Employee Attrition

By: Amanda Jo Griffin (Aj)

Background

As the lead data engineer for a large enterprise, I am spearheading a collaborative effort with HR to analyze employee attrition trends and develop an advanced predictive application.

My primary focus is designing a robust prediction model.

Through the integration of cutting-edge technology and leveraging data-driven insights, our goal is to provide the HR department with a powerful tool for proactive decision-making and effective mitigation of employee attrition.

Purpose

For the HR department, I am tasked by the VP of Data and Product to deliver a concise overview of our new attrition prediction app's market launch readiness.

This will include key findings on features that best predict attrition based on employee information.

Additionally, I'll provide insights into the reliability rate of our predictions.

Data Overview

The Data

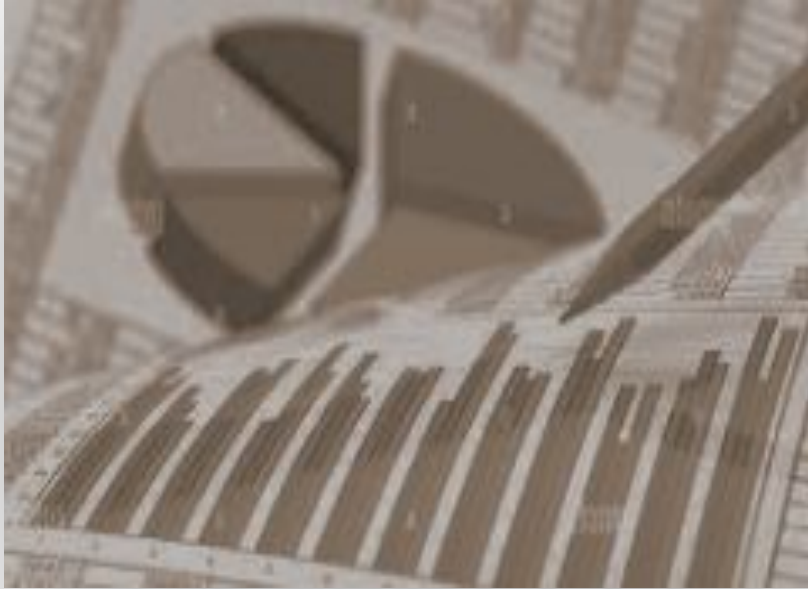Information about various features related to employees that work for the company.
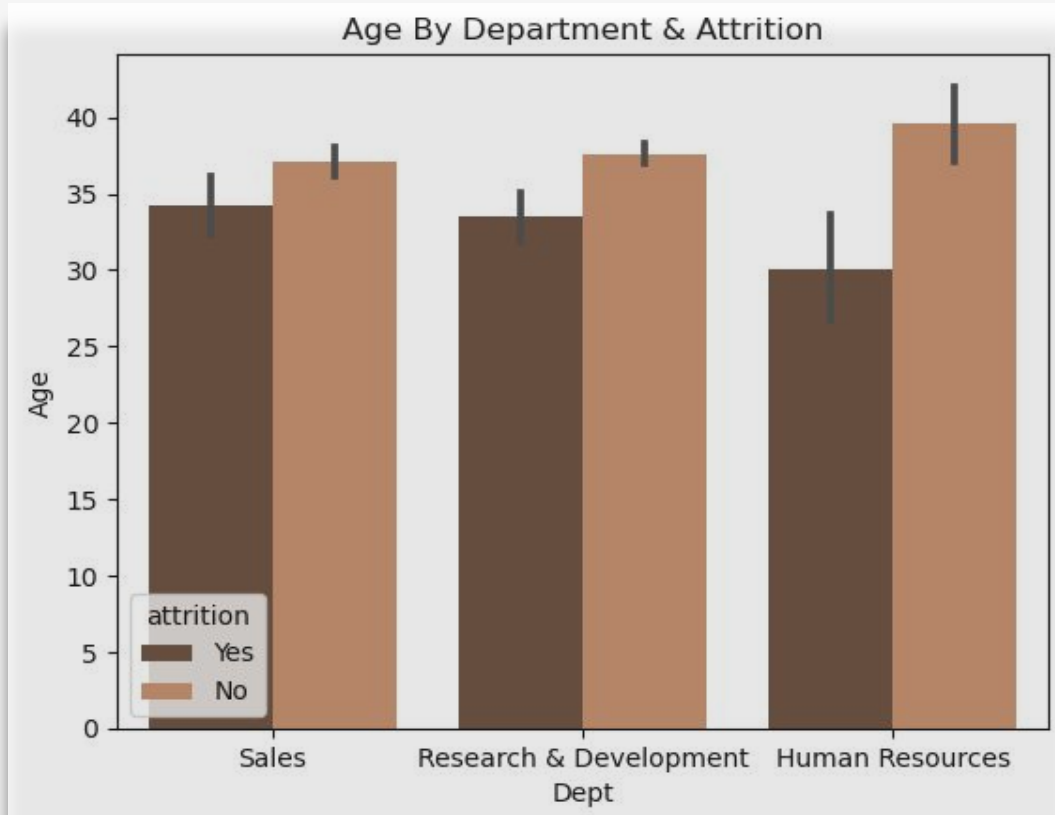
Size

1470 rows
35 columns

Learn More About The Data

HERE

Current Trends

Age By Department & Attrition
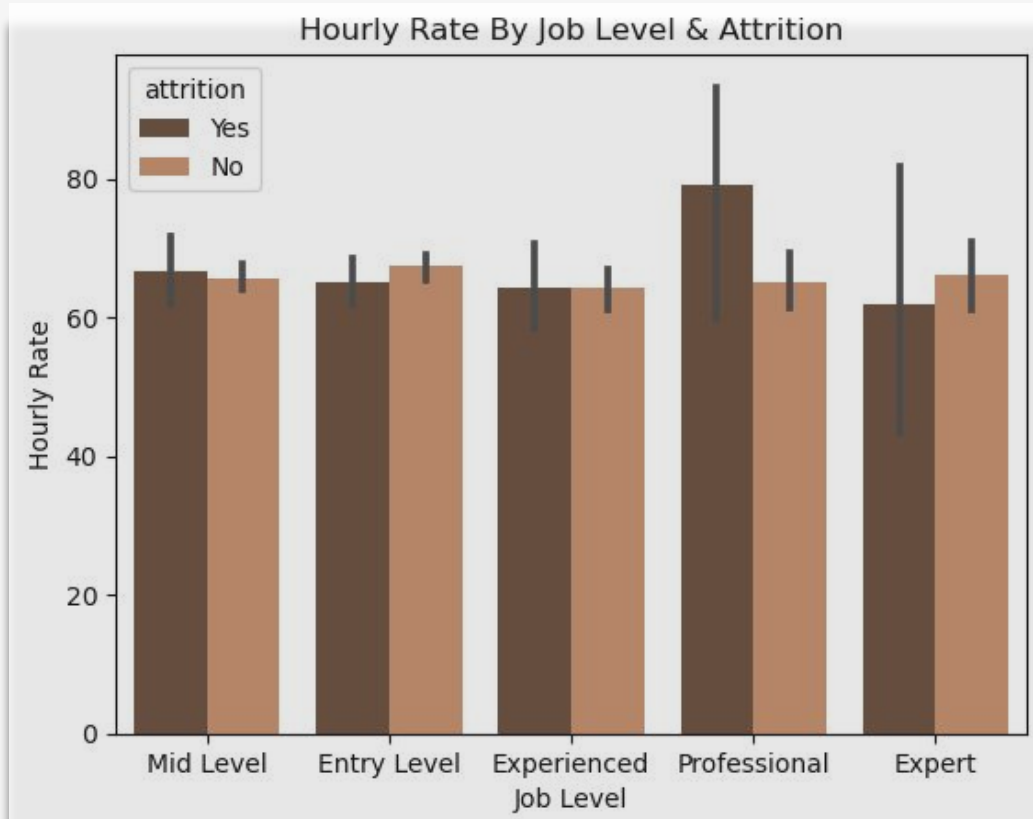

Age By Department & Attrition

Average Age Range

30-40

Retention Patterns

Slightly older (35-40) = longer tenures, particularly in HR dept.

Hourly Rate By Job Level & Attrition


Average Hourly Rate

- 60-80

Retention Patterns

- Entry & Expert level more inclined to stay, especially when paid more.
- Employees at Expert level tend to stay more, reflecting higher retention rate when job level increases.

Attrition Patterns

- Higher pay at Mid and Professional levels corresponds to higher likelihood of attrition, particularly at the Professional level where they exhibit higher tendency to leave.

How Attrition Varies W/ Age

How Attrition Varies W/ Age

Age

Attrition - Y: Left Company , N: Still There
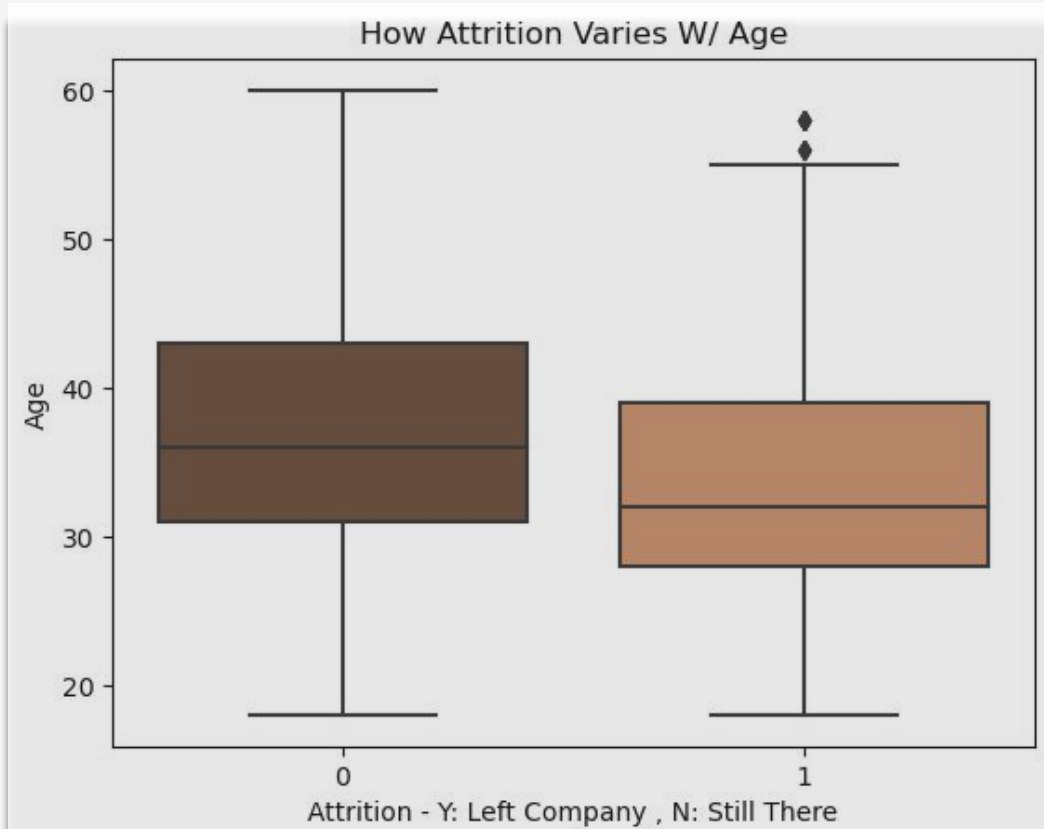
Attrition Age Range (50%)

- Half of employees who left were between 28 and 39.

Retention Age Range (50%)

- 50% of employees who stayed were between 31 and 43.
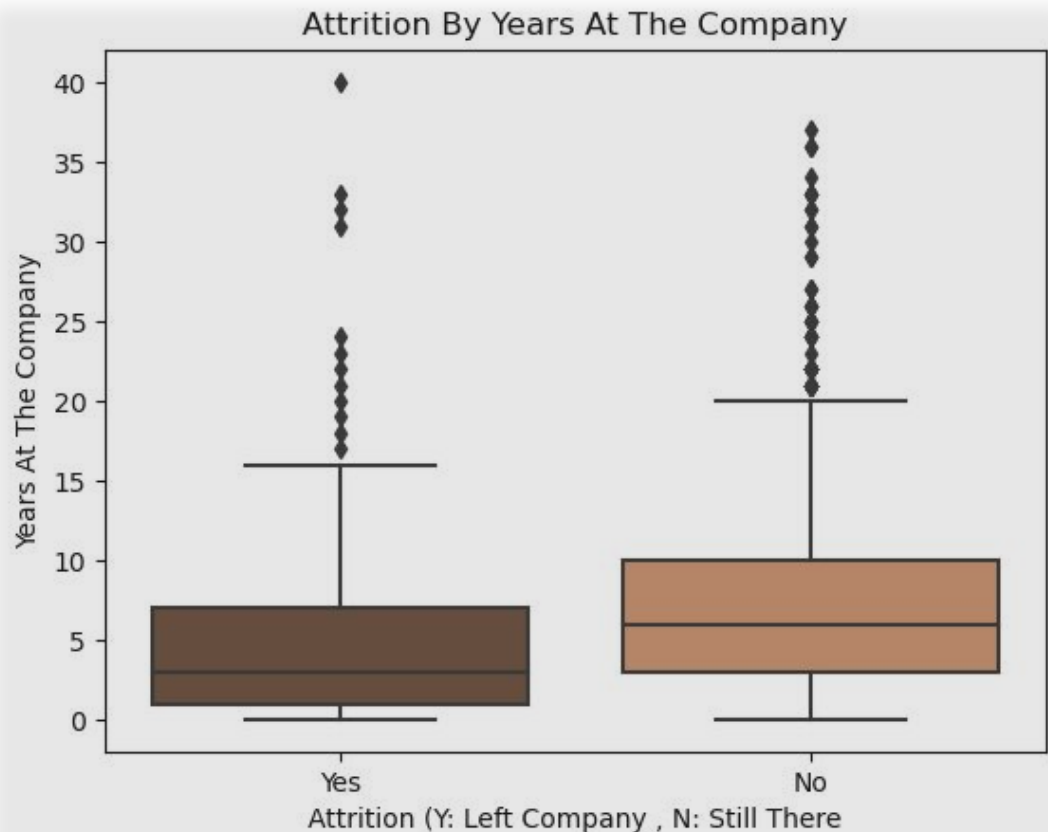
Median Age Range

- Median age for those who left: 32
- Median age for those who stayed: 36

General Trend

- A discernible trend that, in general, younger employees are more likely to experience attrition.
- Despite the trend, a few outliers present, representing those who left at older ages.

Attrition By Years At The Company

Attrition By Years At The Company

Predominant Groups

- Leaving: Tenure of 1-7 years
- Staying: 3-10 years

Median Tenure

- 3 years

50%

- Half of those departing had a tenure between 1 and 7 years.
- While for those staying, tenure is around 6 years.

General Trend

- A notable trend suggesting that the longer employees have been with the company, the more likely they are to stay.
- Despite trend, there are a few outliers who deviate from the typical tenure pattern.

Attrition % By Business Travel

Attrition Percentage by Business Travel
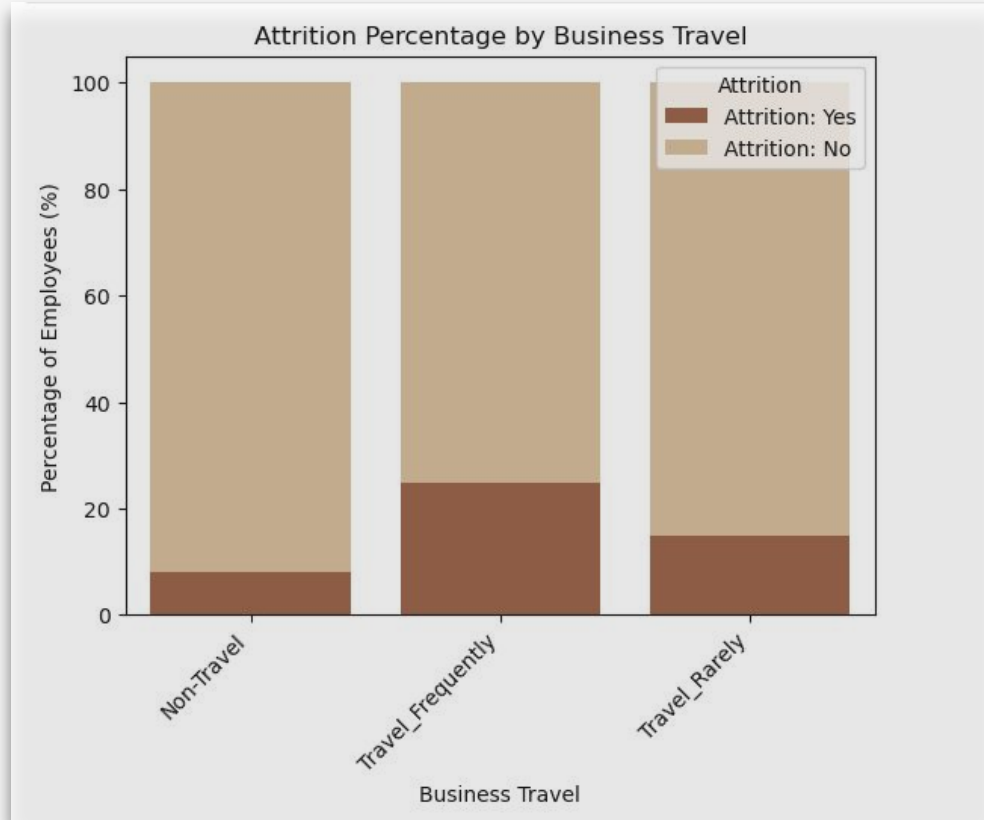
Rare Travelers

- Approximately 90% retention rate, with a less than 10% attrition rate

Frequent Travelers

- Retention rate around 80%, but with a higher attrition rate of about 25%.

Non Travelers

- An exceptionally high retention rate of approximately 95%, with a low attrition rate of about 5%.

Observations

- Non-traveling employees demonstrate the strongest job stability, followed by rare travels and then frequent travelers.

Attrition % By Job Role


Attrition Percentage by Job Role
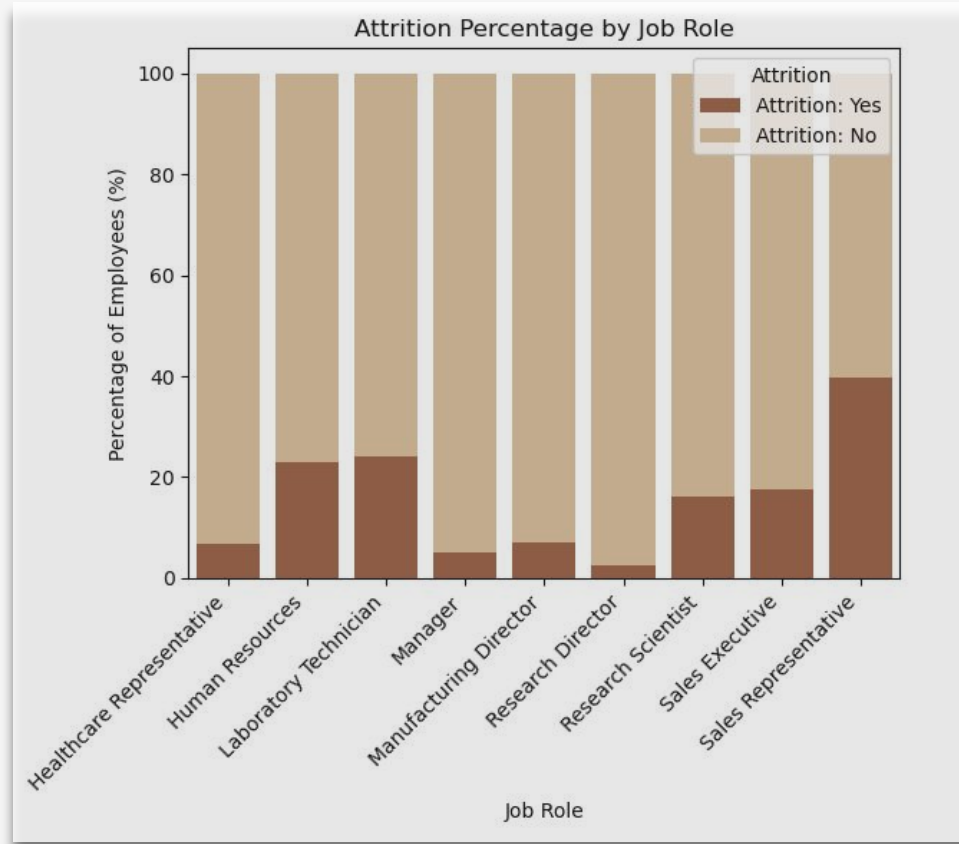
Attrition Trends

- Sales Reps: 40% turnover - Factors contributing to high turnover need exploration.
- Research Directors: 2% turnover - Exceptionally stable workforce.
- HR Professionals: 20% turnover - Notable turnover, reasons warrant attention.
- Managers: 5% turnover - Highlights the role of effective leadership in promoting loyalty and stability.
- Lab Techs & Manufacturing Directors: Slightly higher attrition compared to Research Scientists & Health Care Reps.

Observations

- Analysis reveals high attrition rate among sales reps and exceptional stability of research directors.
- Emphasizes importance of addressing specific challenges and implementing retention strategies tailored to each role.

Attrition % By Job Level


Attrition Percentage by Job Level
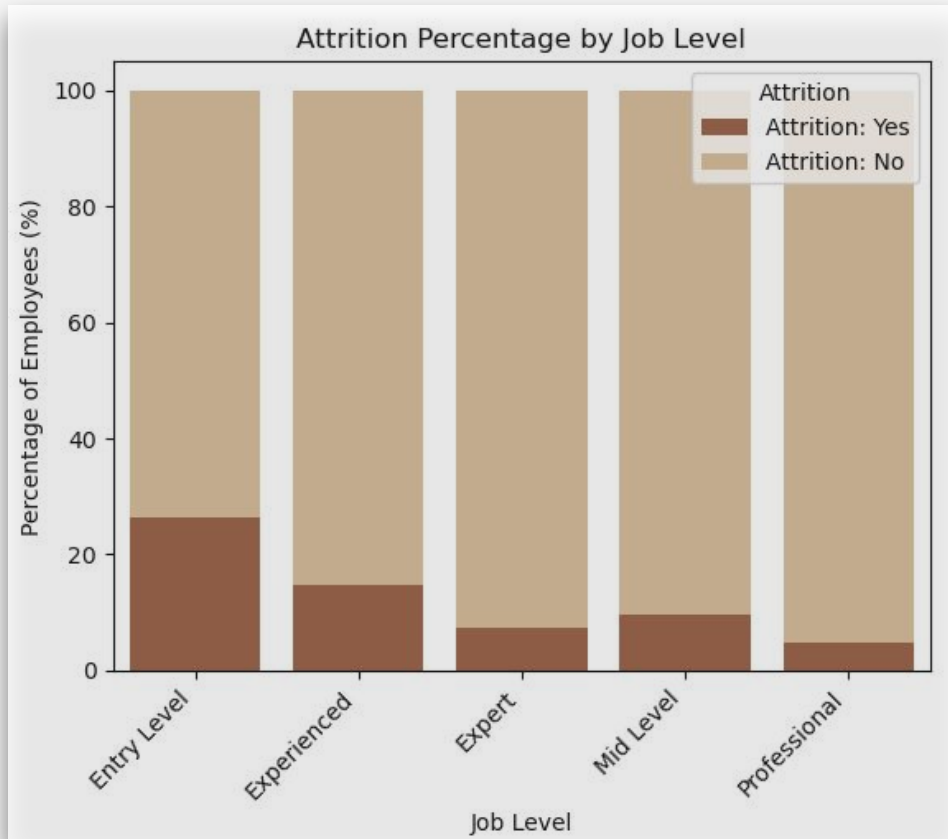
Attrition Trends

- Entry-Level: 25% turnover
- Experienced: 15% turnover
- Mid-Level: 10% turnover
- Professionals: Low attrition rate, emphasizing the value of retaining skilled workforce.
- Experts: Exceptionally low attrition rate, highlighting challenges in replacing individuals with specialized skills.

Observations

- Attrition rates decrease with progression, showcasing a correlation between tenure and job stability.
- Majority choose to stay in each category, underscoring a general trend of robust employee retention across all levels.

Attrition % Marital Status

Attrition Percentage by Marital Status
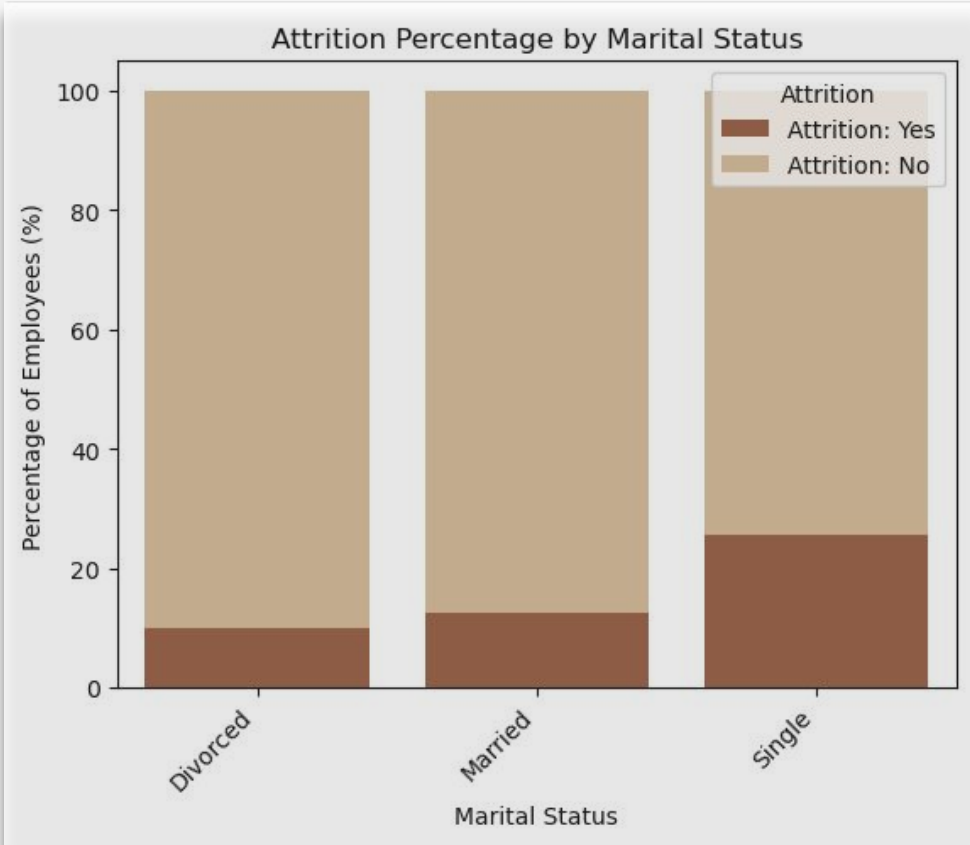
Attrition Trends

- Single: 30% turnover - Possible factors: career mobility or desire for change.
- Married: 15% turnover - Suggests stability from marital relationships positively impacting job commitment.
- Divorced: 10% turnover - Indicates potential challenges with leaving, such as personal life adjustments or the need for increased stability.

Observations

- Important to note that number of employees who choose to stay outweighs those who leave, indicating overall commitment and job statiscating within the workforce, regardless of marital status.

Attrition % Education


Attrition Percentage by Education
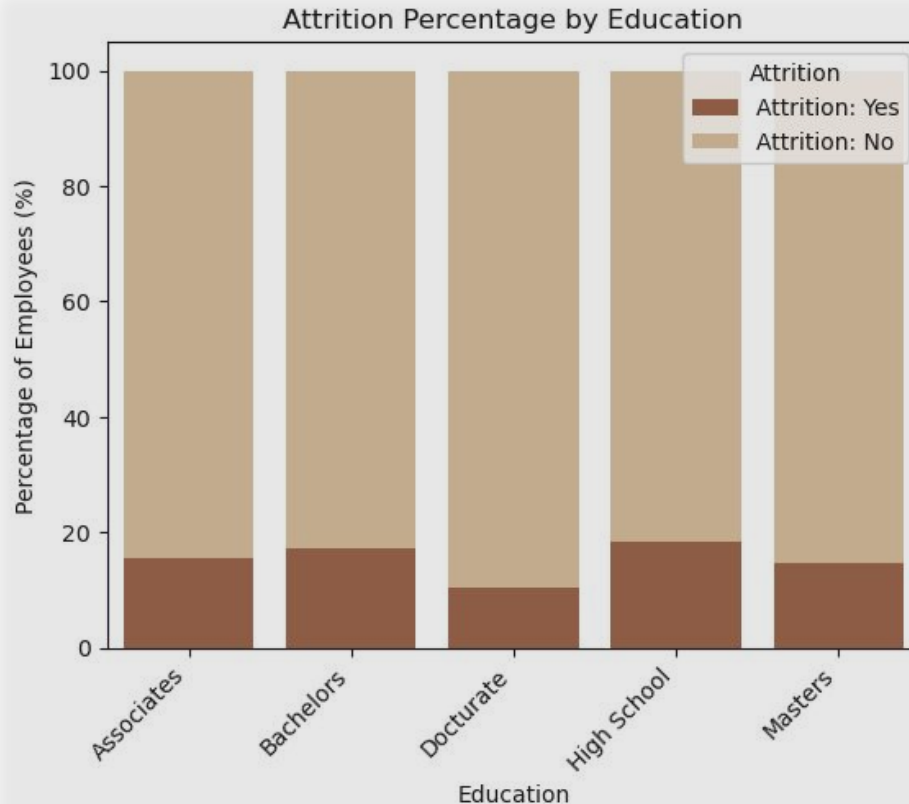
Attrition Trends

- Associate's Degree: 20% turnover
- Bachelor's Degree: 20% turnover (similar to high school diploma holders)
- Master's Degree: Just under 20% turnover
- High School Degree: Around 20% turnover
- Doctoral Degree: 15% turnover

Observations

- Emphasizes the value of advanced education and expertise gained through doctoral studies in promoting lower attrition rates.
- Majority choose to stay across all categories, emphasizing overall commitment and job satisfaction within our workforce.

Age Vs. Monthly Income By Attrition
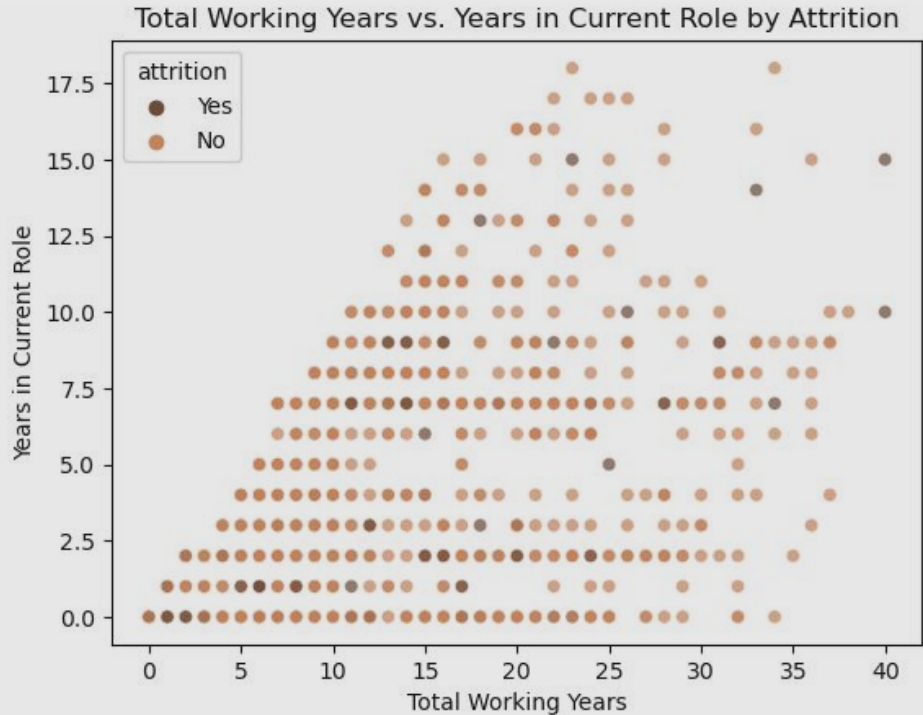

Age vs. Monthly Income by Attrition
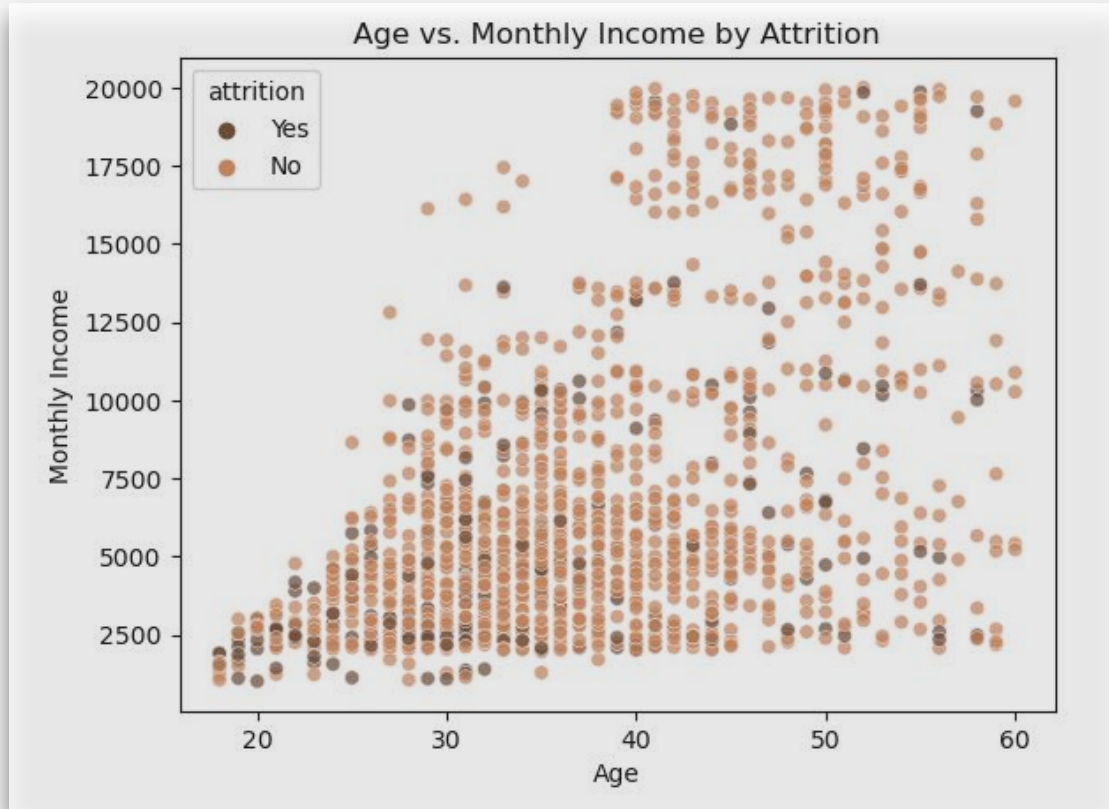
Dot Scatter Analysis:

- Concentration of brown dots (attrition) in lower half of age and income.
- Majority of dots, regardless of attrition, in lower half of age and income.

Observations

- Suggests potential correlation between younger age, lower income, and attrition.

Total Working Yrs Vs. Yrs In Current Role By Attrition

Total Working Years vs. Years in Current Role by Attrition

Dot Scatter Analysis:

- Higher concentration of brown dots (attrition) in lower half of years in current role and total working years.

Observations

- Suggests employees with fewer years in current role and overall work experience are more likely to experience attrition.
- Indicates a potential correlation between attrition and employees who are relatively new to their roles or have less overall work experience.

Years At Company By Attrition

Years at Company by Attrition
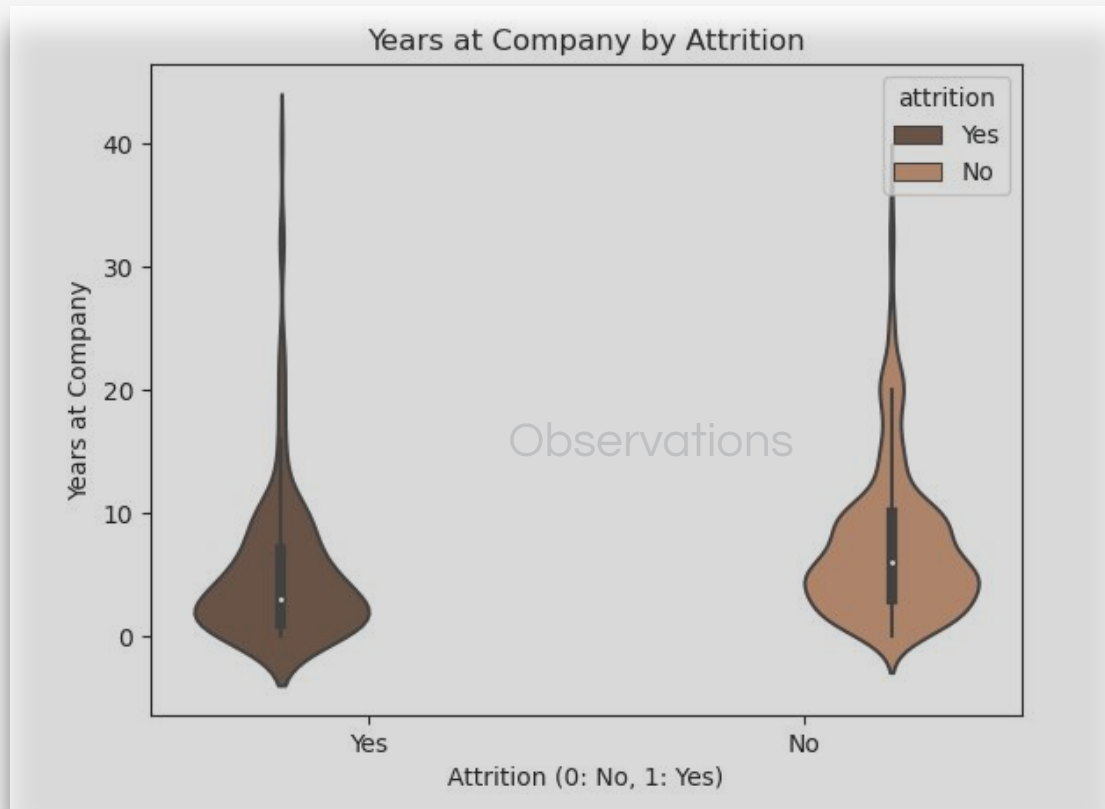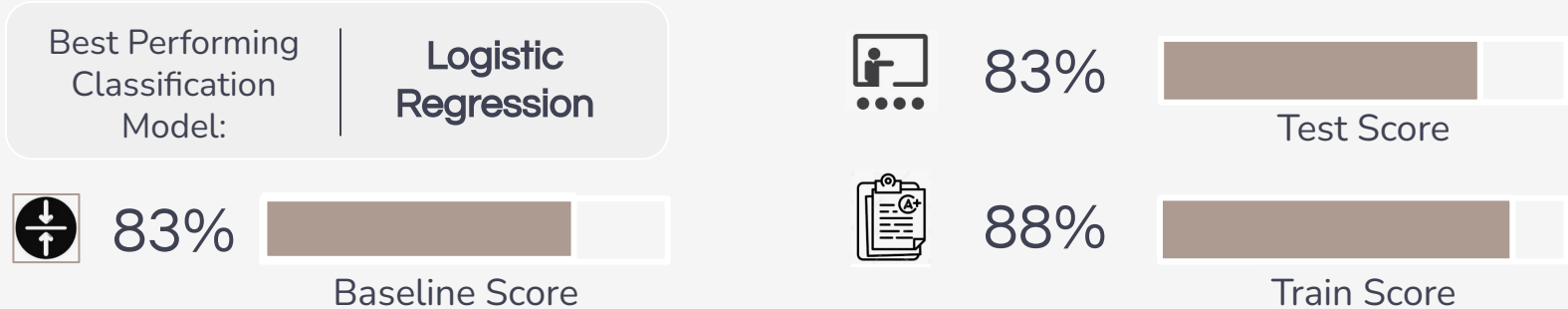
Violin Analysis

- Concentration around median years at the company.
- Median tenure: Stay (7 years), Leave (3 years).
- Attrition more frequent among shorter tenures.
- Some stay for extended durations, even with attrition.
- Relatively low number with very short tenures, slightly shorter for those who leave.
- Majority of data (mid-bubble part) for those who stay ends at about 15 years, indicating a significant portion staying for an extended period.
- Difference in shape implies different distributions, with a higher concentration of longer tenures among those who stay.

Modeling

Performance

Best Performing Classification Model:	Logistic Regression

83% — Test Score

83% — Baseline Score

88% — Train Score

➔ Although the Random Forest Classifier achieved a perfect accuracy score of 100% on the training data, it did not generalize well to the testing data, achieving an accuracy score of only 85%. K-Nearest Neighbors (KNN) model showed a relatively consistent performance with an accuracy score of 86% on the training data and slightly improved to 86% on the testing data. Logistic Regression model performed consistently with an accuracy score of 83% on the training data and improved to 88% on the testing data.

➔ We can conclude that while the Random Forest Classifier may have overfit the training data by achieving a perfect score, it struggled to generalize to new, unseen data. Both the KNN and Logistic Regression models demonstrated better generalization performance, with the Logistic Regression model having a slightly higher accuracy score on the testing data.

➔ When using predictive modeling, working with KNN or Logistic Regression will yield the best results.

Application For Predicting

→ {LINK}

Synopsis

Conclusions

Attrition Patterns	Departmental Insights	Education & Job Levels	Demographic Trends	Modeling Performance	Application For Predicting
Employees with shorter tenures, younger ages, and lower incomes are more prone to attrition.	Sales Reps: High attrition - Investigate contributing factors. Research Directors: Exceptional stability - Highlight effective practices. HR Professionals: Notable turnover - Address specific challenges. Managers: Low attrition - Emphasize effective leadership.	Higher education, especially a doctoral degree, correlates with lower attrition rates. Experts exhibit lower attrition, emphasizing the value of retaining a skilled workforce.	Age, monthly income, and business travel influence attrition rates. Non-traveling employees show strong job stability, while frequent travelers experience higher attrition.	Logistic Regression is the best-performing model for attrition prediction. Achieves 84% to 88% accuracy, beating the baseline of 83%.	Streamlit app for further EDA and predicting outcomes based on employee features.

Recommendations:

🎯 Focus On:

➔ **Retention Strategies:** Tailor strategies for Sales Reps to address high turnover factors. Implement effective practices observed in Research Directors' departments.

➔ **Leadership Development:** Invest in leadership development programs for lower attrition. Prioritize skill development for managers to enhance effective leadership.

➔ **Targeted Support for HR Professionals:** Investigate and address specific challenges for HR Professionals to reduce turnover.

➔ **Education and Skill Development:** Continue supporting higher education, correlating with lower attrition. Retaining Experts for their significant contributions.

⏳ Prioritize:

➔ **Demographic Considerations:** Explore flexible arrangements for frequent travelers to mitigate higher attrition. Consider additional support for younger employees with lower incomes.

➔ **Continuous Monitoring:** Regularly monitor attrition trends and adjust strategies accordingly.

➔ **Communication and Feedback:** Establish open channels for employee feedback on workplace experiences. Utilize insights from the predictive model for proactive decision-making.

➔ **Utilize Streamlit App:** Incorporate the developed Streamlit app for ongoing analysis and prediction.

Thank You!

Q&A