Lab-4 Logistic Regression

Write Python code to implement the following. Consider dataset file as “HR_comma_sep.csv”

1. Do some exploratory data analysis to figure out which variables have direct and clear impact on employee retention (i.e. whether they leave the company or continue to work)

2. Plot bar charts showing impact of employee salaries on retention

3. Plot bar charts showing corelation between department and employee retention

4. Build logistic regression model using variables that were narrowed down in step 1

5. Measure the accuracy of the model

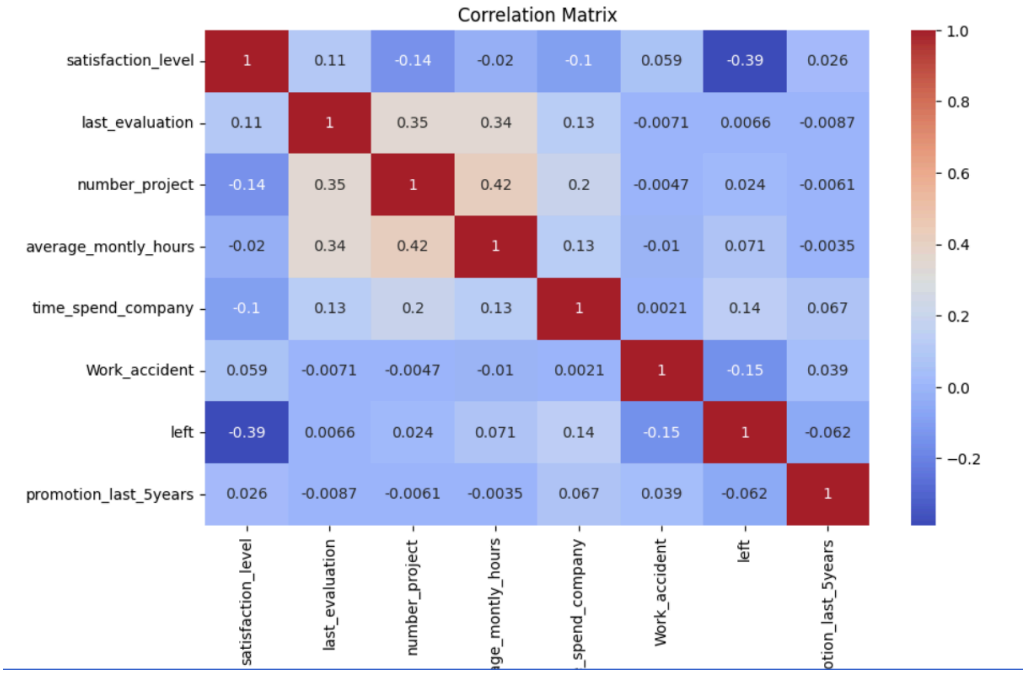
Code:

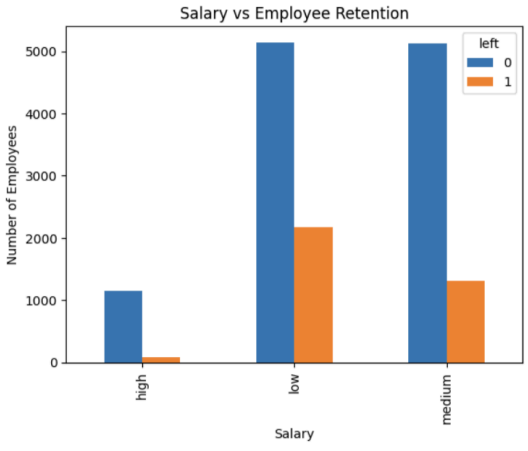
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix


hr = pd.read_csv("HR_comma_sep.csv")

print("First 5 Rows:")
print(hr.head())


plt.figure(figsize=(10,6))
sns.heatmap(
   hr.select_dtypes(include=['int64','float64']).corr(),
   annot=True,
   cmap="coolwarm"
)
plt.title("Correlation Matrix")
plt.show()

pd.crosstab(hr.salary, hr.left).plot(kind='bar')
```

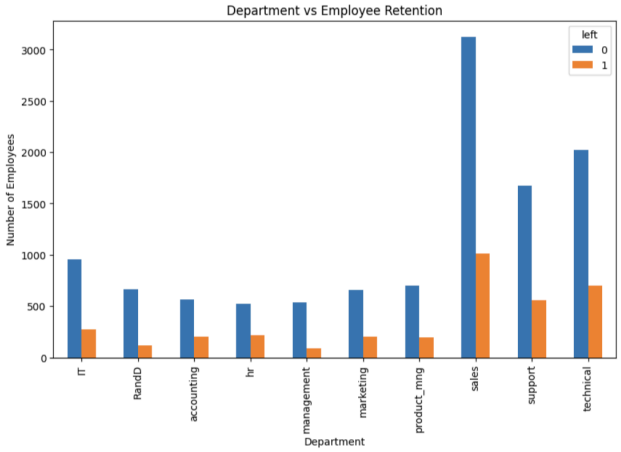
```
plt.title("Salary vs Employee Retention")
plt.xlabel("Salary")
plt.ylabel("Number of Employees")
plt.show()

pd.crosstab(hr.Department, hr.left).plot(kind='bar', figsize=(10,6))
plt.title("Department vs Employee Retention")
plt.xlabel("Department")
plt.ylabel("Number of Employees")
plt.show()


hr = pd.get_dummies(hr, columns=['salary','Department'], drop_first=True)

X = hr.drop("left", axis=1)
y = hr["left"]

X_train, X_test, y_train, y_test = train_test_split(
   X, y, test_size=0.3, random_state=42)


model = LogisticRegression(max_iter=1000)
model.fit(X_train, y_train)


y_pred = model.predict(X_test)


accuracy = accuracy_score(y_test, y_pred)
print("Binary Classification Accuracy:", accuracy)


cm = confusion_matrix(y_test, y_pred)

plt.figure(figsize=(5,4))
sns.heatmap(cm, annot=True, fmt='d')
plt.title("Confusion Matrix - Binary")
plt.xlabel("Predicted")
plt.ylabel("Actual")
plt.show()
```

Output:

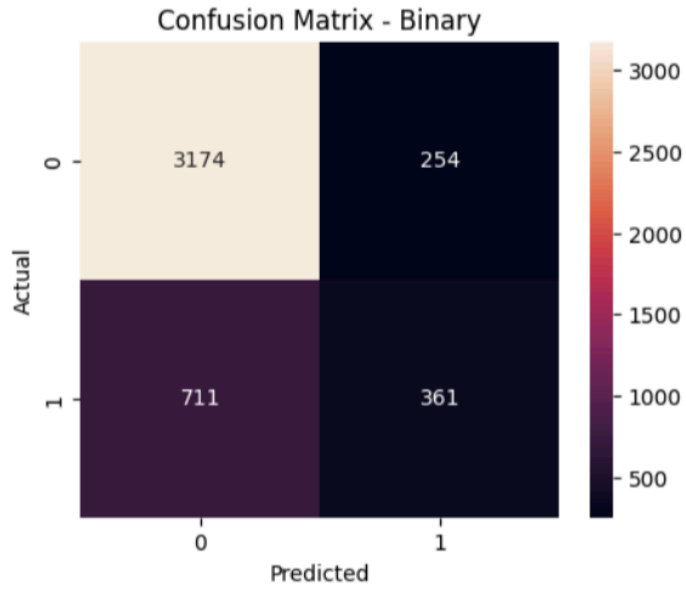
```
First 5 Rows:
   satisfaction_level  last_evaluation  number_project  average_montly_hours  \
0                0.38             0.53               2                   157
1                0.80             0.86               5                   262
2                0.11             0.88               7                   272
3                0.72             0.87               5                   223
4                0.37             0.52               2                   159

   time_spend_company  Work_accident  left  promotion_last_5years Department  \
0                   3              0     1                      0      sales
1                   6              0     1                      0      sales
2                   4              0     1                      0      sales
3                   5              0     1                      0      sales
4                   3              0     1                      0      sales

   salary
0     low
1  medium
2  medium
3     low
4     low
```







Binary Classification Accuracy: 0.7855555555555556



Write Python code to implement the following. Consider dataset file “zoo-data.csv” to predict. Details of class type is provided in “zoo-class_type .csv”

1.If require apply necessary data preprocessing.

2.Build logistic regression model to predict “class_type”

3.Measure the accuracy of the model

4.Plot the confusion matrix

Code:

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score, confusion_matrix

zoo = pd.read_csv("zoo-data.csv")

print("First 5 Rows:")
print(zoo.head())
```

```
zoo = zoo.drop("animal_name", axis=1)

X = zoo.drop("class_type", axis=1)
y = zoo["class_type"]

X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.3, random_state=42)

model = LogisticRegression(max_iter=1000, multi_class='multinomial')
model.fit(X_train, y_train)

y_pred = model.predict(X_test)

print("Multiclass Classification Accuracy:",
      accuracy_score(y_test, y_pred))

cm = confusion_matrix(y_test, y_pred)

plt.figure(figsize=(6,5))
sns.heatmap(cm, annot=True, fmt='d')
plt.title("Confusion Matrix - Multiclass")
plt.xlabel("Predicted")
plt.ylabel("Actual")
plt.show()
```

Output:

```
First 5 Rows:
  animal_name  hair  feathers  eggs  milk  airborne  aquatic  predator  \
0    aardvark     1         0     0     1         0        0         1
1    antelope     1         0     0     1         0        0         0
2        bass     0         0     1     0         0        1         1
3        bear     1         0     0     1         0        0         1
4        boar     1         0     0     1         0        0         1

   toothed  backbone  breathes  venomous  fins  legs  tail  domestic  catsize  \
0        1         1         1         0     0     4     0         0        1
1        1         1         1         0     0     4     1         0        1
2        1         1         0         0     1     0     1         0        0
3        1         1         1         0     0     4     0         0        1
4        1         1         1         0     0     4     1         0        1

   class_type
0           1
1           1
2           4
3           1
4           1
Multiclass Classification Accuracy: 0.9354838709677419
/usr/local/lib/python3.12/dist-packages/sklearn/linear_model/_logistic.py:1247: FutureWarning: 'multi_class' was deprecated in version 1.5 and will be removed in 1.7. From then on, it will always use 'multinomial'. Leave it to its default value to avoid this warning.
  warnings.warn(
```