HR Analytics – Predicting Employee Attrition (Enhanced)

Introduction
Employee attrition is a major concern for organizations, resulting in recruitment expenses, productivity loss, and reduced employee morale. By leveraging HR analytics, organizations can uncover key factors influencing attrition and build predictive models to retain top talent.

Abstract
This project analyzes HR datasets to predict employee attrition and identify actionable retention strategies. Exploratory analysis was conducted to study department-wise, salary-related, and role-based attrition trends. Machine learning models were applied, including Logistic Regression, Decision Tree, Random Forest, and XGBoost. To address the imbalanced dataset problem, SMOTE was used for oversampling attrition cases. The enhanced models achieved improved performance in predicting attrition, and insights were visualized through charts and dashboards.

Tools Used
- Python (Pandas, Seaborn, Scikit-learn, XGBoost, Imbalanced-learn)
- Power BI – Interactive dashboards for HR metrics
- SHAP/Feature Importance – To interpret model predictions

Steps Involved
1. **Data Preprocessing** – Cleaned the dataset, encoded categorical variables, and scaled features.
2. **Exploratory Data Analysis (EDA)** – Visualized attrition distribution by department, salary band, and promotions. Sales and low-salary employees showed higher attrition.
3. **Model Building** – Applied Logistic Regression, Decision Tree, Random Forest, and XGBoost classifiers.
4. **Handling Imbalance** – Used SMOTE oversampling technique to balance attrition vs non-attrition classes.
5. **Model Evaluation** – Random Forest and XGBoost achieved better recall and precision for attrition cases, with accuracy ~85-87%.
6. **Feature Importance** – Salary, job role, and years at company were identified as top attrition drivers.
7. **Visualization** – Built Power BI dashboard showing attrition by department, salary bands, and role-wise distribution.

Conclusion
The enhanced HR analytics project provided more accurate predictions of employee attrition by using advanced machine learning techniques and balancing the dataset with SMOTE. The study concluded that low salaries, lack of promotions, and long tenure in the same role significantly contribute to attrition. Recommended strategies include:
- Competitive and fair compensation
- Regular career development and promotions
- Work-life balance policies
- Employee engagement programs

By adopting these measures, companies can reduce attrition, improve employee satisfaction, and build a sustainable workforce.