Assessment Report

on

"Predict Employee Attrition"

submitted as partial fulfillment for the award of

BACHELOR OF TECHNOLOGY DEGREE

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By

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1. Problem Statement

Employee attrition refers to the situation where employees voluntarily or involuntarily leave a company. It is a major concern for organizations, as it leads to loss of talent, increased hiring and training costs, and lower employee morale.

In this project, we aim to predict whether an employee is likely to leave the company based on several features such as **Job Satisfaction**, **Hourly Rate**, **Environment Satisfaction**, and **Years at Company**. Additionally, we perform **employee segmentation** using clustering to group similar employees together, which helps in analyzing employee behavior and identifying potential areas of improvement.

2. Approach Used to Solve the Problem

To solve this problem, we used the following steps:

a. Data Loading and Cleaning

- The dataset was loaded using `pandas`.
- Irrelevant columns like `EmployeeCount`, `EmployeeNumber`, `Over18`, and `StandardHours` were dropped because they do not provide useful information for prediction.

b. Feature Selection

- We selected only the most relevant features for prediction: `JobSatisfaction`, `HourlyRate`, `EnvironmentSatisfaction`, `YearsAtCompany`, and the target variable `Attrition`.

c. Encoding

- Since `Attrition` is a categorical column with values like "Yes"/"No", it was converted into numeric form using **Label Encoding**.

d. Splitting the Data

- We split the dataset into **training** and **testing** sets using an 80-20 ratio to train the model and evaluate its performance.

e. Model Building

- We used a **Random Forest Classifier**, a popular machine learning algorithm, to train the model. It works well for classification problems and handles both numerical and categorical data.

f. Model Evaluation

- We evaluated the model using:
    - **Accuracy Score** – how often the model predicted correctly.
    - **Precision Score** – how many predicted "leavers" were actually correct.
    - **Recall Score** – how many actual "leavers" were correctly identified.
- We also visualized the **confusion matrix** using a heatmap to better understand model performance.

g. Making Predictions

- A **custom prediction function** was created, which takes input from the user (using widgets) and tells whether the employee is likely to stay or leave the company.
- We used **interactive widgets** like sliders and text boxes to make the input user-friendly in a Jupyter Notebook.

h. Employee Clustering (KMeans)

- To understand employee behavior better, we used **KMeans Clustering** to group employees into 3 different segments based on their `Job Satisfaction`, `Hourly Rate`, and `Years at Company`.
- The clusters were visualized using a scatter plot to easily interpret different employee groups.

3. Code

```
import pandas as pd

import seaborn as sns

import matplotlib.pyplot as plt

from sklearn.model_selection import train_test_split

rom sklearn.preprocessing import LabelEncoder

from sklearn.ensemble import RandomForestClassifier

from sklearn.metrics import confusion_matrix, accuracy_score, precision_score, recall_score

from sklearn.cluster import KMeans
```

```
import ipywidgets as widgets

from IPython.display import display

# Load the dataset

df = pd.read_csv("/content/6. Predict Employee Attrition.csv")



df = df.drop(columns=['EmployeeCount', 'EmployeeNumber', 'Over18', 'StandardHours'])


# Feature selection: Select relevant columns for prediction

relevant_columns = ['JobSatisfaction', 'HourlyRate', 'EnvironmentSatisfaction', 'YearsAtCompany',
'Attrition']

df = df[relevant_columns]


# Encode categorical variables (if any) to numerical format using LabelEncoder

label_encoders = {}

for column in df.select_dtypes(include='object').columns:

    le = LabelEncoder()

    df[column] = le.fit_transform(df[column])

    label_encoders[column] = le


# Separate the features (X) and the target variable (y)

X = df.drop('Attrition', axis=1)

y = df['Attrition']


# Split the data into training and testing sets (80% train, 20% test)

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

```
# Initialize and train the Random Forest Classifier model
model = RandomForestClassifier(random_state=42)
model.fit(X_train, y_train)

# Make predictions using the test set
y_pred = model.predict(X_test)

# Evaluate the model using various metrics
conf_matrix = confusion_matrix(y_test, y_pred)
accuracy = accuracy_score(y_test, y_pred) * 100
precision = precision_score(y_test, y_pred)
recall = recall_score(y_test, y_pred)

# Print evaluation metrics
print("Evaluation Metrics:")
print(f"Accuracy : {accuracy:.2f}%")
print(f"Precision: {precision:.4f}")
print(f"Recall   : {recall:.4f}")

# Confusion Matrix Heatmap
plt.figure(figsize=(6, 4))
sns.heatmap(conf_matrix, annot=True, fmt='d', cmap='Blues',
            xticklabels=['No', 'Yes'], yticklabels=['No', 'Yes'])
plt.title('Confusion Matrix - Employee Attrition')
plt.xlabel('Predicted')
plt.ylabel('Actual')
```

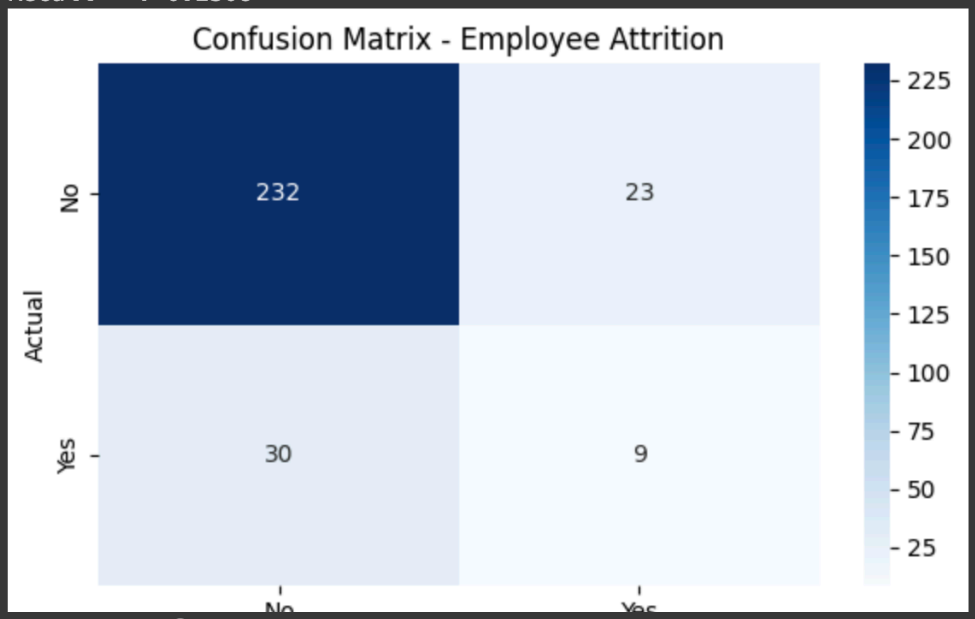
```
plt.tight_layout()

plt.show()


# Function to predict whether the employee will stay or leave

def predict_employee(job_satisfaction, hourly_rate, environment_satisfaction, years_at_company):

    # Create a DataFrame with the input values

    new_employee = pd.DataFrame({

        'JobSatisfaction': [job_satisfaction],

        'HourlyRate': [hourly_rate],

        'EnvironmentSatisfaction': [environment_satisfaction],

        'YearsAtCompany': [years_at_company]

    })


    # Predict whether the employee will leave the company (1 = Yes, 0 = No)

    predicted_attrition = model.predict(new_employee)


    # Output the prediction

    if predicted_attrition[0] == 1:

        return "The employee is likely to leave the company."

    else:

        return "The employee is likely to stay with the company."


# Creating input widgets for employee details

job_satisfaction_widget = widgets.FloatSlider(value=3, min=1, max=4, step=1, description="Job
Satisfaction:")

hourly_rate_widget = widgets.FloatText(description="Hourly Rate:")
```

```
environment_satisfaction_widget = widgets.FloatSlider(value=3, min=1, max=4, step=1,
description="Environment Satisfaction:")

years_at_company_widget = widgets.FloatText(description="Years at Company:")


# Display input widgets

display(job_satisfaction_widget, hourly_rate_widget, environment_satisfaction_widget,
years_at_company_widget)


# Function to handle the prediction when values are changed

def on_button_click(b):

    job_satisfaction = job_satisfaction_widget.value

    hourly_rate = hourly_rate_widget.value

    environment_satisfaction = environment_satisfaction_widget.value

    years_at_company = years_at_company_widget.value


    # Make the prediction based on user input

    prediction = predict_employee(job_satisfaction, hourly_rate, environment_satisfaction,
years_at_company)


    # Display the prediction result

    print(prediction)


# Create a button to trigger the prediction

predict_button = widgets.Button(description="Predict Attrition")

predict_button.on_click(on_button_click)


# Display the button

display(predict_button)
```

```
# Clustering (Segmentation) - KMeans clustering

# Let's perform KMeans clustering to segment employees based on job satisfaction, hourly rate, and years at the company

kmeans = KMeans(n_clusters=3, random_state=42)

df['Cluster'] = kmeans.fit_predict(X)


# Visualizing the clustering (you can modify based on more features)

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

sns.scatterplot(x=df['JobSatisfaction'], y=df['YearsAtCompany'], hue=df['Cluster'], palette='viridis', s=100)

plt.title('Employee Segmentation (Clustering) - Job Satisfaction vs Years at Company')

plt.xlabel('Job Satisfaction')

plt.ylabel('Years at Company')

plt.legend(title='Cluster')

plt.tight_layout()

plt.show()
```

4. Output

```
Evaluation Metrics:
Accuracy : 81.97%
Precision: 0.2812
Recall   : 0.2308
```



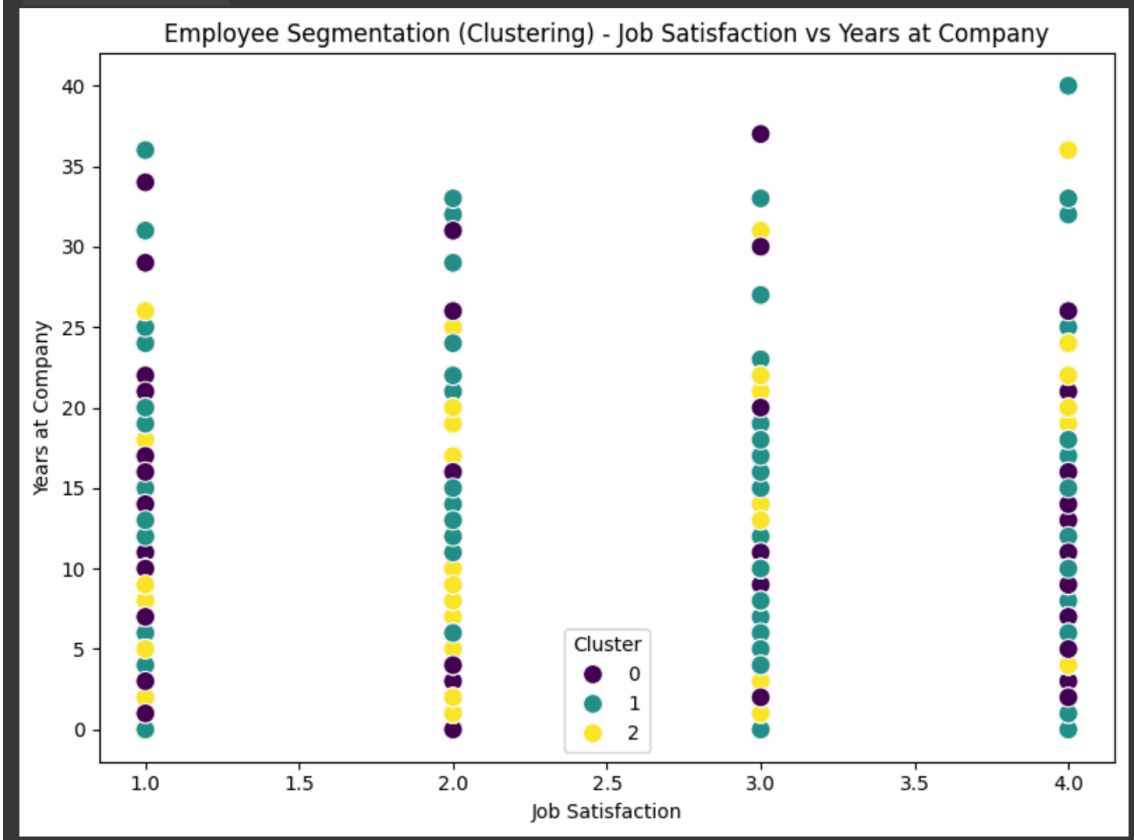
Job Satisfa… 3.00

Hourly Rate: 0

Environme… 3.00

Years at C… 0

Predict Attrition



5.Credits

This project was developed with the guidance and help of **ChatGPT**, an AI developed by OpenAI. ChatGPT assisted in writing the Python code, and creating this in a clear and beginner-friendly way.

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