**Project Summary with Analysis and Recommendation**

INX Future Inc, is one of the leading data analytics and automation solutions provider and have provided us with data of their employees. The main task of this project is to find out what are most import factors contributing to employee’s performance and build a machine learning model that will help predict employee’s performance rating. This machine learning model will be used to hire new employees.

Since the purpose of this data analysis is to be able to predict the performance rating of the employees, we first had to do the exploratory data analysis to find meaningful insights of the data.

**Our Overall Findings:**

We see that the age group of 31-40 regardless of gender are prone to leaving the company. Another interesting fact that was observed is that even though most employees that are prone to leaving the company has mostly rated 'high' or 'very high' in each of the department except human resource department.

Most of the employees in our firm are married. We find out that younger employees between the ages of 20 to 30 are more satisfied with their job.

Sales, Development and R&D make up the most of the department in our firm.

Most of the employees travel frequently, has a bachelor’s degree and they rated 'very high' in their job satisfaction.

Even though most of the employees do not work overtime their job involvement remains very high.

It is a positive thing that most employees are not leaving the organization and they have a 'better' work life balance.

We also wanted to find out whether employees who travel frequently and remain far from home are happy with their job and how they are performing. We found that men who travels more frequently are divorced but they got more outstanding rating. On the other hand, women who travel frequently are mostly either married or single and they got more 'Excellent' rating.

Very few frequent travelling males and females have rated their work life balance as 'best'. Only in sales and R&D department, employees feel that they have the 'best' work-life balance.

In most of the department, employees who got outstanding rating has rated their work-life balance as either 'Good' or 'Bad'.

Another interesting find from our exploratory data analysis of employee background and their current department, was that in sales & human resources department most of the employees have background of marketing & human resource respectively and most of these employees are given outstanding or excellent rating. R&D and development department has more people from life science and medical background; and most of these employees got excellent rating. Finally. Data Science and Finance department has more employees from life science and medical background and these employees got excellent rating.

**Department wise Performance Report**

**Sales Department:**

The majority of employees receive an excellent (3) performance rating, indicating a generally high level of performance across the organization. Interestingly, it appears that younger employees tend to outperform their older counterparts, although the difference is not particularly significant.

An essential observation is the strong positive correlation between job satisfaction and environment satisfaction with performance ratings. Employees who report higher job and environment satisfaction tend to receive higher performance ratings, emphasizing the importance of fostering a positive work environment.

Furthermore, it's noteworthy that Sales Executives and Representatives tend to perform better than their managers, suggesting that certain roles within the organization may have a more direct impact on performance.

Another intriguing finding is that both new employees and those with the longest tenure at the company tend to perform better than those with moderate levels of experience. This highlights the value of fresh perspectives and the dedication of long-term employees.

Moreover, employees who are relatively new to their current role or have less experience in their current position tend to outperform their more experienced counterparts. This indicates that adaptability and a proactive approach to new roles can lead to enhanced performance.

Lastly, employees who have been recently promoted tend to have higher performance ratings compared to those who haven't been promoted for more than four years. This underscores the positive impact of career advancement opportunities on employee motivation and performance.

**Development Department:**

The majority of employees excel in their performance, with the highest rating being "excellent" (3), indicating a generally high level of employee performance. When considering age groups, both the younger and older employees tend to outperform their middle-aged counterparts, showcasing that age does not necessarily correlate with performance.

Gender-wise, there's a slight edge in performance for female employees compared to their male counterparts. Job satisfaction and environmental satisfaction play a pivotal role in determining performance ratings. Employees reporting higher satisfaction in these areas tend to achieve better performance ratings.

Employees in roles such as Developers and Tech Leads consistently outperform their peers in other job roles. Surprisingly, the length of experience in one's current role doesn't significantly influence performance ratings, implying that adaptability and fresh approaches are equally valuable. Notably, employees who have received recent promotions tend to have higher performance ratings compared to those who haven't been promoted in over four years, highlighting the positive impact of career growth opportunities on motivation and performance.

**Research & Development Department:**

Predominantly, employees in the Research & Development Department achieve an "excellent" (3) performance rating, indicating consistently high performance levels. Notably, the youngest age group, up to 25 years old, significantly outperforms other age groups within this department.

Gender-wise, female employees exhibit slightly better performance than their male counterparts. Environment satisfaction is strongly linked to performance ratings, with higher satisfaction levels associated with better performance. In this department, both new employees and those with extensive experience tend to perform better than those with moderate experience.

**Human Resources Department:**

The Human Resources Department also boasts a majority of employees with "excellent" (3) performance ratings. Performance-wise, individuals up to the age of 30 tend to outperform older age groups in this department. Female employees outshine male employees by a considerable margin in terms of performance. Similar to R&D, environment satisfaction significantly influences performance ratings here.

**Finance Department:**

The Finance Department exhibits a mixed performance profile, with a notable presence of low-performing employees compared to other departments. Performance-wise, employees aged 41-50 generally achieve good performance levels within this department. Surprisingly, job satisfaction has a weaker link to performance ratings in this department. Similar to other departments, environment satisfaction remains closely related to performance ratings.

Interestingly, sales executives and representatives outperform their managers in this finance-focused department.

**Data Science Department:**

In the Data Science Department, most employees maintain an "excellent" (3) performance rating. Performance remains consistently high across all age groups within this department.

Like other departments, job satisfaction and environment satisfaction are positively correlated with performance ratings. Employees with lower experience in their current role tend to perform better, likely reflecting the learning curve associated with this dynamic field.

Overall, the Development and Data Science departments stand out with a significantly higher number of high-performing employees, while the Finance Department exhibits a higher proportion of lower-performing employees in comparison to other departments.

**Top 3 Factors Affecting Employee Performance**

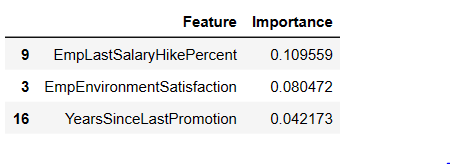
In our visualization.ipynb notebook we have used K-Means Clustering to try to cluster different classes.

Using Elbow method, we found best n\_cluster as 3. We have successfully separated the top performers (rating 4) and the least performers (rating 2) in cluster 1 using K-Means Clustering.

Next we ran the clusters in a tree based model RandomForestClassifier() model to find the “.feature\_importances” method.

Also, using our best tree based boosted classifier model (XGBoost) we have found out the top most important features using the “.feature\_importances” method.

Top 3 Important Features are:



**Our Recommendations**

We need management to provide some more benefits other than promotion like job-enrichment or job diversification etc. to make sure to stop employee attrition. The management has to provide some relief to frequent travelling employees by giving them sabbatical so that they can spend their time with family and they can maintain their work life balance. The management need to decide what type to people to hire for each department. For example, we see very little employee that have technical background. In todays' world of A.I revolution, we need more technical people to handle complex tasks. Other recommendations are detailed below:

1. **Focus on Employee Satisfaction:** Since "EmpEnvironmentSatisfaction" is a significant predictor, management should pay close attention to employee satisfaction levels. Regularly gather feedback from employees through surveys, interviews, or other means to understand their satisfaction with their working environment. Addressing issues related to satisfaction can improve overall performance and reduce turnover.
2. **Salary and Compensation Review:** "EmpLastSalaryHikePercent" is another crucial factor. Consider conducting regular salary and compensation reviews to ensure that employees receive fair and competitive compensation. Providing salary hikes based on performance can motivate employees to perform better.
3. **Promotion and Career Development:** "YearsSinceLastPromotion" suggests that career advancement opportunities play a role in employee performance. Management should focus on creating clear career paths for employees and providing opportunities for skill development and promotions based on merit.
4. **Employee Training and Development:** In addition to promotions, investing in employee training and development can have a positive impact on performance. Consider offering training programs that enhance employees' skills and knowledge, making them more valuable to the organization.
5. **Retention Strategies:** To retain top-performing employees, implement strategies that recognize and reward their contributions. Recognize outstanding performance through awards, bonuses, or other incentives.
6. **Regular Performance Reviews:** Implement regular performance reviews and feedback sessions. This can help employees understand their strengths and weaknesses, set performance improvement goals, and track progress over time.
7. **Data-Driven Decision Making:** Continue to use data-driven approaches to monitor and assess employee performance. Regularly analyze the impact of these key factors on performance and adjust strategies accordingly.