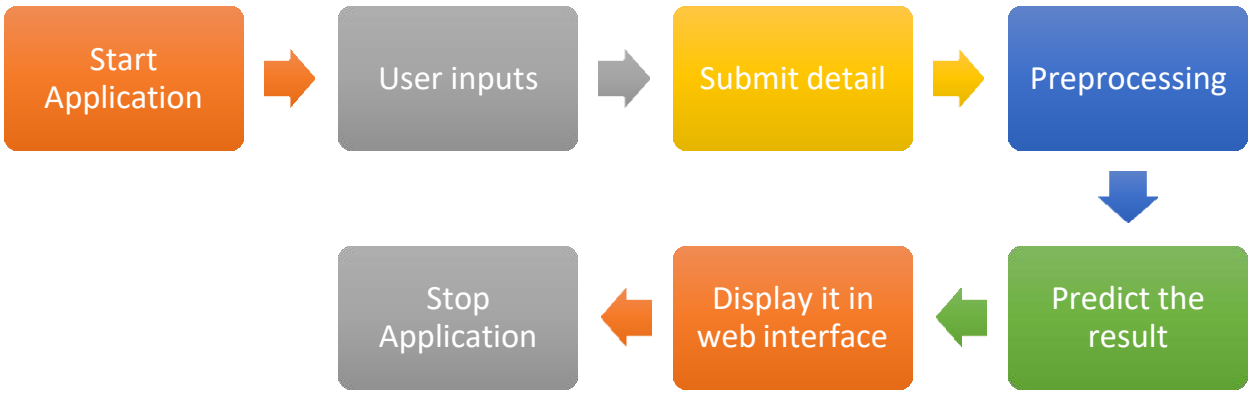
Scope

The objective is to develop an effective and precise predictive solution that can forecast the suitability of candidates for various campus placement opportunities offered by educational institutions. This task holds immense significance for both students and institutions, as it enables them to make well-informed decisions regarding career paths, skill development, and placement strategies.

Process Flow



Deployment Process



Source Code

Exploratory Data Analysis:

Campus placements Prediction

1) Problem statement

- to predict whether the student will be recruited in campus placements or not based on the available factors in the dataset.

2) Data collection

- Dataset Source - https://www.kaggle.com/competitions/ml-with-python-course-project/data
  - The train data consists of 15 column and 215 rows.
  - The test data consist of 3 columns and 43 rows.

2.1 Import Data and Required Packages

Importing Pandas, Numpy, Matplotlib, Seaborn and Warings Library.

In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')
```

Import the CSV Data as Pandas DataFrame

In [4]:
```
df = pd.read_csv('data/train.csv')
df_test = pd.read_csv('data/test.csv')
```

In [5]:
```
df.shape, df_test.shape
```

Out[5]:
```
((215, 15), (43, 3))
```

Show Top 5 Records

In [13]:
```
df.head()
```

Out[13]:

	sl_no	gender	ssc_p	ssc_b	hsc_p	hsc_b	hsc_s	degree_p	degree_t	workex	etest_p	specialisation	mba_p	status	salary
0	1	0	67.00	Others	91.00	Others	Commerce	58.00	Sci&Tech	No	55.0	Mkt&HR	58.80	Placed	270000.0
1	2	0	79.33	Central	78.33	Others	Science	77.48	Sci&Tech	Yes	86.5	Mkt&Fin	66.28	Placed	200000.0
2	3	0	65.00	Central	68.00	Central	Arts	64.00	Comm&Mgmt	No	75.0	Mkt&Fin	57.80	Placed	250000.0
3	4	0	56.00	Central	52.00	Central	Science	52.00	Sci&Tech	No	66.0	Mkt&HR	59.43	Not Placed	NaN
4	5	0	85.80	Central	73.60	Central	Commerce	73.30	Comm&Mgmt	No	96.8	Mkt&Fin	55.50	Placed	425000.0

2.2 Dataset information

- **sl_no**: anonymous id unique to a given employee
- **gender**: employee gender
- **ssc_p**: SSC is Secondary School Certificate (Class 10th). ssc_p is the percentage of marks secured in Class 10th.
- **ssc_b**: SSC Board. Binary feature.
- **hsc_p**: HSC is Higher Secondary Certificate (Class 12th). hsc_p is the percentage of marks secured in Class 12th.
- **hsc_b**: HSC Board. Binary feature.
- **hsc_s**: HSC Subject. Feature with three categories.
- **degree_p**: percentage of marks secured while acquiring the degree.
- **degree_t**: branch in which the degree was acquired. Feature with three categories.
- **workex**: Whether the employee has some work experience or not. Binary feature.
- **etest_p**: percentage of marks secured in the placement exam.
- **specialisation**: the specialization that an employee has. Binary feature.
- **mba_p**: percentage of marks secured by an employee while doing his MBA.
- **status**: whether the student was placed or not. Binary Feature. Target variable.
- **salary**: annual compensation at which an employee was hired.

3. Data Checks to perform

- Check Missing values
- Check Duplicates
- Check data type
- Check the number of unique values of each column
- Check statistics of data set
- Check various categories present in the different categorical column

3.1 Check Missing values

In [16]:
```
df.isna().sum()
```

Out[16]:
```
sl_no             0
gender            0
ssc_p             0
ssc_b             0
hsc_p             0
hsc_b             0
hsc_s             0
degree_p          0
degree_t          0
workex            0
etest_p           0
specialisation    0
mba_p             0
status            0
salary           67
dtype: int64
```

Observation:

- There are **67** missing values in salary depicts that 67 out of 215 has not been placed

In [17]:
```
df
```

Out[17]:

	sl_no	gender	ssc_p	ssc_b	hsc_p	hsc_b	hsc_s	degree_p	degree_t	workex	etest_p	specialisation	mba_p	status	salary
0	1	0	67.00	Others	91.00	Others	Commerce	58.00	Sci&Tech	No	55.0	Mkt&HR	58.80	Placed	270000.0
1	2	0	79.33	Central	78.33	Others	Science	77.48	Sci&Tech	Yes	86.5	Mkt&Fin	66.28	Placed	200000.0
2	3	0	65.00	Central	68.00	Central	Arts	64.00	Comm&Mgmt	No	75.0	Mkt&Fin	57.80	Placed	250000.0
3	4	0	56.00	Central	52.00	Central	Science	52.00	Sci&Tech	No	66.0	Mkt&HR	59.43	Not Placed	NaN
4	5	0	85.80	Central	73.60	Central	Commerce	73.30	Comm&Mgmt	No	96.8	Mkt&Fin	55.50	Placed	425000.0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
210	211	0	80.60	Others	82.00	Others	Commerce	77.60	Comm&Mgmt	No	91.0	Mkt&Fin	74.49	Placed	400000.0
211	212	0	58.00	Others	60.00	Others	Science	72.00	Sci&Tech	No	74.0	Mkt&Fin	53.62	Placed	275000.0
212	213	0	67.00	Others	67.00	Others	Commerce	73.00	Comm&Mgmt	Yes	59.0	Mkt&Fin	69.72	Placed	295000.0
213	214	1	74.00	Others	66.00	Others	Commerce	58.00	Comm&Mgmt	No	70.0	Mkt&HR	60.23	Placed	204000.0
214	215	0	62.00	Central	58.00	Others	Science	53.00	Comm&Mgmt	No	89.0	Mkt&HR	60.22	Not Placed	NaN

215 rows × 15 columns

3.2 Check Duplicates

In [18]:
```
df.duplicated().sum()
```

Out[18]:
```
0
```

There are no duplicates values in the data set

3.3 Check data types

In [19]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 215 entries, 0 to 214
Data columns (total 15 columns):
 #   Column          Non-Null Count  Dtype  
---  ------          --------------  -----  
 0   sl_no           215 non-null    int64  
 1   gender          215 non-null    int64  
 2   ssc_p           215 non-null    float64
 3   ssc_b           215 non-null    object 
 4   hsc_p           215 non-null    float64
 5   hsc_b           215 non-null    object 
 6   hsc_s           215 non-null    object 
 7   degree_p        215 non-null    float64
 8   degree_t        215 non-null    object 
 9   workex          215 non-null    object 
 10  etest_p         215 non-null    float64
 11  specialisation  215 non-null    object 
 12  mba_p           215 non-null    float64
 13  status          215 non-null    object 
 14  salary          148 non-null    float64
dtypes: float64(6), int64(2), object(7)
memory usage: 25.3+ KB
```

3.4 Checking the number of unique values of each column

In [20]:
```
df.nunique()
```

Out[20]:
```
sl_no             215
gender              2
ssc_p             103
ssc_b               2
hsc_p              97
hsc_b               2
hsc_s               3
degree_p           89
degree_t            3
workex              2
etest_p           100
specialisation      2
mba_p             205
status              2
salary             45
dtype: int64
```

3.5 Check statistics of data set

In [21]:
```
df.describe()
```

Out[21]:

	sl_no	gender	ssc_p	hsc_p	degree_p	etest_p	mba_p	salary
count	215.000000	215.000000	215.000000	215.000000	215.000000	215.000000	215.000000	148.000000
mean	108.000000	0.353488	67.303395	66.333163	66.370186	72.100558	62.278186	288655.405405
std	62.209324	0.479168	10.827205	10.897509	7.358743	13.275956	5.833385	93457.452420
min	1.000000	0.000000	40.890000	37.000000	50.000000	50.000000	51.210000	200000.000000
25%	54.500000	0.000000	60.600000	60.900000	61.000000	60.000000	57.945000	240000.000000
50%	108.000000	0.000000	67.000000	65.000000	66.000000	71.000000	62.000000	265000.000000
75%	161.500000	1.000000	75.700000	73.000000	72.000000	83.500000	66.255000	300000.000000
max	215.000000	1.000000	89.400000	97.700000	91.000000	98.000000	77.890000	940000.000000

Observation

- The given data is perfect with no outliers.

3.6 Exploring Data

In [23]:
```
df.head()
```

Out[23]:

	sl_no	gender	ssc_p	ssc_b	hsc_p	hsc_b	hsc_s	degree_p	degree_t	workex	etest_p	specialisation	mba_p	status	salary
0	1	0	67.00	Others	91.00	Others	Commerce	58.00	Sci&Tech	No	55.0	Mkt&HR	58.80	Placed	270000.0
1	2	0	79.33	Central	78.33	Others	Science	77.48	Sci&Tech	Yes	86.5	Mkt&Fin	66.28	Placed	200000.0
2	3	0	65.00	Central	68.00	Central	Arts	64.00	Comm&Mgmt	No	75.0	Mkt&Fin	57.80	Placed	250000.0
3	4	0	56.00	Central	52.00	Central	Science	52.00	Sci&Tech	No	66.0	Mkt&HR	59.43	Not Placed	NaN
4	5	0	85.80	Central	73.60	Central	Commerce	73.30	Comm&Mgmt	No	96.8	Mkt&Fin	55.50	Placed	425000.0

In [24]:
```
# define numerical & categorical columns
numeric_features = [feature for feature in df.columns if df[feature].dtype != 'O']
categorical_features = [feature for feature in df.columns if df[feature].dtype == 'O']

# print columns
print('We have {} numerical features : {}'.format(len(numeric_features), numeric_features))
print('\nWe have {} categorical features : {}'.format(len(categorical_features), categorical_features))
```

```
We have 8 numerical features : ['sl_no', 'gender', 'ssc_p', 'hsc_p', 'degree_p', 'etest_p', 'mba_p', 'salary']

We have 7 categorical features : ['ssc_b', 'hsc_b', 'hsc_s', 'degree_t', 'workex', 'specialisation', 'status']
```

In [25]:
```
for feature in categorical_features:
    print(f'unique values in "{feature}" column: ', df[feature].unique())
    print()
```

```
unique values in "ssc_b" column:  ['Others' 'Central']

unique values in "hsc_b" column:  ['Others' 'Central']

unique values in "hsc_s" column:  ['Commerce' 'Science' 'Arts']

unique values in "degree_t" column:  ['Sci&Tech' 'Comm&Mgmt' 'Others']

unique values in "workex" column:  ['No' 'Yes']

unique values in "specialisation" column:  ['Mkt&HR' 'Mkt&Fin']

unique values in "status" column:  ['Placed' 'Not Placed']
```

Observations

- The data look perfect with no mistaken records.
- the naming convention maybe improved slightly for better understanding.

Model Training:

1.1 Import Data and Required Packages

Importing Pandas, Numpy, Matplotlib, Seaborn and Warings Library.

In [1]:
```
# Basic Import
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
# Modelling
from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score, confusion_matrix
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier, AdaBoostClassifier
from sklearn.svm import SVC
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, precision_score, recall_score, f1_score, confusion_matrix
from sklearn.model_selection import RandomizedSearchCV
from catboost import CatBoostClassifier
from xgboost import XGBClassifier
import warnings
```

Import the CSV Data as Pandas DataFrame

In [2]:
```
df = pd.read_csv('data/train.csv')
```

Show Top 5 Records

In [4]:
```
df.head()
```

Out[4]:

	sl_no	gender	ssc_p	ssc_b	hsc_p	hsc_b	hsc_s	degree_p	degree_t	workex	etest_p	specialisation	mba_p	status	salary
0	1	0	67.00	Others	91.00	Others	Commerce	58.00	Sci&Tech	No	55.0	Mkt&HR	58.80	Placed	270000.0
1	2	0	79.33	Central	78.33	Others	Science	77.48	Sci&Tech	Yes	86.5	Mkt&Fin	66.28	Placed	200000.0
2	3	0	65.00	Central	68.00	Central	Arts	64.00	Comm&Mgmt	No	75.0	Mkt&Fin	57.80	Placed	250000.0
3	4	0	56.00	Central	52.00	Central	Science	52.00	Sci&Tech	No	66.0	Mkt&HR	59.43	Not Placed	NaN
4	5	0	85.80	Central	73.60	Central	Commerce	73.30	Comm&Mgmt	No	96.8	Mkt&Fin	55.50	Placed	425000.0

In [5]:
```
df.drop('sl_no', axis=1, inplace=True)
```

In [6]:
```
df['salary'] = df['salary'].fillna(0)
```

In [7]:
```
df['status'] = df['status'].replace({'Placed': 1, 'Not Placed': 0})
```

In [8]:
```
df.drop('salary', axis=1, inplace=True)
```

In [9]:
```
df.head()
```

Out[9]:

	gender	ssc_p	ssc_b	hsc_p	hsc_b	hsc_s	degree_p	degree_t	workex	etest_p	specialisation	mba_p	status
0	0	67.00	Others	91.00	Others	Commerce	58.00	Sci&Tech	No	55.0	Mkt&HR	58.80	1
1	0	79.33	Central	78.33	Others	Science	77.48	Sci&Tech	Yes	86.5	Mkt&Fin	66.28	1
2	0	65.00	Central	68.00	Central	Arts	64.00	Comm&Mgmt	No	75.0	Mkt&Fin	57.80	1
3	0	56.00	Central	52.00	Central	Science	52.00	Sci&Tech	No	66.0	Mkt&HR	59.43	0
4	0	85.80	Central	73.60	Central	Commerce	73.30	Comm&Mgmt	No	96.8	Mkt&Fin	55.50	1

In [10]:
```
X = df.drop(columns=['status'], axis=1)
y = df['status']
```

In [11]:
```
# Create Column Transformer with 3 types of transformers
num_features = X.select_dtypes(exclude="object").columns
cat_features = X.select_dtypes(include="object").columns

from sklearn.preprocessing import OneHotEncoder, StandardScaler
from sklearn.compose import ColumnTransformer

numeric_transformer = StandardScaler()
oh_transformer = OneHotEncoder()

preprocessor = ColumnTransformer(
    [
        ("OneHotEncoder", oh_transformer, cat_features),
         ("StandardScaler", numeric_transformer, num_features),
    ]
)
```

In [12]:
```
X = preprocessor.fit_transform(X)
```

In [13]:
```
X.shape
```

Out[13]:
```
(215, 20)
```

Preparing X and Y variables

In [14]:
```
# separate dataset into train and test
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X,y,test_size=0.2,random_state=42)
X_train.shape, X_test.shape
```

Out[14]:
```
((172, 20), (43, 20))
```

Create an Evaluate Function to give all metrics after model Training

In [15]:
```
def evaluate_model(true, predicted):
    mae = mean_absolute_error(true, predicted)
    mse = mean_squared_error(true, predicted)
    rmse = np.sqrt(mean_squared_error(true, predicted))
    r2_square = r2_score(true, predicted)
    return mae, rmse, r2_square
```

In [22]:
```
models = {
    "Logistic Regression": LogisticRegression(),
    "K-Neighbors Classifier": KNeighborsClassifier(),
    "Decision Tree Classifier": DecisionTreeClassifier(),
    "Random Forest Classifier": RandomForestClassifier(),
    "SVM Classifier": SVC(),
    "XGBoost Classifier": XGBClassifier(),
    "CatBoost Classifier": CatBoostClassifier(verbose=False),
    "AdaBoost Classifier": AdaBoostClassifier()
}

model_list = []
accuracy_list = []

for model_name, model in models.items():
    model.fit(X_train, y_train)  # Train model

    # Make predictions
    y_train_pred = model.predict(X_train)
    y_test_pred = model.predict(X_test)

    # Evaluate Train and Test dataset
    accuracy_train = accuracy_score(y_train, y_train_pred)
    accuracy_test = accuracy_score(y_test, y_test_pred)

    print(model_name)
    model_list.append(model_name)

    print('\nModel performance for Training set')
    print("- Accuracy: {:.4f}".format(accuracy_train))

    print('----------------------------------')

    print('Model performance for Test set')
    print("- Accuracy: {:.4f}".format(accuracy_test))
    accuracy_list.append(accuracy_test)

    print('=' * 35)
    print('\n')

# Now you can access the model names and their accuracy scores in model_list and accuracy_list, respectively.
```

```
Logistic Regression

Model performance for Training set
- Accuracy: 0.8953
----------------------------------
Model performance for Test set
- Accuracy: 0.8837
===================================


K-Neighbors Classifier

Model performance for Training set
- Accuracy: 0.8837
----------------------------------
Model performance for Test set
- Accuracy: 0.7907
===================================
```

```
Decision Tree Classifier

Model performance for Training set
- Accuracy: 1.0000
----------------------------------
Model performance for Test set
- Accuracy: 0.8372
==================================


Random Forest Classifier

Model performance for Training set
- Accuracy: 1.0000
----------------------------------
Model performance for Test set
- Accuracy: 0.8372
==================================


SVM Classifier

Model performance for Training set
- Accuracy: 0.9360
----------------------------------
Model performance for Test set
- Accuracy: 0.8140
==================================


XGBoost Classifier

Model performance for Training set
- Accuracy: 1.0000
----------------------------------
Model performance for Test set
- Accuracy: 0.8372
==================================


CatBoost Classifier

Model performance for Training set
- Accuracy: 0.9942
----------------------------------
Model performance for Test set
- Accuracy: 0.7907
==================================


AdaBoost Classifier

Model performance for Training set
- Accuracy: 1.0000
----------------------------------
Model performance for Test set
- Accuracy: 0.8605
==================================
```

Results

In [19]:
```
pd.DataFrame(list(zip(model_list, accuracy_list)),
             columns=['Model Name', 'R2_Score']).sort_values(by=["R2_Score"],ascending=False)
```

Out[19]:

	Model Name	R2_Score
0	Logistic Regression	0.883721
7	AdaBoost Classifier	0.860465
2	Decision Tree Classifier	0.837209
5	XGBoost Classifier	0.837209
4	SVM Classifier	0.813953
1	K-Neighbors Classifier	0.790698
3	Random Forest Classifier	0.790698
6	CatBoost Classifier	0.790698

In [20]:
```
log_model = LogisticRegression()
log_model =log_model.fit(X_train, y_train)
y_pred = log_model.predict(X_test)
score = accuracy_score(y_test, y_pred)*100
print(" Accuracy of the model is %.2f" %score)
```

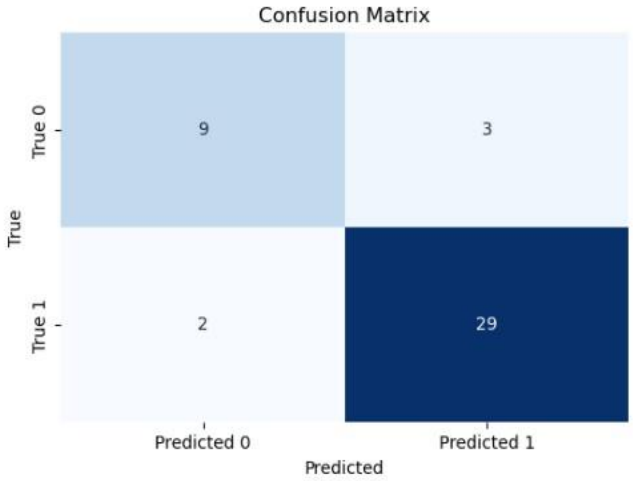
```
Accuracy of the model is 88.37
```

Plot y_pred and y_test

In [21]:
```
from sklearn.metrics import confusion_matrix

cm = confusion_matrix(y_test, y_pred)

# Create a heatmap for the confusion matrix
plt.figure(figsize=(6, 4))
sns.heatmap(cm, annot=True, fmt="d", cmap="Blues", cbar=False,
            xticklabels=["Predicted 0", "Predicted 1"],
            yticklabels=["True 0", "True 1"])
plt.xlabel('Predicted')
plt.ylabel('True')
plt.title('Confusion Matrix')
plt.show()
```



Observation

- model predicted with 5 wrong prediction.

Data_Ingestion.py

```
import os
import sys
sys.path.append(r'D:\Programs\Machine_learning_projects\Campus_placement_pre
diction')
from dataclasses import dataclass

import pandas as pd
from sklearn.model_selection import train_test_split

from src.Components.data_transformation import DataTransformationConfig
from src.Components.data_transformation import DataTransformation
from src.Components.model_trainer import ModelTrainer
from src.Components.model_trainer import ModelTrainerConfig

from src.exception import CustomException
from src.logger import logging

@dataclass
class DataIngestionConfig:
    train_data_path: str= os.path.join('artifacts', 'train_data.csv')
    test_data_path: str= os.path.join('artifacts', 'test_data.csv')
    raw_data_path: str= os.path.join('artifacts', 'data.csv')

class DataIngestion:
    def __init__(self):
        self.ingestion_config = DataIngestionConfig()

    def initiate_data_ingestion(self):
        logging.info('Entered data ingestion')
        try:
            df = pd.read_csv('Notebooks\data\Train_clean.csv')
            logging.info('Reading the dataset.')
            os.makedirs(os.path.dirname(self.ingestion_config.test_data_path
), exist_ok=True)
            df.to_csv(self.ingestion_config.raw_data_path, index=False,
header=True)
            logging.info("Train test split initiated")

            train_set, test_set = train_test_split(df, test_size=0.2,
random_state=42)
```

```
            train_set.to_csv(self.ingestion_config.train_data_path,
index=False, header=True)
            test_set.to_csv(self.ingestion_config.test_data_path,
index=False, header=True)

            logging.info('Ingestion of data is completed.')
            return (
                self.ingestion_config.train_data_path,
                self.ingestion_config.test_data_path
            )
        except Exception as e:
            raise CustomException(e, sys)

if__name__== '__main__':
    obj = DataIngestion()
    train_data, test_data = obj.initiate_data_ingestion()

    data_transformation = DataTransformation()
    train_arr, test_arr, _=
data_transformation.initiate_data_transformation(train_data, test_data)

    model = ModelTrainer()
    print(model.initiate_model_trainer(train_arr, test_arr))
```

Data_Transformation.py

```
import sys
from dataclasses import dataclass

import numpy as np
import pandas as pd
from sklearn.compose import ColumnTransformer
from sklearn.impute import SimpleImputer
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import OneHotEncoder,StandardScaler

from src.exception import CustomException
from src.logger import logging
import os

from src.utils import save_object

@dataclass
```

```
class DataTransformationConfig:
    preprocessor_obj_file_path=os.path.join('artifacts',"preprocessor.pkl")

class DataTransformation:
    def_init_(self):
        self.data_transformation_config=DataTransformationConfig()

    def get_data_transformer_object(self):
        '''
        This function is responsible for data transformation

        '''
        try:
            numerical_columns = ['gender', 'ssc_p', 'hsc_p', 'degree_p',
'etest_p', 'mba_p']
            categorical_columns = ['ssc_b', 'hsc_b', 'hsc_s', 'degree_t',
'workex', 'specialisation']

            num_pipeline= Pipeline(
                steps=[
                ("imputer",SimpleImputer(strategy="median")),
                ("scaler",StandardScaler())

                ]
            )

            cat_pipeline=Pipeline(

                steps=[
                ("imputer",SimpleImputer(strategy="most_frequent")),
                ("one_hot_encoder",OneHotEncoder(handle_unknown="ignore")),
                ("scaler",StandardScaler(with_mean=False))
                ]

            )

            logging.info(f"Categorical columns: {categorical_columns}")
            logging.info(f"Numerical columns: {numerical_columns}")

            preprocessor=ColumnTransformer(
                [
                ("num_pipeline",num_pipeline,numerical_columns),
                ("cat_pipelines",cat_pipeline,categorical_columns)
```

```
                ]


            )

            return preprocessor

        except Exception as e:
            raise CustomException(e,sys)

    def initiate_data_transformation(self,train_path,test_path):

        try:
            train_df=pd.read_csv(train_path)
            test_df=pd.read_csv(test_path)

            logging.info("Read train and test data completed")

            logging.info("Obtaining preprocessing object")

            preprocessing_obj=self.get_data_transformer_object()

            target_column_name="status"

            input_feature_train_df=train_df.drop(columns=[target_column_name
],axis=1)
            target_feature_train_df=train_df[target_column_name].values

            input_feature_test_df=test_df.drop(columns=[target_column_name],
axis=1)
            target_feature_test_df=test_df[target_column_name].values

            logging.info(
                f"Applying preprocessing object on training dataframe and
testing dataframe."
            )

            print(input_feature_train_df.columns)
            print(input_feature_test_df.columns)

            input_feature_train_arr=preprocessing_obj.fit_transform(input_fe
ature_train_df)
```

```
            input_feature_test_arr=preprocessing_obj.transform(input_feature
_test_df)

            train_arr = np.c_[input_feature_train_arr,
np.array(target_feature_train_df)]
            test_arr = np.c_[input_feature_test_arr,
np.array(target_feature_test_df)]

            logging.info(f"Array concatenated sucessfully.")

            save_object(

                file_path=self.data_transformation_config.preprocessor_obj_f
ile_path,
                obj=preprocessing_obj

            )

            logging.info(f"Saved preprocessing object.")

            return (
                train_arr,
                test_arr,
                self.data_transformation_config.preprocessor_obj_file_path,
            )
        except Exception as e:
            raise CustomException(e,sys)
```

Model_Trainer.py

```
import os
import sys
from dataclasses import dataclass

from sklearn.preprocessing import StandardScaler
from sklearn.metrics import accuracy_score, precision_score, recall_score,
f1_score, confusion_matrix
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier, AdaBoostClassifier
from sklearn.svm import SVC
from sklearn.linear_model import LogisticRegression
```

```
from sklearn.metrics import accuracy_score, precision_score, recall_score,
f1_score, confusion_matrix
from sklearn.model_selection import RandomizedSearchCV
from catboost import CatBoostClassifier
from xgboost import XGBClassifier

from src.exception import CustomException
from src.logger import logging
from src.utils import save_object, evaluate_model

@dataclass
class ModelTrainerConfig:
    trained_model_file_path: str= os.path.join('artifacts', 'model.pkl')

class ModelTrainer:
    def __init__(self) -> None:
        self.model_trainer_config = ModelTrainerConfig()

    def initiate_model_trainer(self, train_array, test_array):
        try:
            logging.info('Entered model trainer. Splitting train and test
dataset.')

            x_train, y_train, x_test, y_test = (
                train_array[:, :-1],
                train_array[:, -1],
                test_array[:, :-1],
                test_array[:, -1]
            )

            models = {
                        "Logistic Regression": LogisticRegression(),
                        "K-Neighbors Classifier": KNeighborsClassifier(),
                        "Decision Tree Classifier":
DecisionTreeClassifier(),
                        "Random Forest Classifier":
RandomForestClassifier(),
                        "SVM Classifier": SVC(),
                        "XGBoost Classifier": XGBClassifier(),
                        "CatBoost Classifier":
CatBoostClassifier(verbose=False),
                        "AdaBoost Classifier": AdaBoostClassifier()
                    }
```

```
            model_report= evaluate_model(X_train=x_train, y_train= y_train,
X_test= x_test, y_test= y_test, models= models)
            best_model_score = max(sorted(model_report.values()))

            best_model_name =
list(model_report.keys())[list(model_report.values()).index(best_model_score
)]

            best_model = models[best_model_name]
            logging.info('Best model found.')

            save_object(
                file_path=
self.model_trainer_config.trained_model_file_path,
                obj=best_model
            )

            predicted=best_model.predict(x_test)
            acc_value = accuracy_score(y_test, predicted)
            return f"Model name: {best_model_name}\nr2_score: {acc_value}"

        except Exception as e:
            raise CustomException(e, sys)
```

Exception.py

```
import sys
from src.logger import logging

def error_message_detail(error, error_detail: sys):
    _, _, exc_tb = error_detail.exc_info()
    filename = exc_tb.tb_frame.f_code.co_filename
    lineno = exc_tb.tb_lineno
    error_message = "Error occured in python script \nname : {0}\nLine
number: {1}\nError message: {2}".format(
        filename, lineno, error
    )

    return error_message

class CustomException(Exception):
    def_init_(self, error_message, error_detail: sys):
        super()._init_(error_message)
```

```
        self.error_message = error_message_detail(error_message,
error_detail)

    def __str__(self) -> str:
        return self.error_message

if_name__== "__main__":
    try:
        a = 1/0
    except Exception as e:
        logging.exception(e)
        raise CustomException(e, sys)
```

Utils.py

```
import os
import pickle
import sys

from sklearn.metrics import accuracy_score
from sklearn.model_selection import GridSearchCV

from src.exception import CustomException
from src.logger import logging

def save_object(file_path, obj):
    try:
        dir_path= os.path.dirname(file_path)
        os.makedirs(dir_path, exist_ok=True)

        with open(file_path, "wb") as file_obj:
            pickle.dump(obj, file_obj)

    except Exception as e:
        raise CustomException(e, sys)

def evaluate_model(X_train, y_train, X_test, y_test, models):
    try:
        report={}

        for i in range(len(list(models))):
            model = list(models.values())[i]
            logging.info(f"In the model: {model}")
```

```
            model.fit(X_train, y_train)

            y_test_pred = model.predict(X_test)
            test_model_score = accuracy_score(y_test, y_test_pred)

            report[list(models.keys())[i]] = test_model_score
            logging.info(f'Completed: {model}')
        return report

    except Exception as e:
        raise CustomException(e, sys)

def load_model(file_path):
    try:
        with open(file_path, 'rb') as obj:
            return pickle.load(obj)

    except Exception as e:
        raise CustomException(e, sys)
```

Logger.py

```
import logging
import os
from datetime import datetime

LOG_FILE = f"{datetime.now().strftime('%m_%d_%Y_%H_%M_%S')}.log"

logs_path = os.path.join(os.getcwd(), "logs", LOG_FILE)
os.makedirs(logs_path, exist_ok=True) # To append file after the folder is
created

LOG_FILE_PATH = os.path.join(logs_path, LOG_FILE)

logging.basicConfig(
    filename= LOG_FILE_PATH,
    format= "[ %(asctime)s ] %(lineno)d %(name)s - %(levelname)s -
%(message)s",
    level= logging.INFO
)

if_name__== "__main__":
    logging.info("Test logging started.")
```

App.py

```
import streamlit as st
import pandas as pd
import numpy as np

from src.pipelines.predict_pipeline import PredictPipeline

st.write("""
# Campus prediction App.

This app predicts whether the student will be recruited in campus placements
or not based on the available factors in the dataset.

Data obtained from [Kaggle campus
placement](https://www.kaggle.com/competitions/ml-with-python-course-
project/data) """)

st.sidebar.header('User Input Features')
st.sidebar.markdown("""
 [Example CSV input file]() """)

# Collects user input features into dataframe
uploaded_file = st.sidebar.file_uploader("Upload your input CSV file",
type=["csv"])
if uploaded_file is not None:
    input_df = pd.read_csv(uploaded_file)
else:
    def user_input_features():
        GENDER = {'Male': 0, 'Female': 1}
        DEGREE_T = {'Science and Technology':'Sci&Tech', 'Commerece and
Management': 'Comm&Mgmt', 'Others': 'Others'}
        SPECIALISATION= {'Market and HR': 'Mkt&HR', 'Market and Finance':
'Mkt&Fin'}
        gender = st.sidebar.selectbox('Gender', ('Male', 'Female'))
        ssc_p = st.sidebar.slider('Percentage of Mark scored in 10th', 0,
100, 40)
        ssc_b = st.sidebar.selectbox('Which Board Studied in 10th',
('Others', 'Central'))
        hsc_p = st.sidebar.slider('Percentage of Mark scored in 12th', 0,
100, 40)
        hsc_s = st.sidebar.selectbox('Which Stream Studied in 12th',
('Science', 'Commerce', 'Arts'))
```

```
        hsc_b = st.sidebar.selectbox('Which Board Studied in 12th',
('Others', 'Central'))
        degree_p = st.sidebar.slider('Percentage of Mark scored while
completing Degree', 0, 100, 40)
        degree_t = st.sidebar.selectbox('Branch in which Degree was
Acquired', ('Science and Technology', 'Commerece and Management', 'Others'))
        etest_p = st.sidebar.slider('Percentage of Mark scored placement
exam', 0, 100, 40)
        workexp = st.sidebar.selectbox('Do you have prior work experience',
('yes', 'no'))
        mba_p = st.sidebar.slider('Percentage of Mark scored in MBA', 0,
100, 40)
        speci = st.sidebar.selectbox('Do you have specialization in any of
the below criteria', ('Market and HR', 'Market and Finance'))
        gender_1 = GENDER[gender]
        degree_t_1 = DEGREE_T[degree_t]
        speci_1 = SPECIALISATION[speci]

        data = {
                'gender': gender_1,
                'ssc_p': ssc_p,
                'ssc_b': ssc_b,
                'hsc_p': hsc_p,
                'hsc_s': hsc_s,
                'hsc_b': hsc_b,
                'degree_p': degree_p,
                'degree_t': degree_t_1,
                'etest_p': etest_p,
                'workex': workexp,
                'mba_p': mba_p,
                'specialisation': speci_1
                }
        features = pd.DataFrame(data, index=[0])
        return features
    input_df = user_input_features()

st.subheader('User Input features')

if uploaded_file is not None:
    st.write(input_df)
else:
    st.write('Awaiting CSV file to be uploaded. Currently using example
input parameters (shown below).')
```

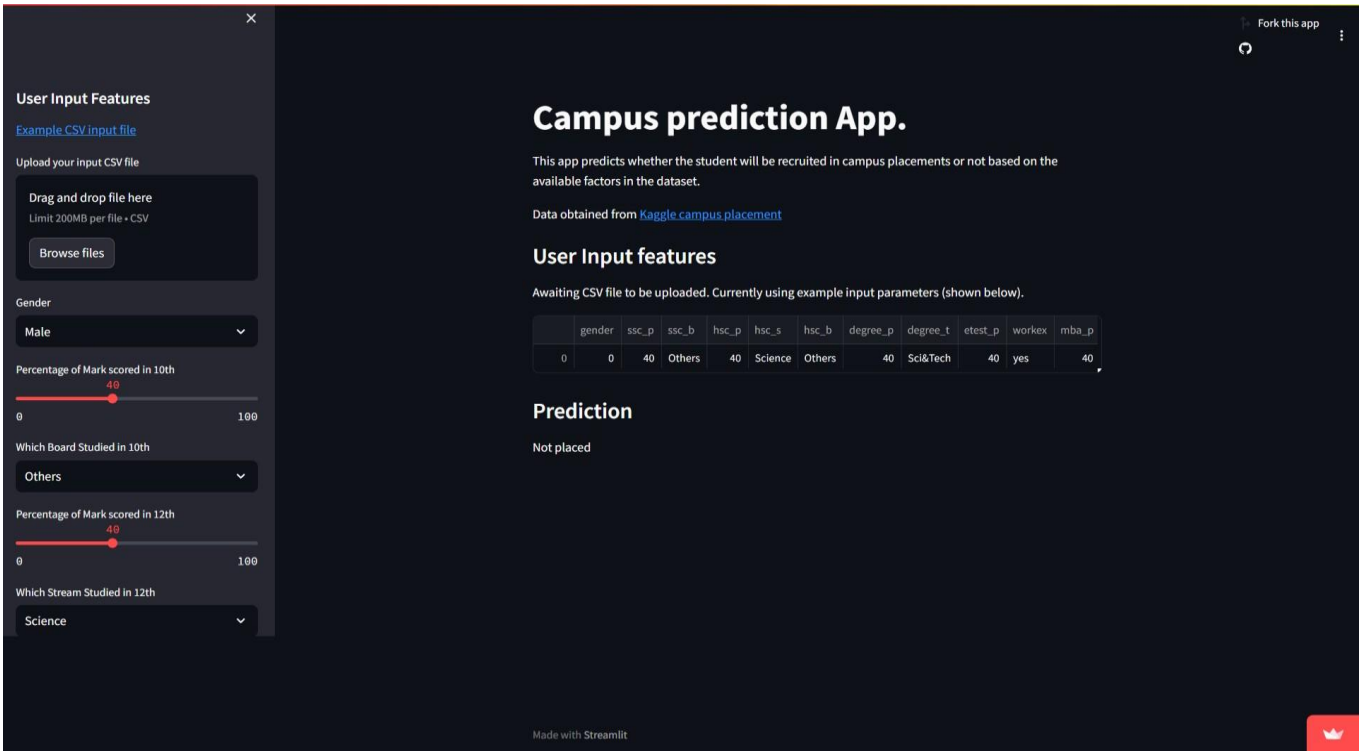
```
    st.write(input_df)

predict_pipeline = PredictPipeline()

predicted_value= predict_pipeline.predict(input_df)

st.subheader('Prediction')
st.write('will be Placed' if predicted_value ==1 else 'Not placed')
```

Web page Output:



References

1. **Programming Language -**

   Python: Python is an interpreted, object-oriented, high-level programming language with dynamic semantics developed by Guido van Rossum-https://realpython.com/

2. **IDE -**

   Jupyter Notebook: The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations, and narrative text- https://jupyter.org/

3. **Machine Learning :** What is machine learning? Machine learning is a branch of artificial intelligence (AI) and computer science which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy - https://www.geeksforgeeks.org/machine-learning/

4. **Streamlit :** Streamlit is an open-source app framework for Machine Learning and Data Science teams. Create beautiful web apps in minutes. https://docs.streamlit.io/

5. **GitHub :** GitHub, Inc. is a platform and cloud-based service for software development and version control using Git, allowing developers to store and manage their code. https://docs.github.com

6. **Referred GitHub repository :** Referred project for hyper parameter tuning and folder structure https://github.com/krishnaik06/mlproject

7. **Referred YouTube playlist :** Referred playlist to learn about the concept of modularizing code, data pipelining and various components https://youtube.com/playlist?list=PLZoTAELRMXVPS-dOaVbAux22vzqdgoGhG&si=RAdzHEaiQTF8LeSV

Conclusion

- In conclusion, this data science project has provided valuable insights into predicting campus placements based on various factors such as educational performance, board, gender, work experience, and specialization.

- Moreover, our data science workflow demonstrated the significance of data preprocessing, feature engineering, and model selection in achieving accurate predictions. We addressed challenges such as handling missing data, which played a crucial role in achieving the project's objectives.

- Our analysis covered a range of features including SSC and HSC percentages, board types, degree marks, work experience, placement exam scores, MBA performance, and specialization choices. These factors were key in determining whether a student would be placed or not.

- As the field of data science continues to evolve, there are boundless opportunities for further exploration and discovery. This project represents a small step forward in the journey of utilizing data to make informed decisions in campus placement scenarios.

- In conclusion, this internship in data science project has not only advanced our understanding of predicting campus placements but it has also demonstrated the power of data-driven decision-making. The skills and methodologies employed in this project can be applied to various domains, making data science a valuable tool in the modern world.