HR Analytics Report: Predict Employee Attrition

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1. Executive Summary

This report focuses on using HR analytics to predict employee attrition. Using machine learning models and data visualization, we uncover key patterns in employee behaviour that lead to turnover, aiming to improve employee retention strategies and reduce business costs associated with attrition.

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2. Objective

- Identify the likelihood of employee attrition.
- Determine the main factors influencing turnover.
- Provide actionable recommendations to HR stakeholders.

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3. Tools & Technologies Used

Tool	Purpose
Python	Data manipulation, modelling
Pandas / NumPy	Data wrangling and preprocessing
Matplotlib / Seaborn	Data visualization
Scikit-learn	Machine learning modelling
XGBoost / Random Forest	Ensemble classification models
Jupyter Notebook / Google Colab	Exploratory data analysis and modelling
Tableau / Power BI *(optional)*	Dashboard for visualization (if deployed for business use)

4. Dataset Overview

Dataset: HR Analytics Employee Attrition Dataset
Rows: 1,470 records
Columns: 35 features
Target Variable: Attrition (Yes/No)
Feature Examples:

- Age, Gender, Department, Job Role
- Job Satisfaction, Environment Satisfaction
- Monthly Income, Overtime, Years at Company

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5. Methodology

1. **Data Cleaning** – Remove nulls, convert data types, encode categorical variables.
2. **Exploratory Data Analysis (EDA)** – Identify correlations, class imbalances, key trends.
3. **Feature Engineering** – One-hot encoding, feature scaling.
4. **Modelling** – Logistic Regression, Random Forest, and XGBoost were trained.
5. **Model Evaluation** – Assessed with accuracy, precision, recall, F1-score.
6. **Interpretation** – Used SHAP values and feature importance charts.

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6. Key Insights

- **Overtime** workers are **3.3x** more likely to leave.
- **Job Satisfaction** below average correlates with higher attrition.
- **Low income** (< $3000/month) employees are more likely to quit.
- Employees with **< 2 years** at the company have the highest attrition rate.
- **Work-life balance** and **environment satisfaction** are also strong predictors.

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7. Model Performance (Best: XGBoost)

Metric	Value
Accuracy	88%
Precision	76%
Recall	73%
F1 Score	74%
AUC-ROC	0.89

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8. Recommendations

1. **Limit Excessive Overtime**: Build a sustainable workload structure.
2. **Improve Early Engagement**: Focus on support for new hires (<2 years).
3. **Monitor Satisfaction Regularly**: Use pulse surveys and 1:1 check-ins.
4. **Offer Competitive Compensation**: Regular benchmarking and raises.
5. **Career Pathing**: Show clear advancement paths to employees.
6. **Work-Life Balance Programs**: Offer flexible working and wellness resources.

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9. Conclusion

Predictive analytics empowers HR to move from reactive to proactive attrition management. By targeting high-risk employee groups and optimizing workplace factors, businesses can retain top talent and improve organizational stability.
