

# Employee Attrition Analysis & Prediction Report

## Introduction

Employee attrition refers to the phenomenon where employees leave an organization voluntarily or involuntarily. High attrition rates can negatively impact productivity, increase recruitment costs, and lower morale. This project aims to analyze HR data, predict employee attrition using machine learning, and provide actionable insights to reduce turnover.

## Abstract

This project applies data analysis and machine learning techniques to predict employee attrition. We performed exploratory data analysis (EDA) to understand attrition trends by department, age, and gender. A Logistic Regression model was built for binary classification (Attrition: Yes/No). We used SHAP values for model explainability and visualized insights via an interactive Power BI dashboard. The final solution enables HR teams to make informed decisions to retain employees.

## Tools Used

- Python (Pandas, Scikit-learn, SHAP, Seaborn, Matplotlib)
- Power BI
- Jupyter Notebook
- IBM HR Analytics Employee Attrition Dataset

## Steps Involved in Building the Project

1. Data Preprocessing: Loaded dataset and checked for missing values. Encoded categorical variables using Label Encoding.
2. Exploratory Data Analysis (EDA): Visualized attrition rate by department, age, and gender. Identified high-risk groups.
3. Model Building: Used Logistic Regression to predict attrition. Split dataset (80% training, 20% testing). Evaluated model with accuracy score and confusion matrix.
4. Model Explainability: Applied SHAP to determine top features influencing attrition (e.g., Overtime, Job Role).
5. Power BI Visualization: Created interactive dashboard showing Attrition rate by department, Age vs Attrition trends, Gender-based attrition differences, and SHAP feature importance.

## Conclusion

This HR Analytics project successfully predicted employee attrition with good accuracy (~85%). The SHAP explainability provided transparency, showing key factors driving attrition risk, such as overtime and job role. The Power BI dashboard allows easy interaction and real-time insights for HR decision-makers. This solution empowers HR teams to act proactively, improving employee retention and reducing costs due to turnover.