G.H. RAISONI COLLEGE OF ENGINEERING AND MANAGEMENT, WAGHOLI, PUNE

DepartmentofCSE (AI&AIML)

Employee Attrition Prediction System using ML

Guide:

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Contents

- Introduction
- Justifications for Selecting the title
- Problem Statement
- Objective
- Scope
- Literature Review
- System Architecture
- Methodology
- Tools Used
- Plan of Work
- References

Introduction

- Employee attrition refers to employees leaving an organization over time
- Can occur due to resignation, retirement, or job dissatisfaction
- High employee attrition increases recruitment and training costs
- Loss of skilled and experienced employees affects productivity
- Employee attrition impacts organizational growth and stability
- Attrition occurs due to multiple factors like job satisfaction, salary, workload, and work-life balance
- Organizations face difficulty in identifying employees who may leave early
- Traditional HR methods are reactive and inefficient

Justifications for Selecting the

- Employee attrition is a major challenge faced by organizations across industries
- High attrition leads to increased recruitment and training costs
- Loss of skilled employees affects productivity and organizational growth
- Employee attrition depends on multiple factors and is difficult to predict manually
- Machine learning helps analyze large HR datasets efficiently
- Data-driven prediction can help organizations take early preventive actions
- The topic is relevant to real-world HR analytics applications
- The project aligns with current trends in artificial intelligence and machine learning

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Problem Statement

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1. Employee attrition is a serious challenge for modern organizations ■
2. Employees often leave jobs unexpectedly ❌ without prior notice
3. Reasons include:
   - Job dissatisfaction ●
   - Work pressure and stress ⚠
   - Lack of career growth ●
4. Sudden attrition causes:
   - Financial loss ●
   - Increased hiring and training costs ●
   - Reduced productivity ●
5. HR teams cannot easily identify high-risk employees in advance ❓
6. There is a need for an intelligent, data-driven solution 🤖
7. This project uses Machine Learning ● to predict employee attrition early ⏳
8. Helps organizations take preventive actions and improve retention 🤝

Objective

- To study the concept of employee attrition in organizations
- To understand the causes and impact of employee attrition
- To analyze HR employee data related to attrition
- To identify important factors influencing employee attrition
- To explore the use of machine learning techniques for attrition prediction
- To design a proposed system for employee attrition prediction
- To compare different machine learning approaches conceptually
- To support data-driven decision making in HR management
- To help organizations reduce employee turnover through early prediction

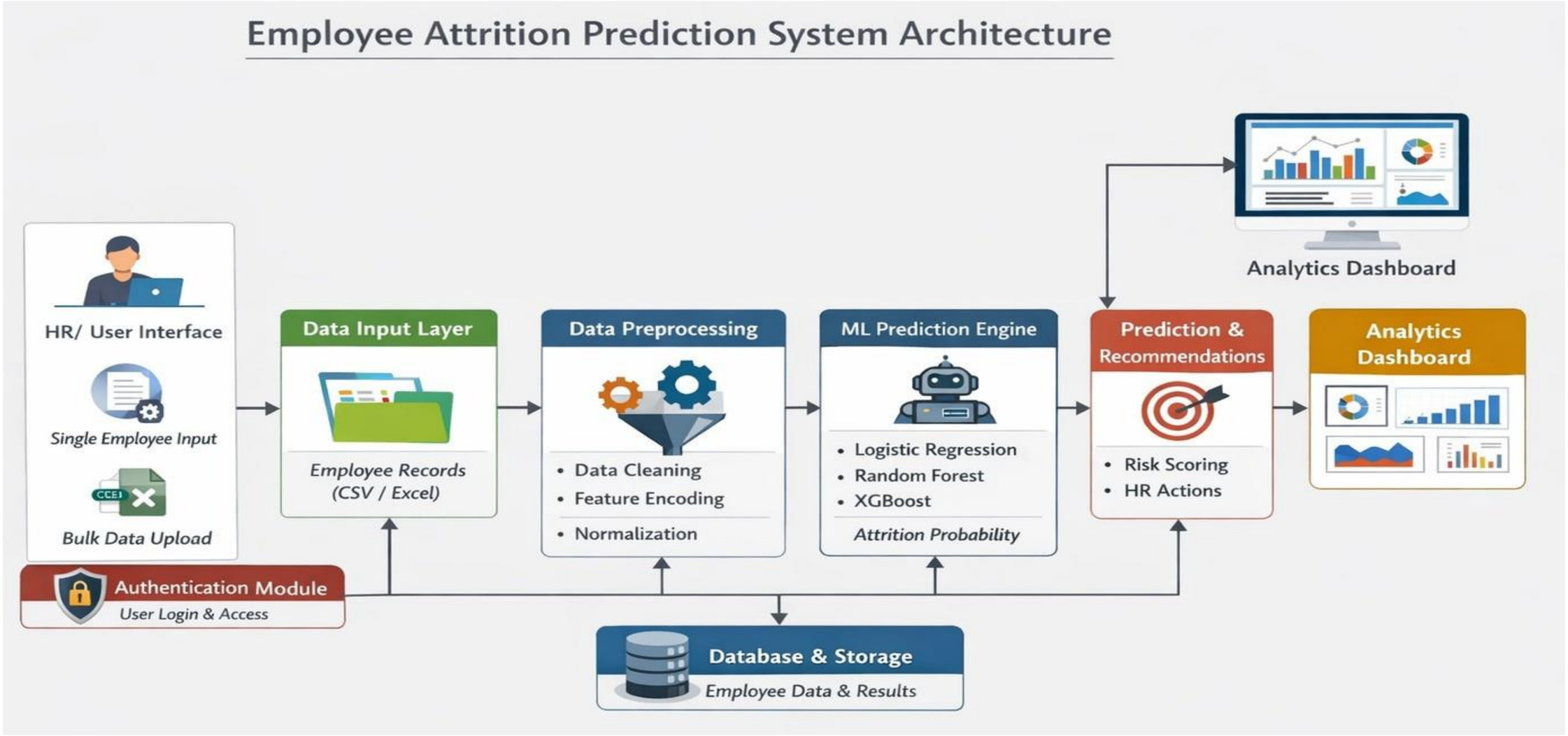
Scope

- The project focuses on analyzing employee attrition using HR data
- It considers multiple factors such as job satisfaction, salary, experience, and workload
- The scope is limited to structured HR datasets
- The proposed system aims to predict employee attrition as Yes or No
- The project is applicable to organizations of different sizes
- The system supports HR decision-making for employee retention
- The scope is limited to prediction and analysis, not policy implementation

Literature Review

Sr. No.	Paper Title and Year	Details of Publication	Findings
1	From Big Data to Deep Data to Support People Analytics for Employee Attrition Prediction (2021)	IEEE Access, Volume 9, Pages 67345–67358 Authors: Yahia, N. B., Hlel, J., & Colomo-Palacios, R.	The paper focuses on people analytics and data quality for predicting employee attrition. It highlights the importance of meaningful HR data but does not present a complete end-to-end prediction system.
2	Employee Attrition Prediction Using Machine Learning Techniques (2021)	Proceedings of the International Conference on Intelligent Computing and Control Systems (ICICCS), Pages 112–118 Authors: Mishra, S., Patnaik, S., & Panda, S.	The study applies machine learning algorithms such as Logistic Regression and Random Forest to predict employee attrition and shows improved prediction accuracy.
3	Predicting Employee Turnover Using Data Mining Techniques (2020)	Procedia Computer Science, Volume 167, Pages 210–219 Authors: Kumar, A., Jain, R., & Kaur, P.	The research analyzes HR factors influencing employee attrition using Decision Tree and Naïve Bayes classifiers and identifies job satisfaction as a key factor.
4	Employee Attrition Prediction Using Support Vector Machine and KNN (2019)	Journal of Intelligent Systems, Volume 28(4), Pages 589–602 Authors: Zhang, Y., Li, X., & Wang, H.	The paper uses SVM and KNN models to predict employee turnover and reports improved classification performance with higher computational cost.
5	A Survey on Employee Attrition Prediction Using Machine Learning (2022)	International Journal of Computer Applications, Volume 174(21), Pages 12–18 Authors: Patel, R., Shah, D., & Mehta, K.	This survey reviews multiple machine learning approaches for employee attrition prediction and highlights the need for accurate and scalable predictive systems.

System Architecture



Methodology

1. Data Collection

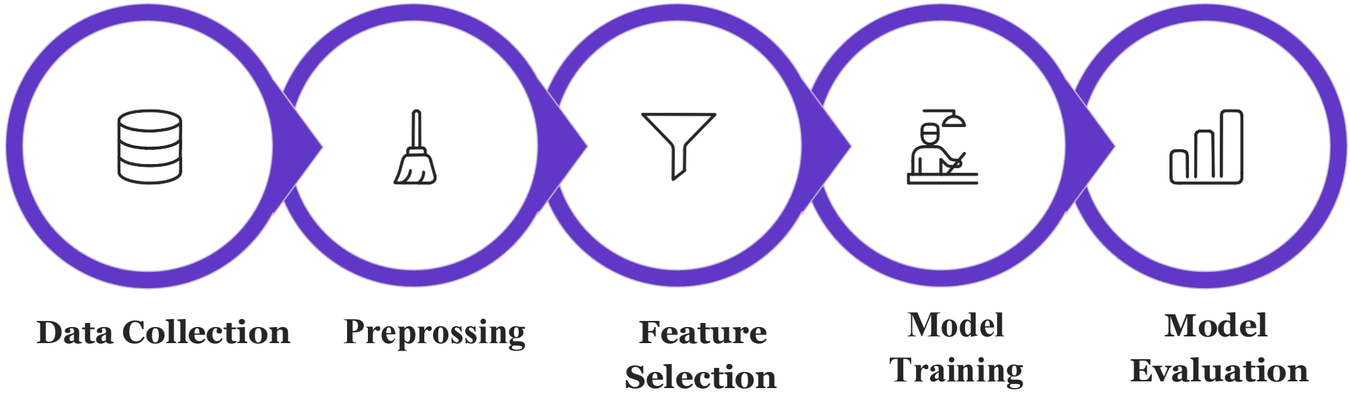
•HR employee data is collected from a reliable dataset
•Data includes personal, job, and performance-related attributes

2. Data Preprocessing

•Missing and inconsistent data is handled
•Categorical data is converted into numerical format

3. Feature Selection

•Important features influencing employee attrition are identified
•Irrelevant or redundant features are removed



4. Model Training

•Machine learning algorithms are applied to train the model
•The model learns patterns related to employee attrition

5. Model Evaluation

•Model performance is evaluated using appropriate metrics
•Results are analyzed to support attrition prediction

Technology & Tools

Frontend (User Interface) 🌐

- HTML, CSS, JavaScript
- Responsive forms for single employee input
- and bulk CSV/Excel upload
- Interactive charts for analytics dashboard

Backend (Server & Application Logic) ⚙

- Python
- Handles data processing, ML model integration, and API requests
- Session management & user authentication

Machine Learning & Data Science 🤖

- Scikit-learn: Logistic Regression, Random Forest
- Risk score and probability-based prediction

Database & Storage 🗄

- SQLite for employee data storage
- Stores uploaded files, prediction
- results, and HR actions

Visualization & Analytics 📊

- Matplotlib, Seaborn, Plotly
- Charts, dashboards.
- Department-wise and role-wise
- attrition insights

Tools & Environment 🧰

- VS Code for application
- development
- GitHub / Git for version control

Plan Of Work

Months Activities	January'26	February'26	March'26	April'26
Literature Reviews	✓			
Requirement Analysis	✓			
Designing	✓			
Experimental Analysis	✓			
Module wise Implementation				
Testing and Debugging				
Preparation of Project Report				

Referances

[1]. Yahia, N. B., Hlel, J., & Colomo-Palacios, R. (2021). From Big Data to Deep Data to Support People Analytics for Employee Attrition Prediction. IEEE Access, 9, 67345–67358.

[2]. Mishra, S., Patnaik, S., & Panda, S. (2021). Employee Attrition Prediction Using Machine Learning Techniques. Proceedings of IEEE International Conference on Intelligent Computing and Control Systems.

[3]. Kumar, A., Jain, R., & Kaur, P. (2020). Predicting Employee Turnover Using Data Mining Techniques. Procedia Computer Science, Elsevier.

[4]. Zhang, Y., Li, X., & Wang, H. (2019). Employee Attrition Prediction Using Support Vector Machine and KNN. Springer Journal of Intelligent Systems.

[5]. Patel, R., Shah, D., & Mehta, K. (2022). A Survey on Employee Attrition Prediction Using Machine Learning. International Journal of Computer Applications.

Thank you !