**📝 HR Analytics – Predict Employee Attrition**

**Project Report**

**🔹 Introduction**

Employee attrition is a major challenge for organizations, affecting productivity, cost, and morale. This project aims to identify the key factors contributing to employee resignation using data analytics and machine learning, and to provide actionable insights to reduce attrition rates.

**🔹 Abstract**

This project analyses HR data to understand why employees leave the organization. Through Python-based data exploration, modelling, and Power BI visualization, we uncover critical attrition drivers such as overtime, low job satisfaction, lack of promotion, and income level. A logistic regression model was built to predict attrition, and SHAP analysis was used to interpret model results.

**🔹 Tools Used**

* **Python**: Pandas, Seaborn, Scikit-learn, SHAP
* **Power BI**: Dashboard and data visualization
* **Google Collab**: For coding and EDA
* **CSV Dataset**: HR Employee Attrition Dataset (1470 rows, 31 columns)

**🔹 Steps Involved in Building the Project**

**✅ 1. Data Cleaning & Preprocessing**

* Removed unnecessary columns (EmployeeCount, StandardHours, EmployeeNumber)
* Encoded categorical values using LabelEncoder
* Mapped Attrition column to binary: 1 = Yes, 0 = No

**✅ 2. Exploratory Data Analysis (EDA)**

* **Attrition by Department**: Highest in Sales and R&D
* **Monthly Income**: Lower income linked to higher attrition
* **Job Satisfaction**: Employees with low satisfaction (1 & 2) left more
* **OverTime**: Major factor - employees doing overtime left more
* **Promotions**: Those with long gaps since promotion were more likely to leave
* **Gender**: Slightly more males resigned compared to females

**✅ 3. Model Building**

* Algorithm: **Logistic Regression**
* Train-Test Split: 80-20%
* Accuracy: **87.75%**
* Confusion Matrix:
* [[252 3]
* [ 33 6]]

**✅ 4. SHAP Value Analysis**

* SHAP (SHapley Additive exPlanations) used to interpret feature impact
* Key features influencing attrition: OverTime, MonthlyIncome, JobSatisfaction, YearsAtCompany

**✅ 5. Power BI Dashboard**

Created a professional, interactive dashboard including:

* 3 bar charts (Department, Gender, Job Satisfaction vs Attrition)
* 2 pie/donut charts (Gender Distribution, Attrition Ratio)
* 1 line chart (Average Income vs Age)
* 3 slicers (Gender, Department, Job Role)

**🔹 Conclusion**

The analysis reveals that employees who earn less, work overtime, are not satisfied with their jobs, or haven't been promoted recently are more likely to leave. The logistic regression model accurately predicts attrition and SHAP analysis adds transparency to feature impact. Power BI enhances communication of findings to stakeholders.

**🔹 Suggestions for Reducing Attrition (for HR):**

* Monitor employees working overtime and ensure proper work-life balance
* Conduct regular job satisfaction surveys
* Design fair and timely promotion plans
* Provide targeted incentives for lower-income groups