



Employee Attrition Prediction System

A Project Report for Inhouse Training 2026 (Cluster 3, Batch 7)

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INTRODUCTION

Employee attrition refers to the gradual reduction of employees in an organization due to resignation, retirement, or other reasons.

Organizations face major challenges due to attrition:

- Increased hiring and training costs
- Productivity loss
- Disruption in team performance
- Loss of experienced employees

This project applies Machine Learning in HR Analytics to predict whether an employee is likely to leave the organization in advance.

The system helps HR teams make proactive and data-driven decisions.

PROBLEM STATEMENT

Many organizations struggle with:

- High employee turnover
- No early warning system
- Manual HR analysis methods
- Inability to identify key attrition factors

Traditional HR decisions are often based on assumptions rather than data.

Proposed Solution:

- Develop a Machine Learning-based prediction system that:
- Predicts attrition risk
- Identifies key contributing factors
- Provides real-time results

OBJECTIVES OF THE PROJECT

The main objectives of this project are:

- To build a Machine Learning model that predicts employee attrition
- To analyze important factors affecting employee turnover
- To develop a user-friendly React-based frontend
- To build a FastAPI backend for model serving
- To integrate frontend and backend using REST APIs
- To display prediction results along with top contributing reasons

DATASET DESCRIPTION

Feature Categories:

1. Demographic Features

- Age
- Gender
- Marital Status
- Education

2. Job Information

- Job Role
- Department
- Job Level
- Years at Company

3. Compensation

- Monthly Income
- Salary Hike
- Percentage

4. Work Environment

- Job Satisfaction
- Work-Life Balance
- Environment Satisfaction

5. Performance

- Performance Rating
- Training Times Last Year

6. Work Behavior

- Overtime
- Distance from Home

Target Variable: Attrition
(Yes/No)

3.

SYSTEM ARCHITECTURE

The system follows a Client-Server Architecture:

1. Frontend (React.js)

- Provides user interface
- Collects employee details
- Sends API request

2. Backend (FastAPI)

- Receives input data
- Loads trained model
- Processes prediction

3. Machine Learning Model

- Random Forest Classifier
- Generates prediction
- Calculates feature importance

Workflow:

User → React → FastAPI → ML Model → Prediction → React UI

METHODOLOGY

Step 1: Data Preprocessing

- Handling missing values
- Encoding categorical variables
- Feature selection
- Data normalization
- Train-Test split

Step 2: Model Training

Algorithms tested:

- Logistic Regression
- Random Forest

Final Model Selected: Random Forest

Reasons:

- Higher accuracy
- Handles nonlinear data
- Provides feature importance

Model files saved as:

- attrition_model.pkl
- columns.pkl

TECHNOLOGIES USED

Component Technology Used

Frontend

React.js

Backend

Fast API

Machine Learning

Scikit-learn

Programming Language

Python

Model Storage

Joblib

API Testing

Fast API Docs

The system is modular,
scalable, and lightweight.

Results:

- Real-time prediction
- Accurate attrition risk detection
- Consistent output
- Top factors identified (e.g., Overtime, Salary, Job Satisfaction)

Observations:

Employees with:

- High overtime
- Low job satisfaction
- Low salary
- Fewer years at company

are more likely to leave.

Advantages of the System

The Employee Attrition Prediction System helps organizations detect potential employee turnover at an early stage, allowing timely preventive actions. It promotes data-driven HR decisions by analyzing employee information using machine learning techniques. The system features a user-friendly interface that enables HR professionals to generate predictions easily. Additionally, its scalable architecture (React, FastAPI, and ML model) allows future integration with company databases, cloud deployment, and advanced analytics dashboards.

CONCLUSION & FUTURE SCOPE

Conclusion:

The Employee Attrition Prediction System successfully demonstrates:

- Application of Machine Learning in HR Analytics
- Full-stack integration (React + FastAPI + ML)
- Real-time prediction with explanation

It helps HR teams make informed decisions and reduce employee turnover.

Future Scope:

- Integration with real HR databases
- Cloud deployment (AWS/Azure)
- Dashboard with advanced visualization
- Continuous model retraining
- Authentication and security features

THANK YOU