



AI-POWERED PREDICTING EMPLOYEE ATTRITION

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Abstract: The employee attrition prediction presented in this study intends to help organizations deal with the problem of retaining talent by creating a machine learning model to forecast employee attrition. Through the examination of variables such as work-life balance, job role, pay, and performance reviews, the model will predict the probability of employee turnover. The intention is to give companies the information they need to take preventative measures to lower employee attrition and raise satisfaction levels. Preprocessing, feature selection, and a variety of machine learning techniques, including logistic regression, decision trees, and random forests, are all part of the solution, which uses an attrition data dataset. As a result, businesses will have a predictive tool to help them find employees who are at risk and put retention plans in place.

Key components: Employee Attrition, Machine Learning, Predictive Modelling.

I. INTRODUCTION

For many businesses, employee attrition the phenomenon of individuals leaving their jobs is a serious issue that affects productivity, morale, and operational costs. Loss of expertise can result from high turnover rates, team disruption, and additional financial challenges because hiring and training are ongoing needs. This study attempts to address the problem of identifying which workers are most likely to quit a company by utilizing artificial intelligence and machine learning. The purpose is to find trends that assist companies in identifying at risk workers before they decide to quit by examining important aspects including job satisfaction, pay, performance, work-life balance, and corporate culture. Using a data-driven approach, the project creates a prediction model with the ability to anticipates employee turnover. The system will find trends and connections between different causes and employee turnover by gathering and evaluating employee data. To ascertain the probability that an employee will remain or leave, Random forests, logistic regression, and decision trees are some of the machine learning algorithms that will be used to train the model. In order to provide businesses with crucial information about the reasons for employee turnover, the model will concentrate on comprehending how factors like tenure, performance reviews, pay, job position, and work-life balance affect attrition. After the model has been developed, the information provided by the system can offer assist organizations in putting retention plans into action. HR departments will be able to proactively address potential issues by improving work conditions, offering better rewards, or using these insights to create chances for professional progress. By determining which workers are most likely to quit and fostering a more supportive and exciting work environment, Employers may boost worker satisfaction, reduce turnover, and increase overall productivity. A more stable workforce can be achieved and the detrimental effects of high attrition can be avoided with the ability to act quickly.

II. PROPOSED SYSTEM

The proposed Employee Attrition Prediction System seeks to transform the way businesses handle employee turnover by offering proactive, data-driven insights into the reasons behind employee departures. This program makes use of machine learning to advanced data analytics techniques to analyse a range of employee experience parameters, including as job satisfaction, performance, work environment, and personal aspects, in order to determine which employees might be in danger of quitting. The technology can reveal hidden patterns and trends that would be challenging to find manually by processing and analyzing massive amounts of data. A predictive model is the end product, which helps firms retain valued personnel by addressing attrition issues before they grow more serious.

The key features are :

- **Comprehensive Data Collection:** Constantly tracking and gathering pertinent data from a range of employee touchpoints, such as performance indicators, surveys, feedback, and individual elements like engagement and job satisfaction.
- **Predictive analytics:** Using machine learning algorithms to predict employee turnover rates from historical and present data enables proactive steps to retain at-risk employees.
- **Trend and Pattern Identification:** By examining team dynamics, employee behaviour, and other elements, executives can detect important turnover drivers and gain insight into the underlying reasons for attrition.
- **Clear Visualization:** By displaying intricate data and forecasts in an intuitive manner, HR and business executives can

quickly understand the findings and take appropriate action.

- **Proactive Retention Strategies:** In order to reduce attrition, companies should use focused retention tactics include enhancing communication, creating opportunities for career advancement, offering assistance, and cultivating a healthy workplace culture. These strategies can be implemented based on the insights supplied.
- **Scalability and Flexibility:** The system may be tailored to meet the particular requirements and difficulties of various industries and organizational structures, and it is built to manage data from businesses of all sizes.

III. SYSTEM ARCHITECTURE AND DESIGN

Layered and modular architecture is used in the design of the suggested vehicle surveillance system to enable real-time tracking and identification of cars when they enter a parking lot. Developed in Python, the system makes use of key libraries including Tesseract for optical character recognition (OCR), OpenCV for image processing, and openpyxl for Excel-based data storage management. The four primary layers of the overall design are input, processing, decision, and output. The input layer of the system is where a security camera continuously records the live video stream at the entry. To determine whether a vehicle is present, this video is divided into individual frames and processed. To precisely locate the license plate, the frames go through a number of preprocessing steps, such as grayscale conversion, noise reduction, and contour detection. Following detection of the license plate, the Tesseract-powered OCR engine takes the alphanumeric characters out of the plate image. After that, the text is sent to the decision layer, where it is contrasted with a list of registered car numbers that are kept in an Excel document. The car is marked as approved if the number appears in the database; if not, it is marked as an intruder. The detection findings must be stored in the output layer. The system logs the vehicle number, date, time, and status (authorized or intruder) into an Excel file using the openpyxl library. For upcoming security evaluations and audits, this logged data acts as a historical record.

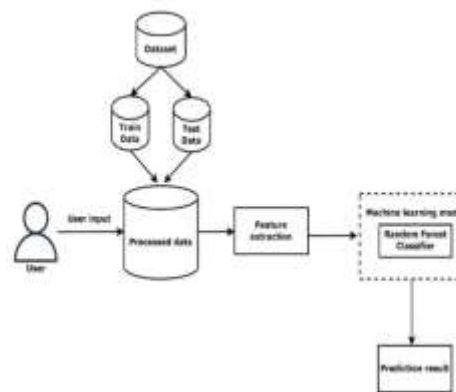


Fig 1.1: workflow diagram

IV. IMPLEMENTATION

Machine learning is used by the Employee Attrition Prediction System to forecast an employee's likelihood of leaving a company. Features like satisfaction level, assessment score, number of projects, department, pay, history of promotions, and work accidents are all included in the dataset. Preprocessing includes handling missing data, normalizing numerical features, dividing the dataset into training and testing sets, and utilizing Label Encoding to encode categorical variables like department and pay. Using this data, a Random Forest Classifier is trained to forecast attrition and pinpoint the main causes of employee turnover. F1-score, recall, accuracy, and precision are used to assess the model. The backend of the system is constructed with Flask, which manages user inputs and makes predictions based on the learned model. The front-end interface, which is made up of HTML, CSS, and JavaScript, is where users enter employee information and see the outcomes. A SQL database contains information such as login credentials and forecast history. The learned model is saved and reused using Joblib. Employee information and predicted outcomes are recorded via a record-keeping system for further review. All things considered, the system offers a full pipeline from data processing to record maintenance and real-time prediction.

V. RESULT AND ANALYSIS

The Employee Attrition Prediction Model, developed using a Random Forest Classifier, forecasts whether employees will leave based on factors like tenure, job satisfaction, performance, and demographics. Using synthetic employee data and preprocessing techniques such as scaling, normalization, and handling missing values, the model's accuracy was significantly improved. The system helps HR professionals gain insights into attrition drivers and take proactive retention measures.

1. **High Accuracy:** The system's excellent classification performance is in line with earlier discoveries regarding OCR accuracy in license plate recognition.
2. **Dependability in Detection:** The model's dependability is the confusion matrix illustrates this, showing that false alarms (FP) were incredibly uncommon.
3. **Areas for Improvement:** There were 45 false negatives (missed detections), indicating that performance could be further improved by enhancing low-light or motion-blurred image preprocessing.



fig 1.2: User interface

V. CONCLUSION

The "Employee Attrition Prediction System" is a significant innovation that leverages machine learning and data analytics to identify employees at risk of leaving, based on factors like job satisfaction, performance, and demographics. By offering real-time analysis, customizable dashboards, and exportable reports through an intuitive interface, it empowers HR professionals to make informed retention decisions. Future enhancements, such as sentiment analysis, AI-powered predictive modelling, and multilingual support, can increase its accuracy even more and global applicability. Additional features like a mobile app and IoT integration could provide more in-depth understanding into employee behaviour and engagement. These advancements aim to make the system a comprehensive and powerful tool for building a stable and motivated workforce.

VI. REFERENCE

- [1] P. Oyinloye and J. Campbell, "Employee Attrition and its Impact on National Cash Flow: A Case Study of the United States Economy in 2024," *International Journal of Economic Policy*, vol. 4, no. 3, pp. 46–62, Sep. 2024, doi: 10.47941/ijecop.2227.
- [2] C. K. Leung, R. Imran, A. G. M. Pazdor, and J. Souza, "An Explainable Artificial Intelligence Solution for the Practical Application of Employee Turnover," *2020 24th International Conference Information Visualisation (IV)*, pp. 1–6, Jul. 2024, doi: 10.1109/iv64223.2024.00055.
- [3] G. M. Díaz, J. J. G. Hernández, and J. L. G. Salvador, "Analyzing Employee Attrition Using Explainable AI for Strategic HR Decision-Making," *Mathematics*, vol. 11, no. 22, p. 4677, Nov. 2023, doi: 10.3390/math11224677.
- [4] B. Y. Marquez, A. Realyvásquez-Vargas, N. Lopez-Esparza, and C. E. Ramos, "Application of Ordinary Least Squares Regression and Neural Networks in Predicting Employee Turnover in the Industry," *Archives of Advanced Engineering Science*, vol. 2, no. 1, pp. 30–36, Sep. 2023, doi: 10.47852/bonviewaaes32021326.
- [5] R. Rathore and S. P. S. Rathore, "Machine Learning Applications in Human Resource Management: Predicting Employee Turnover and Performance," *International Journal for Global Academic & Scientific Research*, vol. 3, no. 2, pp. 48–59, Jul. 2024, doi:10.55938/ijgasr.v3i2.77.
- [6] D. M. Quinteros, "Predictive Modelling of Employee Attrition Using Deep Learning," *Acadlore Transactions on AI and Machine Learning*, vol. 2, no. 4, pp. 212–225, Nov. 2023, doi: 10.56578/ataiml020404.