

EMPLOYEE ATTRITION PREDICTION USING HR ANALYTICS

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ABSTRACT

Employee Attrition Prediction using HR Analytics is a data-driven approach to identify employees who are likely to leave an organization. Employee attrition causes financial loss, reduced productivity, and operational instability. The objective of this project is to predict employee attrition using supervised machine learning techniques by analyzing historical HR data. The system considers multiple factors such as job satisfaction, salary, experience, working hours, performance rating, and work-life balance. Data preprocessing and feature selection are applied to improve prediction accuracy. Machine learning models such as Logistic Regression, Decision

Tree, Random Forest, and Support Vector Machine are used for prediction. The system provides accurate results and actionable insights to HR managers, helping organizations reduce attrition and improve employee retention strategies.

KEYWORDS: *Employee Attrition, HR Analytics, Machine Learning, Supervised Learning, Predictive Analysis, Workforce Management.*

INTRODUCTION

Employee attrition refers to the gradual reduction of workforce due to resignation, retirement, or termination. High attrition rates negatively impact organizational growth and increase recruitment and training costs. Traditional HR practices rely on surveys and manual analysis, which are time-consuming and less effective. With the growth of data analytics, HR

departments can now use machine learning techniques to predict attrition in advance. HR Analytics combines statistical analysis, data mining, and machine learning to derive meaningful insights from employee data. This project focuses on building an intelligent system that predicts employee attrition and supports HR managers in proactive decision-making.

LITERATURE REVIEW

Several researchers have explored employee attrition prediction using machine learning. IBM HR Analytics (2016) demonstrated how predictive models can identify attrition risk using employee datasets. Punnoose and Ajit (2018) compared machine learning algorithms and concluded that ensemble methods provide better accuracy. Zhao et al. (2020) used deep learning techniques but highlighted high computational complexity. Rahman et al. (2020) applied decision tree and random forest models with improved performance. However, most existing studies lack interpretability and real-time usability. The proposed system addresses these limitations by using efficient supervised learning models with clear outputs.

RELATED WORK

Earlier HR systems relied on statistical reports and descriptive analytics. With advancements in data science, machine learning models such as Logistic Regression, Decision Trees, Random Forests, and SVMs became popular for attrition prediction. Recent research focuses on ensemble and deep learning techniques. However, many systems suffer from data imbalance, overfitting, and lack of explainability. Few systems are designed specifically for HR usability. The proposed project integrates accurate prediction models with easy interpretation and practical implementation.

EXISTING METHOD

Existing employee attrition analysis methods are mostly reactive. Organizations rely on historical attrition trends and manual surveys. Traditional systems lack predictive capabilities and fail to analyze multiple employee attributes together. Some automated systems use basic statistical models with limited accuracy. They do not provide real-time insights or actionable recommendations. As a result, HR managers cannot take preventive actions effectively.

PROPOSED SYSTEM

The proposed system predicts employee attrition using supervised machine learning algorithms. Employee data is collected and preprocessed to handle missing values and categorical variables. Feature selection is performed to identify key factors influencing attrition. Machine learning models such as Logistic Regression, Decision Tree, Random Forest, and Support Vector Machine are trained using labeled data. The system classifies employees as “Will Resign” or “Will Not Resign.” The results help HR managers take timely actions to improve employee retention.

SYSTEM ARCHITECTURE

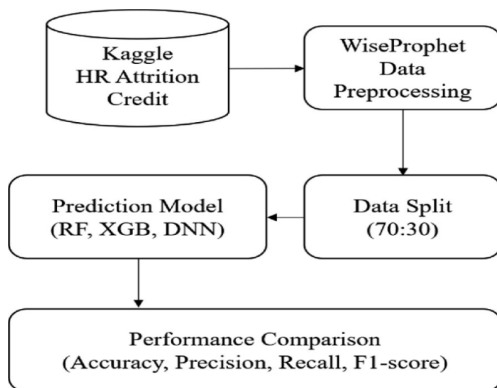


Fig 1: Employee Attrition Prediction System Architecture

METHODOLOGY

DESCRIPTION

Data Collection: Employee data is collected from HR databases, including age, department, salary, experience, job satisfaction, performance rating, and working hours.

Data Preprocessing: Missing values are handled, categorical variables are encoded, and numerical features are normalized.

Feature Selection: Important features affecting attrition are identified using correlation analysis and feature importance methods.

Model Training: Supervised learning algorithms are trained using historical labeled data.

Model Evaluation: Models are evaluated using accuracy, precision, recall, F1-score, and confusion matrix.

Prediction: The trained model predicts whether an employee is likely to resign or not.

Output: Results are displayed as clear messages for HR decision-making.

RESULTS AND DISCUSSION

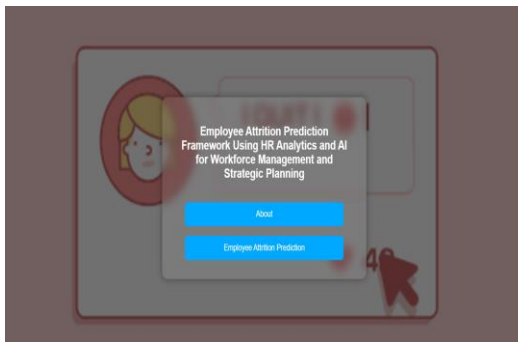


Fig 2: Employee Dataset Analysis

The system successfully analyzes employee data and predicts attrition risk.

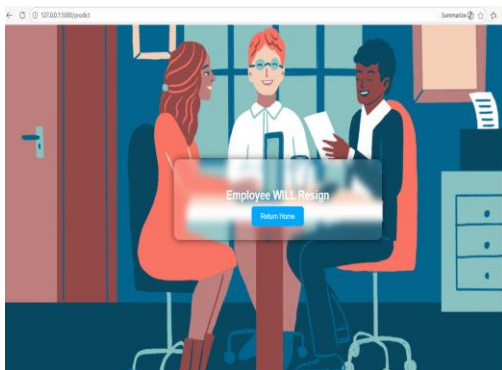


Fig 3: Employee Will Resign Output

When employee parameters indicate high risk, the system displays “Employee Will Resign.”

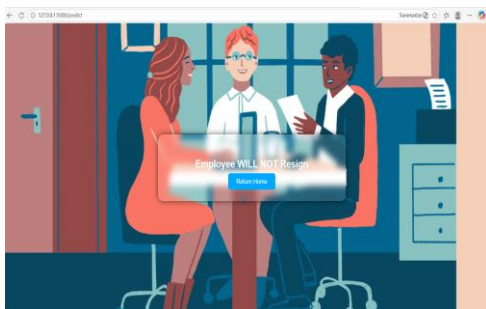


Fig 4: Employee Will Not Resign Output: For stable employee profiles,

the system displays “Employee Will Not Resign.” The results show that Random Forest and Logistic Regression provide high accuracy and reliable predictions.

CONCLUSION

Employee Attrition Prediction using HR Analytics provides an effective solution for predicting employee turnover. The system uses supervised machine learning techniques to deliver accurate and reliable results. It helps organizations reduce attrition, improve workforce planning, and enhance employee satisfaction. This project demonstrates the importance of data-driven decision-making in modern HR management.

FUTURE SCOPE

Future enhancements include integrating deep learning models, employee sentiment analysis, real-time dashboards, and cloud-based deployment. The system can also be extended with AI-driven recommendation engines to suggest retention strategies.

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