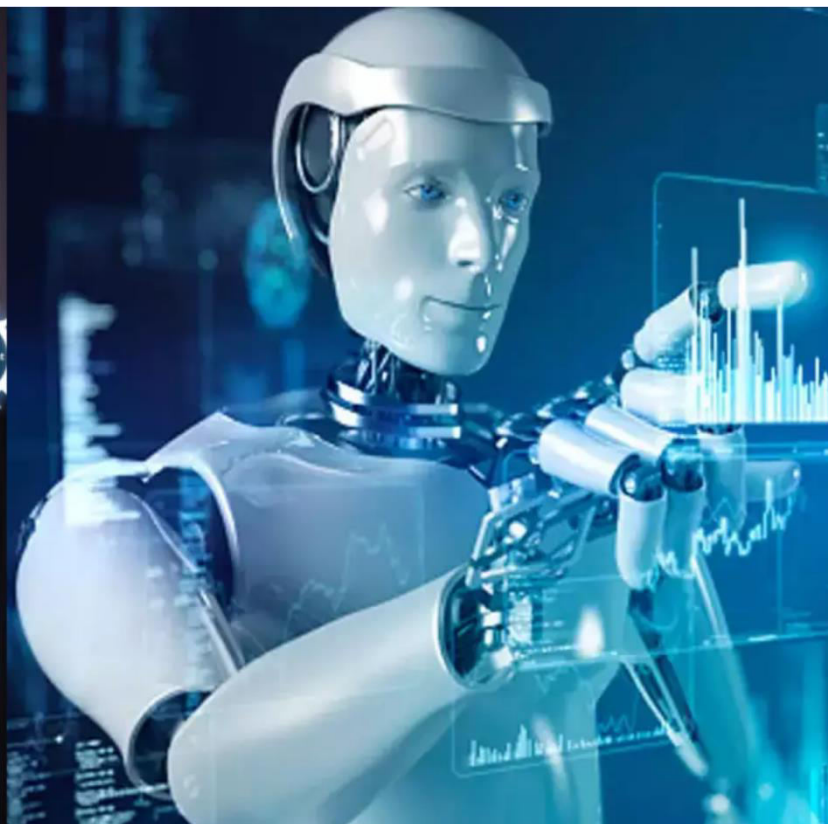




International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 15, Issue 3, March 2026

HREYE: An Automated Employee Attrition and Layoff Prediction System

Dr. S. Raghu¹, D. Shyam Sundara Chary², R. Abhinav Sreenivas³, K. Bhavya Sri⁴

Assistant Professor, Department of CSE, ACE Engineering College, Hyderabad, Telangana, India¹

IV B.Tech. Students, Department of CSE, ACE Engineering College, Hyderabad, Telangana, India^{2,3,4}

ABSTRACT: HrEye is an AI-driven automated system designed to predict employee attrition and layoff probability using Machine Learning and data analytics techniques. In contemporary organizations, managing employee turnover is a critical challenge that significantly impacts recruitment costs, productivity, and business continuity. The proposed HrEye system analyzes key employee parameters such as job role, experience, salary, department, and performance ratings using supervised learning algorithms including Logistic Regression, Random Forest, and XGBoost. The system employs Explainable AI (XAI) techniques to provide transparent, interpretable reasoning for each prediction, enabling HR professionals to make fair and data-driven decisions. HrEye features interactive dashboards for visualizing attrition trends, automated report generation for HR documentation, and seamless integration with existing HR databases.

KEYWORDS: Employee Attrition, Layoff Prediction, Machine Learning, Random Forest, XGBoost, Explainable AI, HR Analytics, Workforce Management

I. INTRODUCTION

Employee retention has become one of the most critical challenges faced by modern organizations. High attrition rates not only increase recruitment and training costs but also affect productivity, morale, and business continuity. Many companies still rely on manual evaluations or historical data to anticipate employee turnover, often reacting too late to prevent it.

HREYE is an AI-driven HR analytics system designed to forecast employee attrition and potential layoffs using predictive modeling and data analysis. The system collects and processes historical employee data to detect hidden patterns that influence an employee's likelihood of leaving or being considered for workforce separation. The model leverages supervised learning algorithms such as Logistic Regression, Random Forest, and XGBoost for accurate prediction. Additionally, Explainable AI (XAI) techniques are applied to make results interpretable, allowing HR professionals to understand why a particular prediction was made.

The system provides:

- Attrition prediction for proactive employee retention.
- Layoff analysis based on performance, contribution, and role redundancy.
- Interactive dashboards for HR visualization and reporting.
- Automated insights for policy decisions and workforce optimization.

II. LITERATURE SURVEY

Employee attrition has long been a focus area in human resource management research. Organizations worldwide are investing in predictive models that analyze workforce data and forecast potential turnover or layoffs.

With the advent of big data analytics and AI, researchers have proposed numerous algorithms to predict attrition rates and employee behavior.

2.1 Related Work

S.No.	Author / Year	Title	Methods	Outcome
1	Khan et al. (2024)	Employee Attrition Prediction Using Machine Learning	Random Forest, Logistic Regression	87% accuracy; performance and salary were key indicators.
2	Bajaj et al. (2025)	Designing a HR Analytics System for Predictive Workforce Planning	Decision Tree, Naive Bayes	Built a predictive workforce planning system using HR analytics.
3	Muzanenhamo & Rankhumise (2021)	Effect of AI on Employee Retention in State-Owned Enterprises	XGBoost, SVM	AI significantly improved employee retention in SOEs.
4	Sukhadiya et al. (2025)	Employee Attrition Prediction Using Data Mining Techniques	KNN, Logistic Regression	Highlighted demographic and behavioral features for predictions.
5	Burange et al. (2023)	Layoff Prediction Using Machine Learning Technique	Random Forest, Gradient Boosting	Identified layoff-risk employees based on productivity metrics.

2.2 Summary of Findings

From the literature reviewed, recent studies (2025) show that machine learning algorithms such as Random Forest, XGBoost, Logistic Regression, and SHAP-based Explainable AI have been successfully applied to predict employee attrition and layoff risk with high accuracy. Key factors include salary, performance ratings, job satisfaction, and experience. However, most systems lack a combined attrition and layoff prediction mechanism with interpretability. HrEye bridges this gap by offering dual prediction with Explainable AI and user-friendly visualization dashboards.

III. METHODOLOGY

The proposed HrEye system's methodology is centered on automated prediction of employee attrition and layoff risk through a structured pipeline of data collection, preprocessing, machine learning analysis, and visualization. The activity diagram (Fig. 1) illustrates the complete step-by-step flow of the system.

3.1 Data Collection and Preprocessing

The system begins with the acquisition of employee data from HR databases or uploaded CSV/Excel files. Collected parameters include job role, department, salary, experience, age, and performance ratings. The raw data undergoes preprocessing including handling of missing or inconsistent entries, encoding of categorical variables, and normalization of numeric features. If missing values are detected, the system either imputes or removes those rows before proceeding.

3.2 Feature Engineering and Model Training

After preprocessing, feature engineering is applied to derive meaningful attributes. Multiple supervised learning algorithms are trained and evaluated — Logistic Regression as a baseline, Random Forest for ensemble-based classification, and XGBoost for gradient-boosted decision trees. Model performance is evaluated using accuracy, precision, recall, and F1-score metrics.

3.3 Explainable AI Integration

SHAP (SHapley Additive exPlanations) values are computed to quantify feature contributions to each individual prediction. This allows HR managers to understand which factors such as salary, performance rating, or tenure contributed most to a specific attrition or layoff risk score.

3.4 Prediction, Storage and Output

The trained model accepts preprocessed employee records and outputs attrition probability scores and layoff risk classifications. Predictions are stored in the database. Results are then visualized on the interactive dashboard, and automated PDF and Excel reports are generated for HR documentation.

HrEye - Activity Diagram

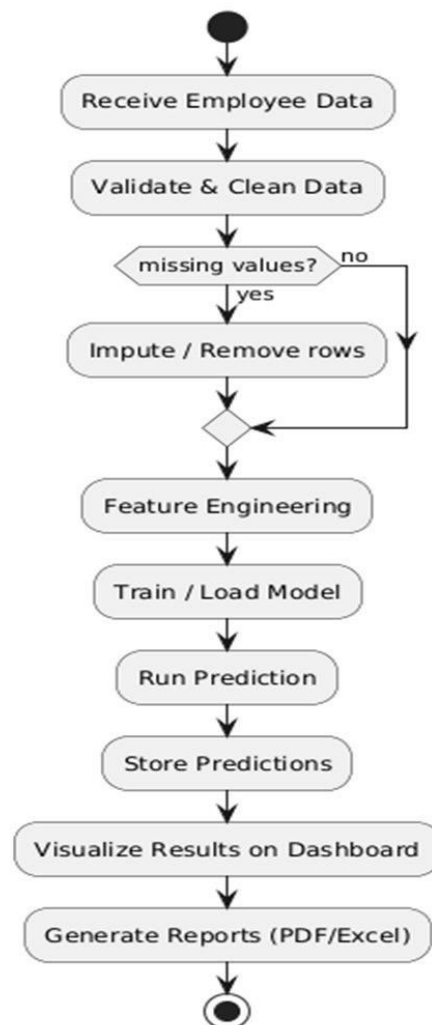


Fig. 1: HrEye Activity Diagram

IV. SYSTEM ARCHITECTURE

The HrEye architecture is designed as a modular pipeline that integrates data ingestion, machine learning analysis, and visualization functions. The HR Manager provides employee information through the user interface. The data flows into the processing layer for cleaning and transformation, then to the prediction layer, and finally the output is visualized in the dashboard for data-driven decision making.

The system consists of five layers: (1) User Interface Layer — Dashboard and Report Generator accessed by the HR Manager; (2) Visualization Layer — Visualization Engine for charts and analytics; (3) Prediction Layer — Prediction

Engine with Explainable AI module; (4) Processing Layer — Data Preprocessing and Feature Engineering; and (5) Data Layer — Employee Database and Data Warehouse.

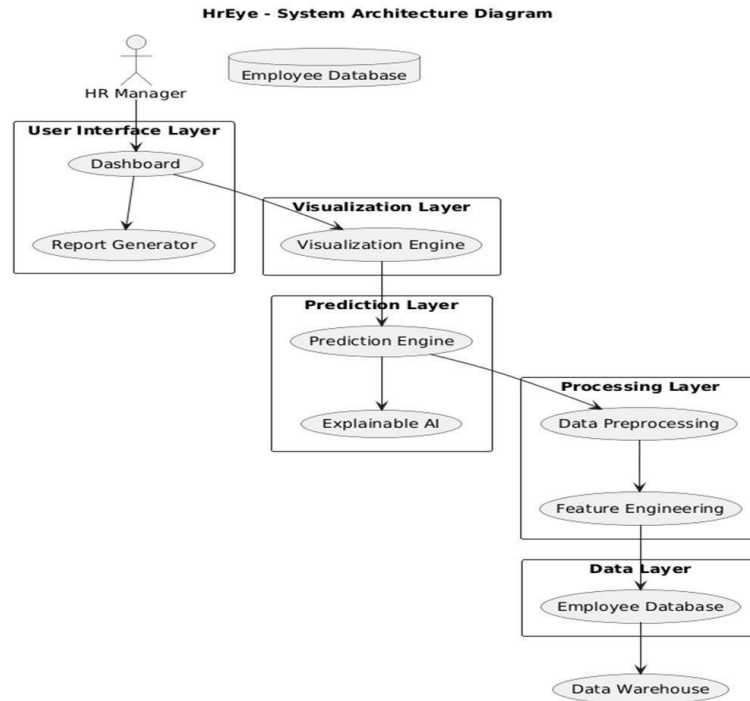


Fig. 2: HrEye System Architecture Diagram

V. SYSTEM OUTPUTS

The HrEye system provides a clean, user-friendly web interface that enables HR managers to upload employee datasets, run attrition analysis, and receive instant risk predictions. The following screens illustrate the complete workflow from data upload through prediction results and analytics.

5.1 Upload Interface

The main landing page allows HR managers to upload employee data in Excel (.xlsx) or CSV format via a drag-and-drop interface. A sample CSV download option is provided for reference.

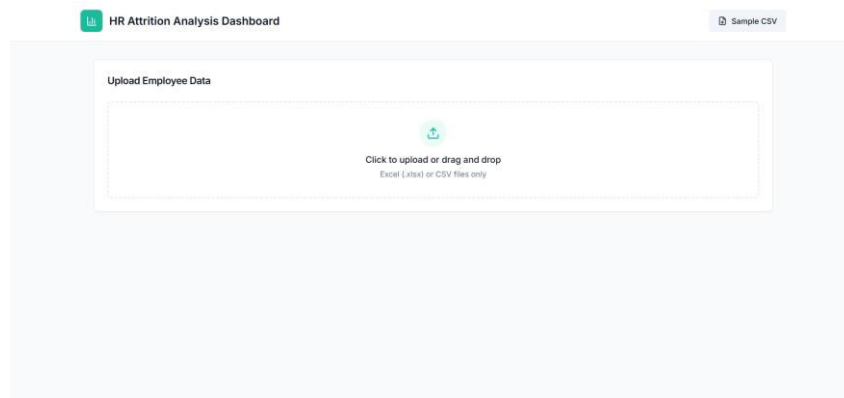


Fig. 3: HR Attrition Analysis Dashboard — Upload Interface

5.2 Data Preview

After uploading, the system displays a preview of the first 5 rows of the imported dataset showing all key employee attributes: EMP ID, Age, Gender, Department, Job Level, Income, Overtime, and Years of service. The system confirms the total number of employees ready for analysis.

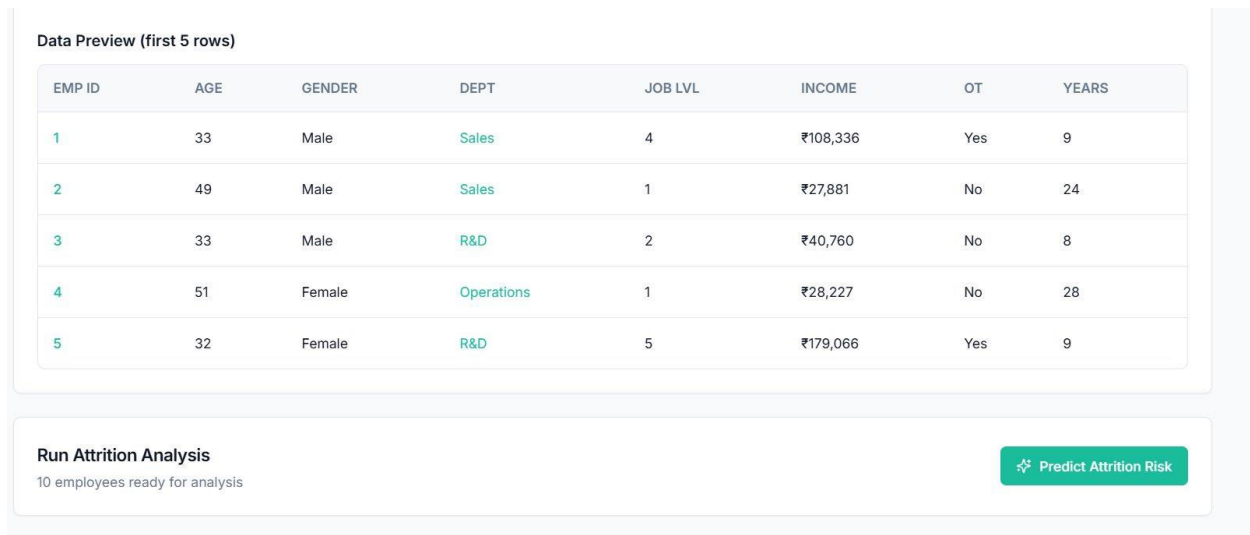


Fig. 4: Data Preview — First 5 Rows of Employee Dataset

5.3 Analytics Dashboard

The analytics dashboard presents a comprehensive overview of the attrition risk landscape across the organization. It displays summary cards for Low Risk (4 employees), Medium Risk (2 employees), and High Risk (4 employees), along with the overall average risk score of 47.4. A donut chart visualizes the risk distribution, and horizontal bar charts rank departments by average risk score — Sales (70.0) and HR (60.0) showing the highest risk.

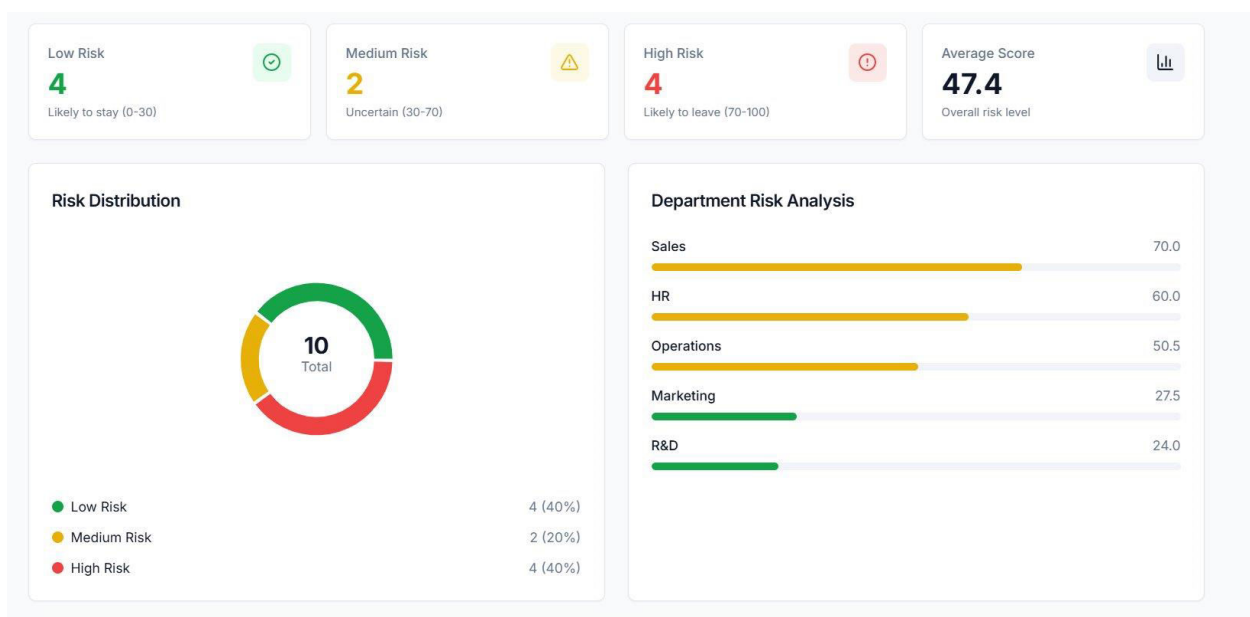


Fig. 5: Risk Distribution Dashboard and Department Risk Analysis

5.4 Top 10 Highest Risk Employees

The ranked table lists the top 10 employees by attrition risk score, with category labels (High Risk, Uncertain, Likely to Stay) color-coded for quick identification. Employees ID 2 and ID 4 both score 99 (High Risk) and are flagged for immediate HR intervention.

RANK	EMP ID	DEPARTMENT	RISK SCORE	CATEGORY
#1	2	Sales	99	High Risk
#2	4	Operations	99	High Risk
#3	10	Sales	83	High Risk
#4	8	HR	60	High Risk
#5	5	R&D	38	Uncertain
#6	9	Marketing	33	Uncertain
#7	1	Sales	28	Likely to Stay
#8	7	Marketing	22	Likely to Stay
#9	3	R&D	10	Likely to Stay
#10	6	Operations	2	Likely to Stay

Fig. 6: Top 10 Highest Risk Employees Table

5.5 Individual Employee Risk Factor Analysis

Expanding any employee row reveals a detailed Risk Factor Analysis card. For each prediction, the system breaks down contributing factors — Work-Life Balance, Tenure, Overtime, Distance, Environment Satisfaction, and Promotion Gap — with impact scores and natural-language explanations. An AI Insights button triggers the recommendation engine, which generates actionable HR interventions such as scheduling a 1-on-1, reviewing compensation, and exploring growth opportunities.

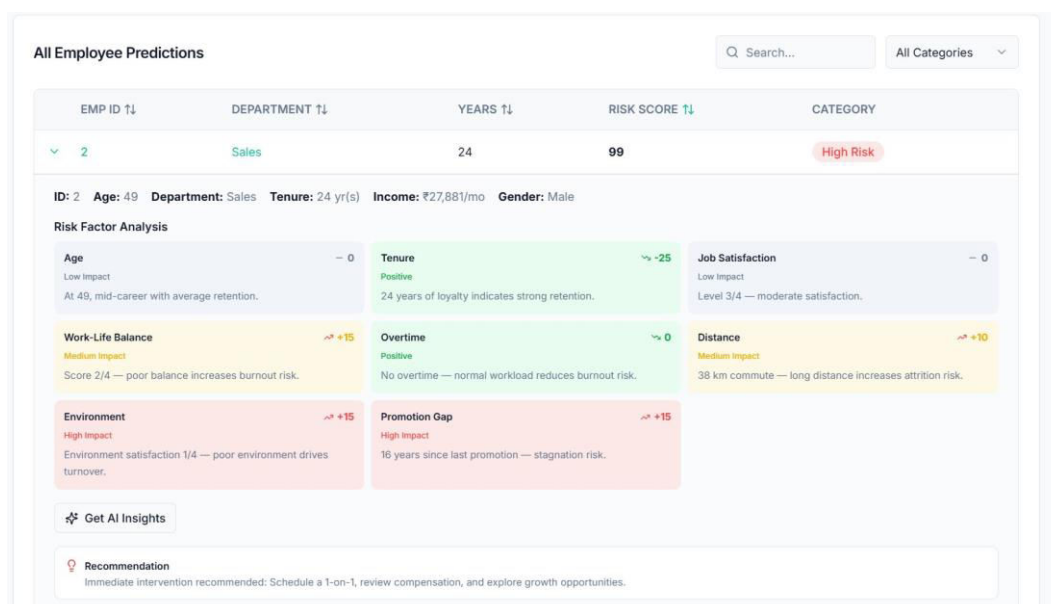


Fig. 7: Individual Employee Prediction with Risk Factor Analysis and AI Recommendation

VI. CONCLUSION

In this work, an automated system named HrEye was designed and implemented to predict employee attrition and layoff risk using Machine Learning and Explainable AI techniques. Traditional HR systems focus mainly on data storage and reporting rather than predictive analytics, leading to reactive rather than proactive workforce management.

The proposed HrEye system addresses these limitations by providing a dual prediction mechanism covering both attrition prediction and layoff risk assessment, combined with interpretable, evidence-based reasoning for each decision. By leveraging ensemble models such as Random Forest and XGBoost along with SHAP-based explanations, the system enables HR professionals to make fair, transparent, and data-driven decisions. The interactive dashboards and automated report generation capabilities further enhance its utility as a practical HR analytics tool.

VII. FUTURE SCOPE

While HrEye has successfully automated attrition and layoff prediction, several enhancements can be made to extend its capabilities. Incorporating real-time sentiment analysis of employee communications could provide additional early-warning signals. Extending the system with a natural language chatbot interface would make insights accessible to non-technical HR users. Integration with platforms such as Jira and Slack would enable real-time workload monitoring. Predictive hiring analytics and scalable cloud deployment on AWS/Azure would further extend HrEye into a comprehensive, end-to-end workforce intelligence platform.

REFERENCES

- [1] M. S. Khan, M. Kumar, K. Das, M. M. Das, and S. Chakraborty, "Employee Attrition Prediction Using Machine Learning," International Advanced Research Journal in Science, Engineering and Technology (IARJSET), vol. 12, no. 6, June 2025. Link:- <https://iarjset.com/wp-content/uploads/2025/06/IARJSET.2025.12642.pdf>
- [2] A. Bajaj, N. Kalluri, C. S. Pavan Kumar, M. Garg, D. Bhatt, and N. Gupta, "Designing a Human Resource Analytics System for Predictive Workforce Planning," Journal of Information Systems Engineering and Management, vol. 10, no. 21s, 2025. Link:
https://www.researchgate.net/publication/390045171_Designing_a_Human_Resource_Analytics_System_for_Predictive_Workforce_Planning/fulltext/67dd08bc3ad6d174c4a3b6c4/Designing-a-Human-Resource-Analytics-System-for-Predictive-Workforce-Planning.pdf
- [3] A. Muzanenhamo and E. Rankhumise, "The Effect of Artificial Intelligence on Employee Retention in State-Owned Enterprises," 2025. Link:-
https://www.researchgate.net/publication/400344837_The_Effect_of_Artificial_Intelligence_on_Employee_Retention_in_State-Owned_Enterprises
- [4] J. Sukhadiya, H. Kapadia, and M. D'silva, "Employee Attrition Prediction Using Data Mining Techniques," International Journal of Management, Technology and Engineering, 2025 Link:-
<https://ijamtes.org/gallery/369%20oct%20ijamte%20-%201127.pdf>
- [5] M. S. Burange, A. R. Raut, H. A. Lahane, P. V. Dabhane, P. G. Bhakre, and J. S. Kandalkar, "Layoff Prediction Using Machine Learning Technique, Challenges, and Future Direction," 2025. Link:- <https://www.ijert.org/papers/IJERT2502841.pdf>
- [6] "Explainable AI in Human Resource Management: Enhancing Transparency in Recruitment Algorithms," 2025. Link:-
https://www.researchgate.net/publication/401531537_Explainable_AI_in_Human_Resource_Management_Enhancing_Transparency_in_Recruitment_Algorithms
- [7] "Predicting Employee Attrition Using Machine Learning Techniques," Computers (MDPI), vol. 9, no. 4, 2020. Link:- <https://www.mdpi.com/2073-431X/9/4/86>
- [8] "A Comparative Study on Machine Learning Algorithms for Employee Attrition Prediction," 2021. Link:-
https://www.researchgate.net/publication/350161743_A_comparative_study_on_machine_learning_algorithms_for_employee_attrition_prediction
- [9] J. Han, M. Kamber, and J. Pei, Data Mining: Concepts and Techniques, 3rd ed. Morgan Kaufmann, 2012.

Link:-<https://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf>

[10] IBM Corporation, "IBM HR Analytics Employee Attrition & Performance Dataset," 2019. [Online].

Link:- <https://www.kaggle.com/datasets/pavansubhasht/ibm-hr-analytics-attrition-dataset>



INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details