

A REAL TIME TRACKING OF EMPLOYEE PERFORMANCE USING MACHINE LEARNING**Mr. Abrar Hussain**

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ABSTRACT:

In a modern world there is a growing intricacy in working places such as shift remote and hybrid working methods as indulge due to this there is need for real time performance monitoring. Traditional methods of performance monitoring files to give us insight into the problem but a modern and machine learning enables the continuous performance assessment through the various tools such as predictive analytical anomaly detection recommendation. this paper examines the current status of ml driven performance tracking and lighten up on strength limitation and its consideration we combine the recent research to identify the recent trends and the future in the practical execution.

Keywords:

Machine learning, performance tracking, HR technology, real time analytics.

INTRODUCTION:

Company success and competitiveness wholly depend upon the employee performance. traditional managers use tools to evaluate employee performance such as periodic reviews but it has its own flaws it often subjective biased not reflect the employee's true abilities. in a modern era with the use of digital tool company can have an access to the continuous performance monitoring, behavioural data and productivity. machine learning offers various methods to employee performance process which is multi source data streams and timely deliver. actionable inside but it also raises the question about its fairness transparency and data privacy.

LITERATURE REVIEW:

In recent years, machine learning (ML) has emerged as a promising approach for evaluating employee performance with greater precision and speed. Singh and Khuteja (2024) demonstrated how Random Forest algorithms can successfully classify levels of employee performance, although their work was primarily based on historical datasets rather than continuous monitoring. Expanding this line of research, Katiyar et al. (2025) integrated IoT-enabled data streams with models such as XGBoost and Neural Networks. Their findings showed that real-time inputs on workplace behaviour and environmental conditions can improve predictive accuracy, particularly in the context of leadership development. Similarly, Riaz and Ghanghas (2024) stressed that embedding AI into performance appraisal systems can help organisations reduce subjectivity, support informed managerial decisions, and raise employee satisfaction. However, they also pointed out that such applications

introduce new concerns related to data security and ethical use. In addition, Alvi et al. (2024) conducted a systematic review of ML techniques for predicting employee outcomes and noted a growing trend towards hybrid models that can handle dynamic datasets. Despite this, they observed that real-time HR analytics still lags behind in adoption.

Addressing fairness in performance evaluation has been another theme in the literature. One study proposed the inclusion of external factors such as social and economic conditions to reduce bias in ML-driven assessments (ScienceDirect, 2024). Work on HR analytics using Python tools has also applied models like Decision Trees and Support Vector Machines to forecast performance and employee attrition (IJRASET, 2023). While these methods achieved reliable results, they were limited to static datasets, which makes them unsuitable for live monitoring. On the other hand, industrial case studies have provided more concrete demonstrations of real-time systems. For instance, the Smart Connected Worker framework in manufacturing employed IoT sensors and computer vision to track workers' tasks and productivity in real time (ScienceDirect, 2021). Although effective in monitoring physical labour, its focus makes it less applicable to knowledge-intensive organisational roles.

Across these studies, three clear insights emerge. First, ML techniques are proving increasingly capable of predicting employee performance with high accuracy. Second, the integration of IoT and sensor technologies indicates strong potential for real-time monitoring, though most examples remain industry-specific. Third, the growing attention to fairness, privacy, and transparency highlights the importance of responsible system design. What is evident overall is that while machine learning is advancing rapidly in this area, most implementations still rely on retrospective data analysis. Only a handful of studies explore continuous, real-time tracking, suggesting that future research should prioritise streaming data pipelines, fairness-aware algorithms, and practical strategies for deploying such systems in everyday organisational settings.

REVIEW METHODOLOGY:

We have analysed around 50 studies industrial reports, case studies published from 2015 to 2025.our sources were taken from Scopus, Google scholars data Science Journal, IEE explorer ACM digital library.

Machine learning in employee performance tracking: Table represent the data sources

Data category	Activities
Work Activity logs	Taken to complete the task, documents edits and code commits.
Pattern of system usage	Login regularity, tool usage.
Communication of data	Frequency of email chats, involvement and participation in meeting.
Quality check-up	clients feedback, reports of question and answer, errors or mistakes rates.

Commonly used machine learning techniques:

- **Time series model:** used to forecast the future which helps to plot the performance trends and also helps organization to make inform decisions. Machine learning models As(LSTM and Prophet).
- **Supervised learning:** it's a database model in machine learning which classified the performance of employee. based on employee performance this model gives the scoring. (Random forest, gradient Boosting).
- **Unsupervised learning:** it's a learning works But analysing unlabelled data to identify the patterns and the relationship. it's an AI type of a machine learning that learn from the data without human supervision. clustering from behaviour profiting and irregularity detection.(isolation forest, K-means).

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- **NLP models:** Natural language processing it's a subfield of AI which guides computer to comprehend, generate and manipulate human language. It allow HR manager to uncover the emotions behind the employee feedback which leads to more informed decisions.(spacy, cloud based, Amazon comprehend).

Current Trends:

- **Predictive analytics for early:** study proves that when an employee performance tips it allows HR steam to take a proactive measures.
- **HR integration:** machine learning model enclapsed with HR and various project management tools which makes employee performance tracking work easier without much efforts and workload.
- **personalised approach:** modern business world moving faster so rather than just applying one size fit to all it provides a different set of scales to each role, working style and experience level of an employee in an organization.
- **Behavioural analytics:** Organization moving beyond task. not just task completion rates. It also records the engagement, responsiveness and collaborative activity levels an employee involved.

Challenges:

- **Issue of privacy:** Continuous monitoring fields invasive without a clear approval and transparency.
- **Bias Alogorithmic:**Providing biased historical data leads to risk of inequalities.
- **Data Quality:** Incomplete and un
- clear data leads to the question the accuracy in a results.

Comparative analysis:

Approach	Strengths	Weaknesses	Example Studies
Supervised Regression Models	High accuracy on well-labeled data	Poor generalization to unseen behaviors	Lee & Kim (2022)
Clustering & Anomaly Detection	Detects subtle deviations	Risk of false positives	Zhang & Huang (2021)
Time-Series Forecasting	Strong predictive capabilities	Needs long-term historical data	Jain & Singh (2023)
NLP-Based Sentiment Analysis	Captures qualitative insights	Sensitive to cultural/language nuances	Kumar et al. (2024)

FUTURE DIRECTIONS:

- **ML hybrid models:** Best combining various model of machine learning we can have a more complete picture of employee performance easily it can track .
- **Transparent:** XAI Champs to understand the working of these model which build transparent among the HR and stakeholders.
- **Ethical:** Respecting the data of employees and treating it in correct way. Because of working on industry wide standard for consent.
- **Tribal on workplace:** (IOT) Internet of Things devices help us to understand the demand of different roles through which it can support employees better.
- **Personalised insight:** Using personalised visual analytics for Tailored specific needs,. Roles and departments.

CONCLUSION:

A real time employee performance tracking using ml it transform the way will look and manage the workforce .Buy revolutionising the workforce management through shifting from reactive to proactive approach tapping a new levels of productivity and efficiency. Research promising the predictive and accuracy capability rapidly changing technology it's crucial in balancing technical transformation with responsibility. Practices along with, ethics, law and culture. by doing this weekend unlock the full potential of this technology and can create a better future for work.

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