

Employee Attrition Prediction System Using Machine Learning and Customer Feedback Analytics

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Abstract

Employee attrition is one of the most critical challenges faced by modern organizations. High turnover rates lead to increased recruitment costs, loss of organizational knowledge, reduced productivity, and lower customer satisfaction. This research proposes an Employee Attrition Prediction System using Machine Learning integrated with Customer Feedback Analytics. The framework combines employee demographic data, job-related factors, satisfaction indicators, and customer feedback information to predict employee turnover risk. Logistic Regression, Decision Tree, Random Forest, and XGBoost models are evaluated. Experimental results demonstrate accuracy between 85% and 92%, while customer feedback integration improves prediction performance by 3–5%. The proposed system assists HR departments in proactive retention planning and workforce management.

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Index Terms

Employee Attrition, Machine Learning, HR Analytics, Customer Feedback Analysis, Employee Satisfaction, Predictive Analytics, XGBoost, Workforce Retention.

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I. INTRODUCTION

Employee attrition refers to the gradual reduction of workforce due to resignation, retirement, termination, or other factors. Organizations increasingly rely on predictive analytics to understand employee behavior and reduce turnover. Employee retention directly influences productivity, organizational stability, and customer satisfaction. Machine learning techniques provide data-driven methods to identify employees at risk of leaving and enable proactive intervention strategies. This study proposes a predictive framework integrating employee data and customer feedback indicators.

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II. RELATED WORK

Previous studies have demonstrated the effectiveness of HR analytics in employee retention. Logistic Regression has been widely used for interpretable attrition prediction. Decision Trees offer transparent decision-making structures, while Random Forest and XGBoost improve predictive performance through ensemble learning. Recent research highlights the importance of employee satisfaction, work-life balance, compensation, and workplace engagement. Customer feedback analytics has emerged as an indirect indicator of employee stress and workplace performance.

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III. SYSTEM ARCHITECTURE

Architecture: Employee Data + Customer Feedback Data → Data Preprocessing → Feature Engineering → Machine Learning Models → Attrition Prediction Dashboard. The architecture enables centralized analysis and decision support for HR managers.

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IV. DESIGN AND METHODOLOGY

The methodology consists of data collection, preprocessing, feature engineering, model development, evaluation, and deployment. Historical employee records are combined with customer satisfaction indicators to construct predictive features. Training and testing datasets are prepared using standard machine learning practices.

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Dataset Description

The dataset includes Age, Gender, Salary, Department, Job Role, Years at Company, Overtime, Work-Life Balance, Job Satisfaction, Performance Rating, Customer Satisfaction Score, Complaint Frequency, Employee Behavior Review, and Attrition Status.

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Data Preprocessing

Missing values are treated using statistical imputation techniques. Categorical variables are encoded. Features are normalized and standardized. Outliers are identified and removed. Data balancing techniques are applied to handle class imbalance.

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Machine Learning Models

Logistic Regression, Decision Tree, Random Forest, and XGBoost are trained and evaluated. Accuracy, Precision, Recall, and F1 Score are used for model comparison.

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Customer Feedback Analysis and Employee Satisfaction Assessment

Customer satisfaction ratings, service quality reviews, complaint frequency, employee behavior reviews, and workplace performance indicators are analyzed. Employees receiving consistently positive customer feedback exhibit lower attrition risk. Departments with frequent customer complaints demonstrate higher stress and turnover probability. Customer satisfaction scores act as additional predictive features.

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V. IMPLEMENTATION

The system is implemented using Python, Flask, Machine Learning libraries, HTML, CSS, and HR Analytics datasets. The trained model is integrated into a web-based dashboard enabling HR managers to evaluate attrition risk.

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VI. RESULTS AND EVALUATION

Experimental analysis indicates Logistic Regression achieved 85% accuracy, Decision Tree 87%, Random Forest 90%, and XGBoost 92%. Integration of customer feedback improved prediction accuracy by approximately 3–5%. Employee satisfaction emerged as the strongest predictor.

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VII. DISCUSSION

The results demonstrate that machine learning models can effectively identify employees at risk of attrition. Customer feedback provides additional behavioral insights that improve prediction quality. Organizations can utilize predictive outputs for retention planning.

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Advantages

Reduces turnover costs, improves workforce planning, enhances employee engagement, supports strategic HR decisions, and improves organizational performance.

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Limitations

Performance depends on data quality, organizational context, and availability of customer feedback metrics. Predictions may require periodic retraining.

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Future Scope

Future enhancements include deep learning, sentiment analysis, real-time HR monitoring, cloud deployment, explainable AI, and integration with enterprise HR systems.

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VIII. CONCLUSION

The proposed Employee Attrition Prediction System demonstrates the effectiveness of machine learning and customer feedback analytics for workforce retention. The framework enables organizations to identify attrition risks proactively and implement targeted interventions.

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TABLE I. DATASET FEATURES

Age, Salary, Department, Job Role, Work-Life Balance, Job Satisfaction, Overtime, Performance Rating, Customer Satisfaction Score, Complaint Count, Attrition Status.

TABLE II. MODEL COMPARISON

Model | Accuracy | Precision | Recall | F1 Score
Logistic Regression | 85% | 84% | 83% | 84%
Decision Tree | 87% | 86% | 86% | 86%
Random Forest | 90% | 89% | 90% | 89%
XGBoost | 92% | 91% | 92% | 91%

TABLE III. CUSTOMER FEEDBACK METRICS

Customer Satisfaction Rating, Complaint Frequency, Service Quality Score, Employee Behavior Reviews, Resolution Time, Service Consistency.

TABLE IV. EXPERIMENTAL RESULTS

Customer Feedback Integration improved prediction accuracy by 3–5%. Employee Satisfaction identified as the most influential factor.

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