

# IBM HR Analytics Employee Attrition & Performance

**“Value your people, or watch them leave”**

# Team Members



**Haneen Mohammed**



**Faris Abouagour**



**Ahmed Ayman**



- **Under Supervision: Eng. Farah Mostafa**

# Agenda

- Team Members
- Problem Statement
- Targeted audience
- Understanding The Data
- Preprocessing
- Visualizations & Dashboard
- Modeling & Performance
- Insights & summary
- Limitations
- Deployment



# Problem Statement

# Problem Statement

"Employee attrition is one of the biggest hidden costs for any company. Replacing an employee is not only expensive but also leads to a loss of valuable skills, experience, and productivity.

Is it mainly influenced by salary? Does the number of years at the company play a role? Or could there be other hidden factors? Let's uncover the answers."





# Targeted audience

# Targeted audience

## HR Mangers

Identify employees at risk of leaving and take preventive actions.

## Data Analysts

Use insights for better workforce planning and retention strategies.



# Understanding The Data



# Data Columns

**And there are Numerical and Categorical columns we will use to answer the questions:**

For example:

- Age → Younger vs older employees, does it affect leaving?
- MonthlyIncome → Salary influence on attrition.
- YearsAtCompany → Loyalty vs boredom/plateau.
- JobRole → Some roles may have higher turnover.
- OverTime → Work-life balance impact.
- BusinessTravel → Does frequent travel cause people to leave?
- WorkLifeBalance → Satisfaction level with balance.
- JobSatisfaction → Direct link to motivation.
- EnvironmentSatisfaction → How the workplace culture affects retention.

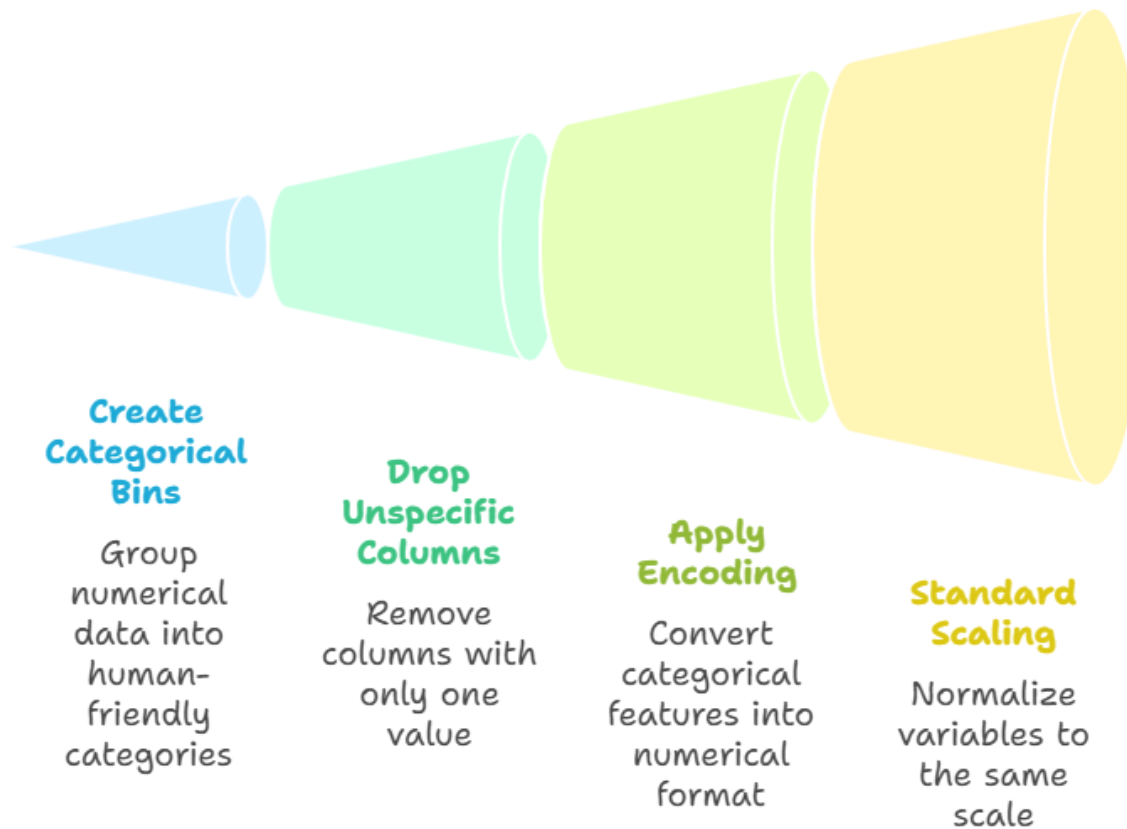
**Data Shape: 1470 x 35**



# Preprocessing

# Preprocessing

## Data Preprocessing for Attrition Analysis

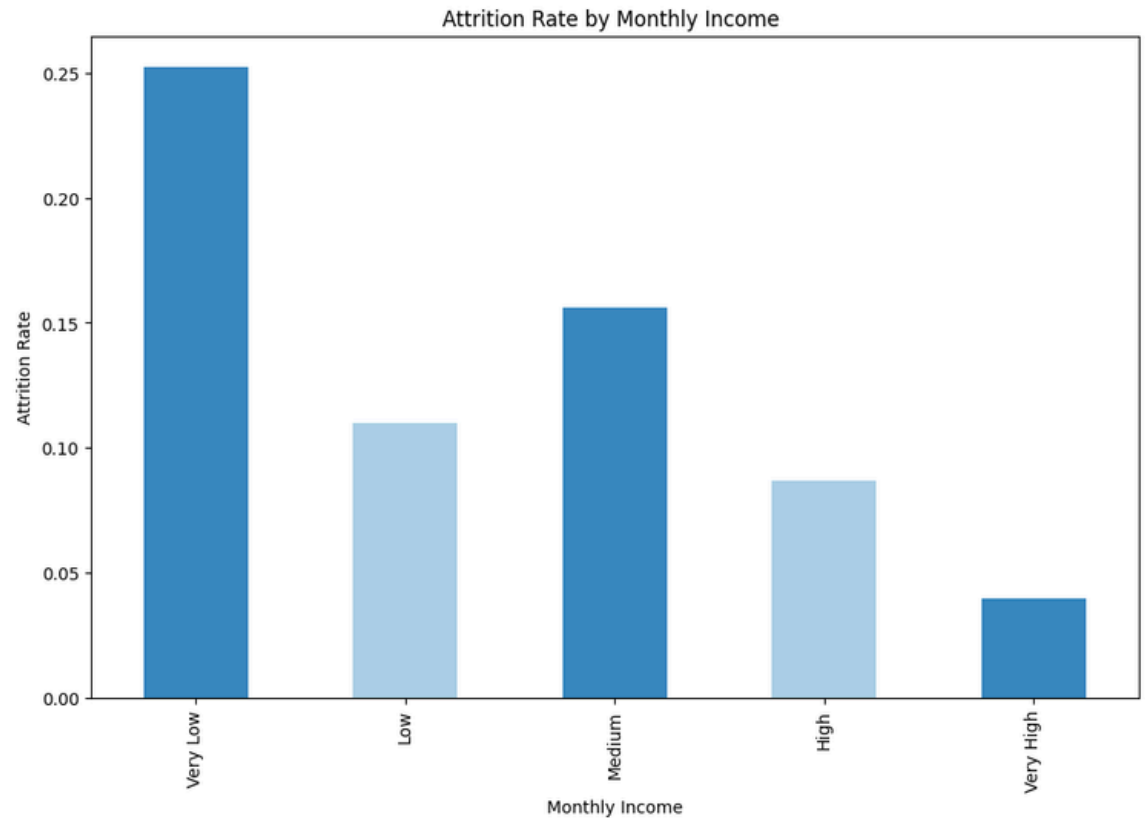




# Visualizations

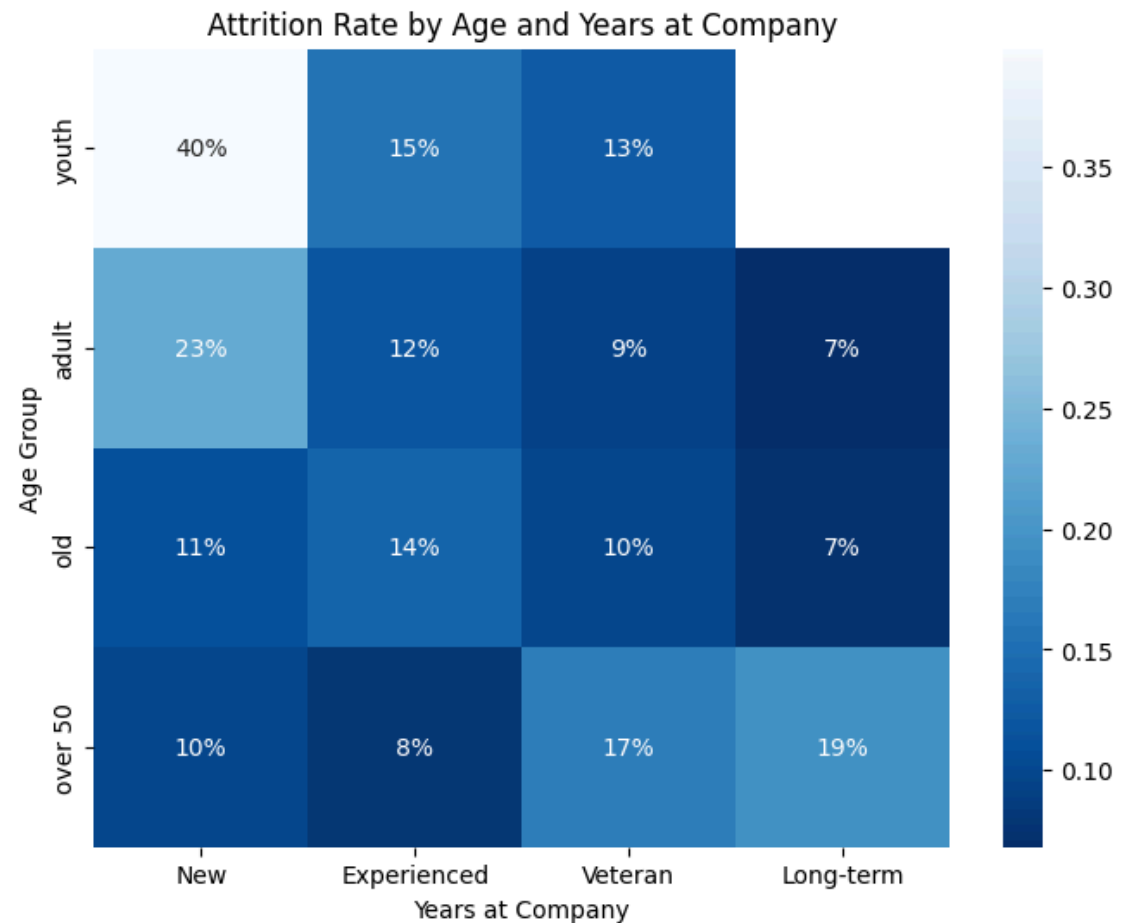
# Does income affect on attrition rate?

- **Attrition is higher among employees with lower monthly incomes**



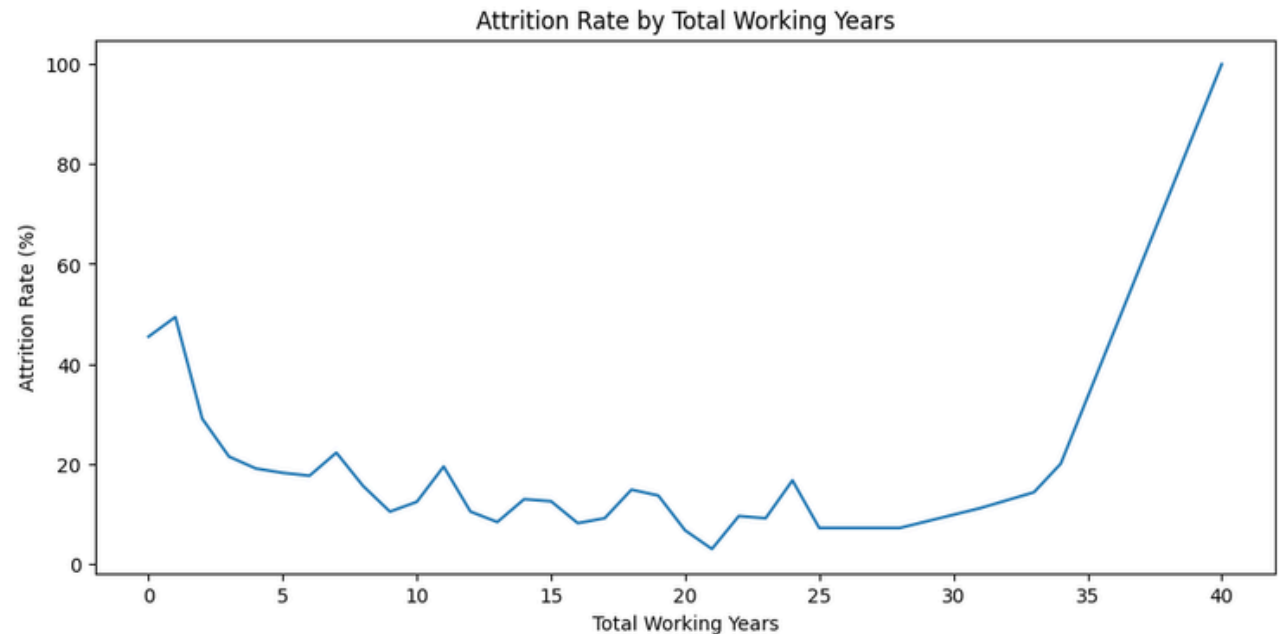
# How do age and years at the company together influence attrition rates?

- **Attrition is highest among new and young employees while it decreases significantly with age and years of service at the company.**

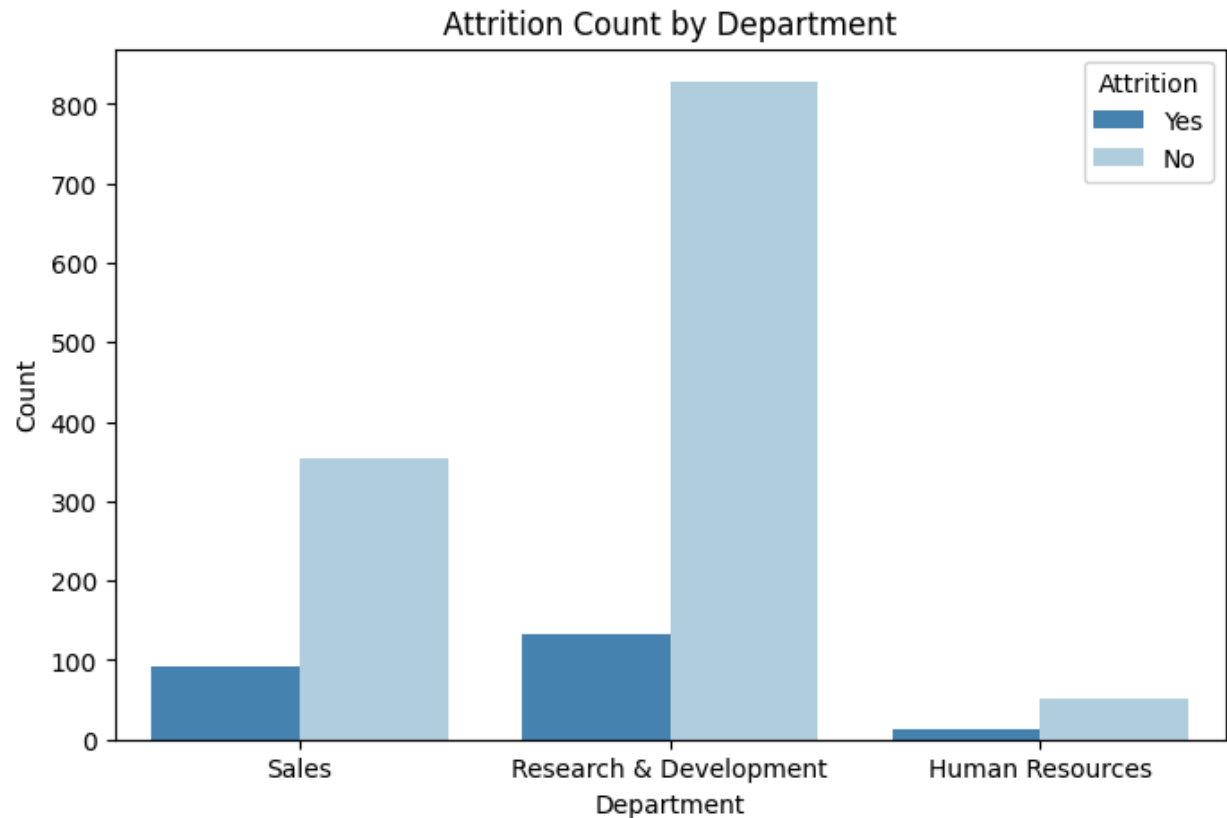


# How does total working experience influence employee attrition?

- **Attrition is highest among employees in their first 0–2 years, then steadily declines with more total working years.**



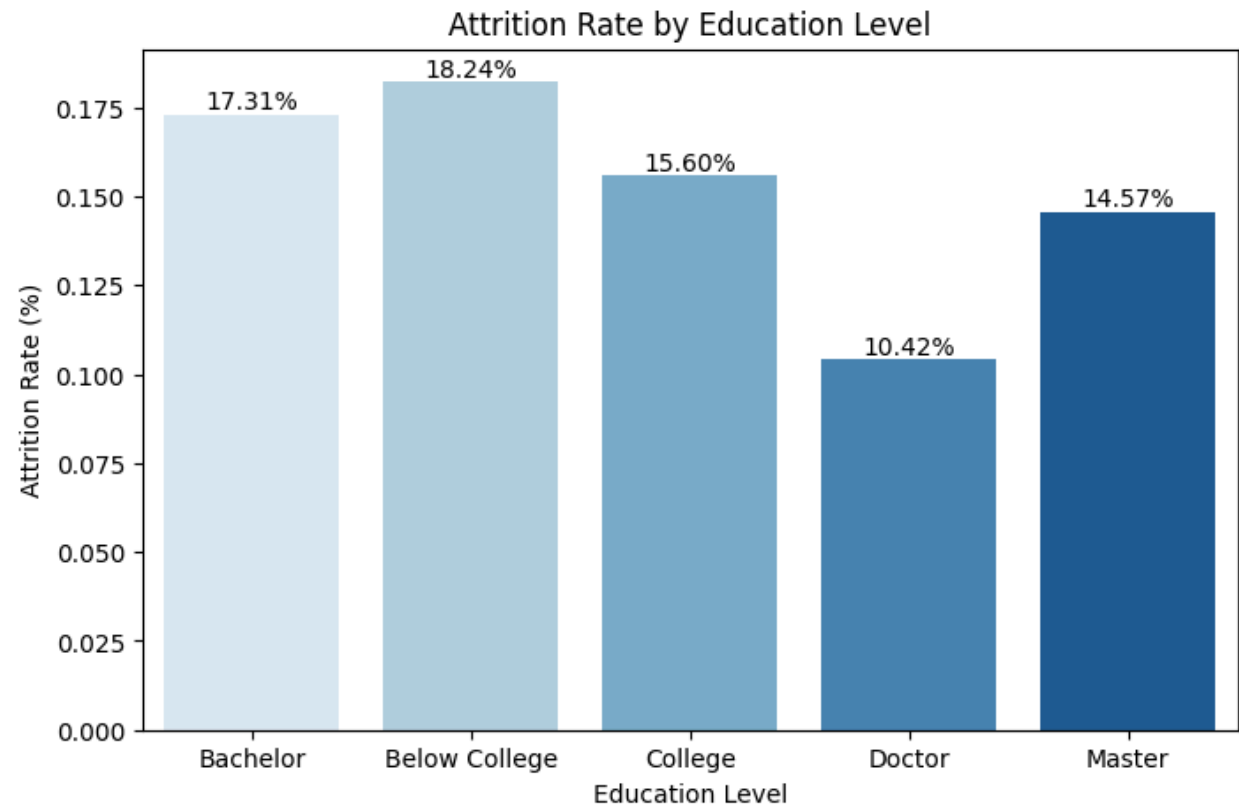
- **Attrition is highest in Sales (20.6%) according to the Sales department and has the lowest in Research & Development (13.8%).**





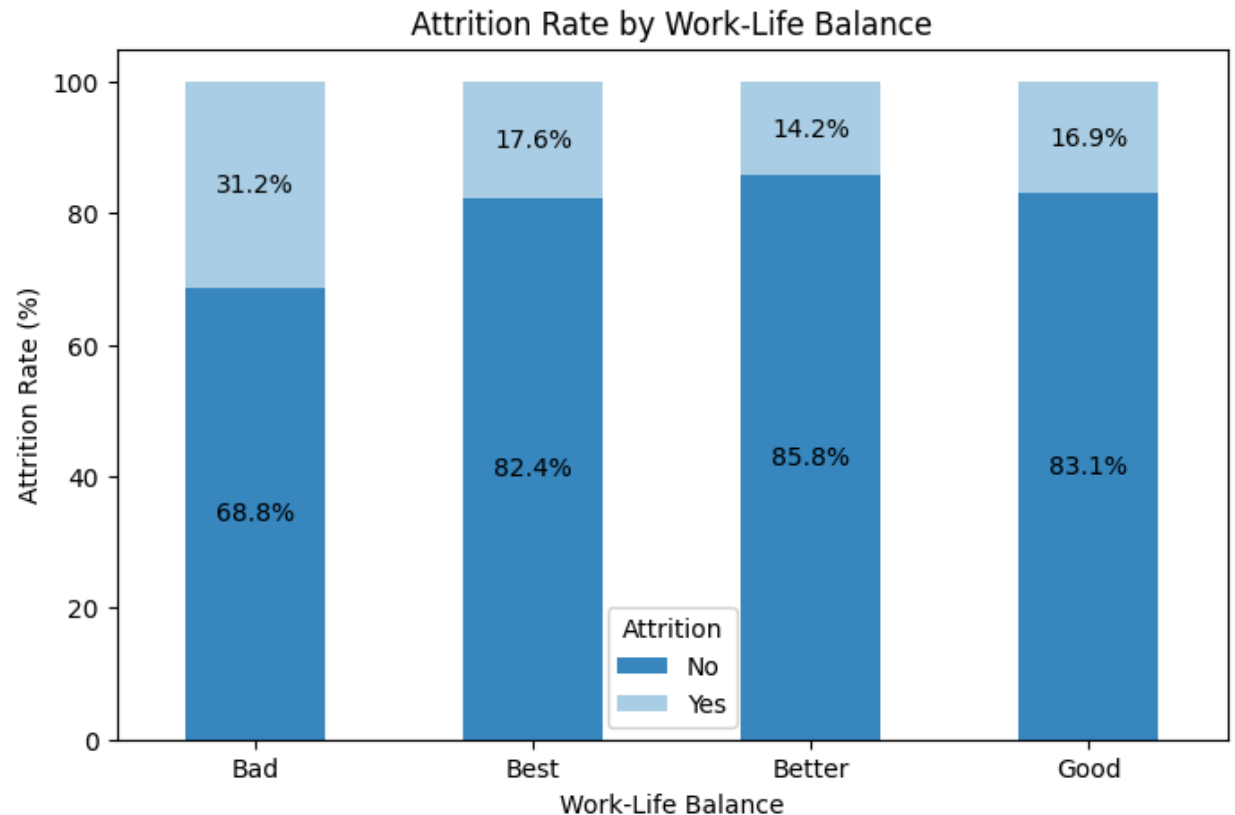
# Does education level influence employee attrition rates?

**Attrition is most common among employees with Below College and Bachelor's education levels, suggesting that higher education is associated with greater job stability."**



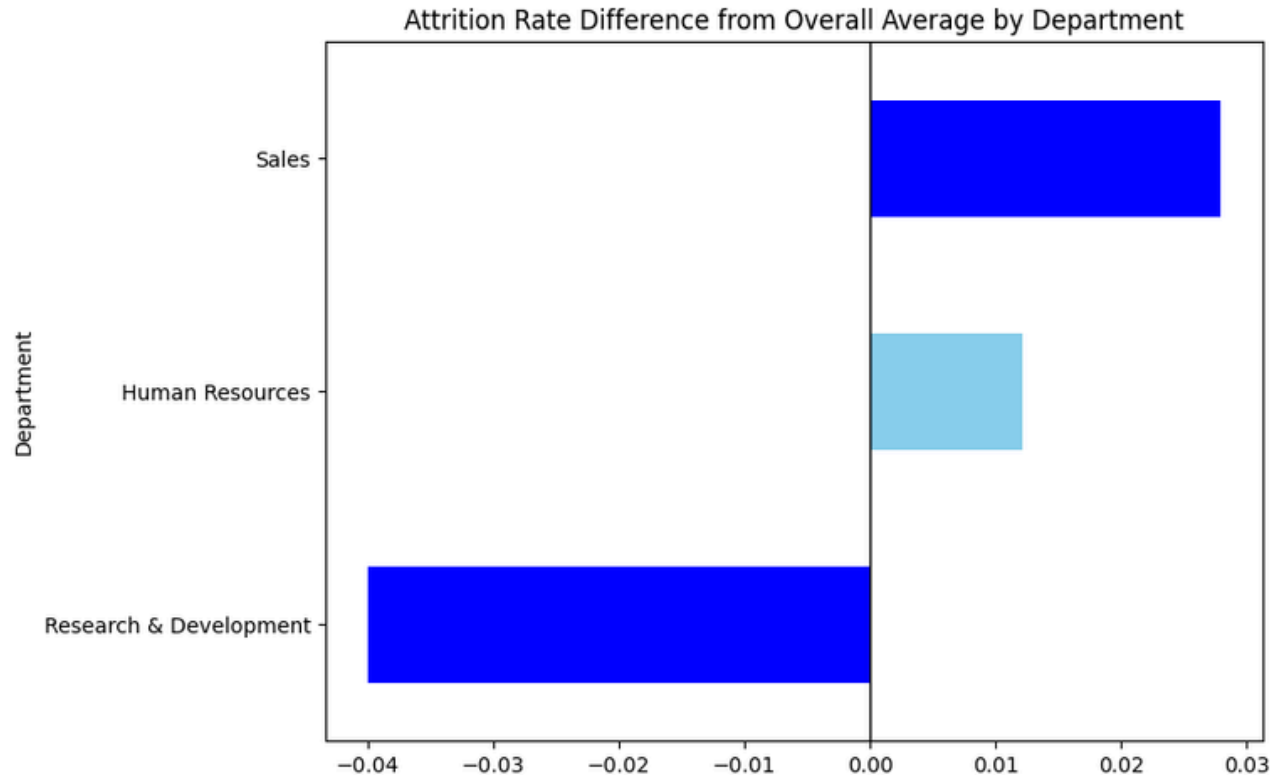
# How does work-life balance affect employee attrition?

**"Attrition is highest (31.2%) among employees with poor work-life balance, while those reporting better balance show much lower rates (14–18%), highlighting work-life balance as a key factor in retention."**



# Which departments experience higher or lower attrition compared to the company average?

**"Sales has the highest attrition rate above the company average, HR is slightly higher, while R&D is below average, indicating more stability in that department."**



# DahshBoard

## EMPLOYEE ATTRITION ANALYSIS DASHBOARD

Human Resources

Research & Development

Sales

Count of Employee

1470

Attrition

237

Attrition Rate

16.1%

Average Monthly Income

6.50K

Average Working Years

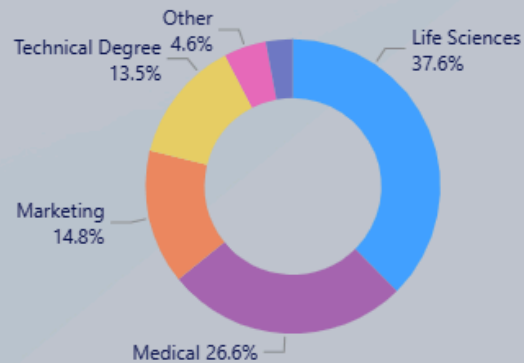
11.28

Distance From Home

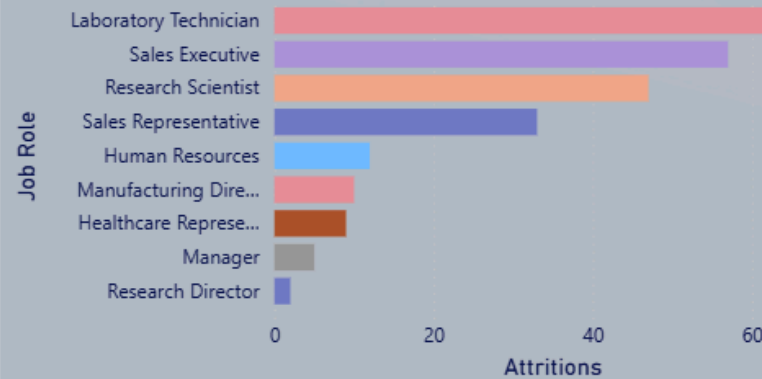
1

29

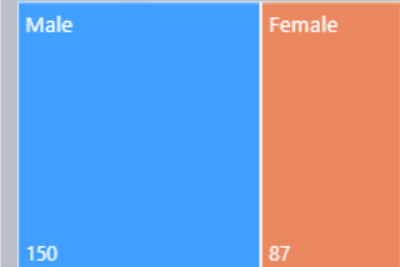
### Attrition Rates Across Different Education



### Attrition by Job Role



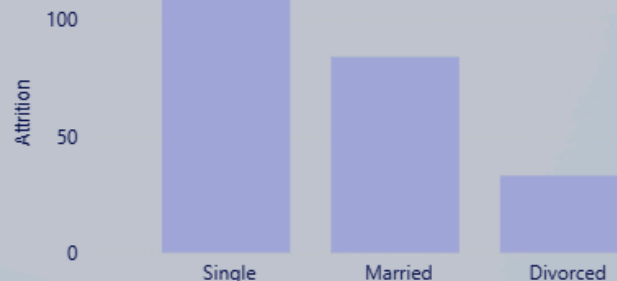
### Attrition by Gender



### Impact of Salary Increases on attrition



### Attrition Trends Across Marital Status



Age	Non-Travel	Travel_Frequently	Travel_Rarely	Total
18	1	2	1	4
19	1	1	4	6
20		2	4	6
21	0	2	4	6
22	0	2	3	5
23		1	3	4
24	0	2	5	7
25	0	1	5	6
26	1	4	7	12
27	0	1	2	3
28	1	3	10	14
Total	12	69	156	237



# Modeling and Evaluation

# Modeling & Class Imbalance Handling

- We applied models like **RandomForest** & **SVM** & **Logistic Regression**, and **XGBoost**, and then applying with each of them **GridSearch** and **RandomizedSearchCV** to get the best accuracy. Since it is **Unbalanced data**, we got:

```
Train Accuracy: 0.9122718052738337
Test Accuracy: 0.8503401360544217
Classification Report:
              precision    recall  f1-score   support

     0           0.85         1.00         0.92         247
     1           0.80         0.09         0.15          47

 accuracy                   0.85         294
 macro avg           0.83         0.54         0.54         294
 weighted avg        0.84         0.85         0.80         294
```

# Test & Evaluation & Class Imbalance Handling

Then we tried resampling techniques **SMOTEENN** and we apply on the same models , and we got this results :

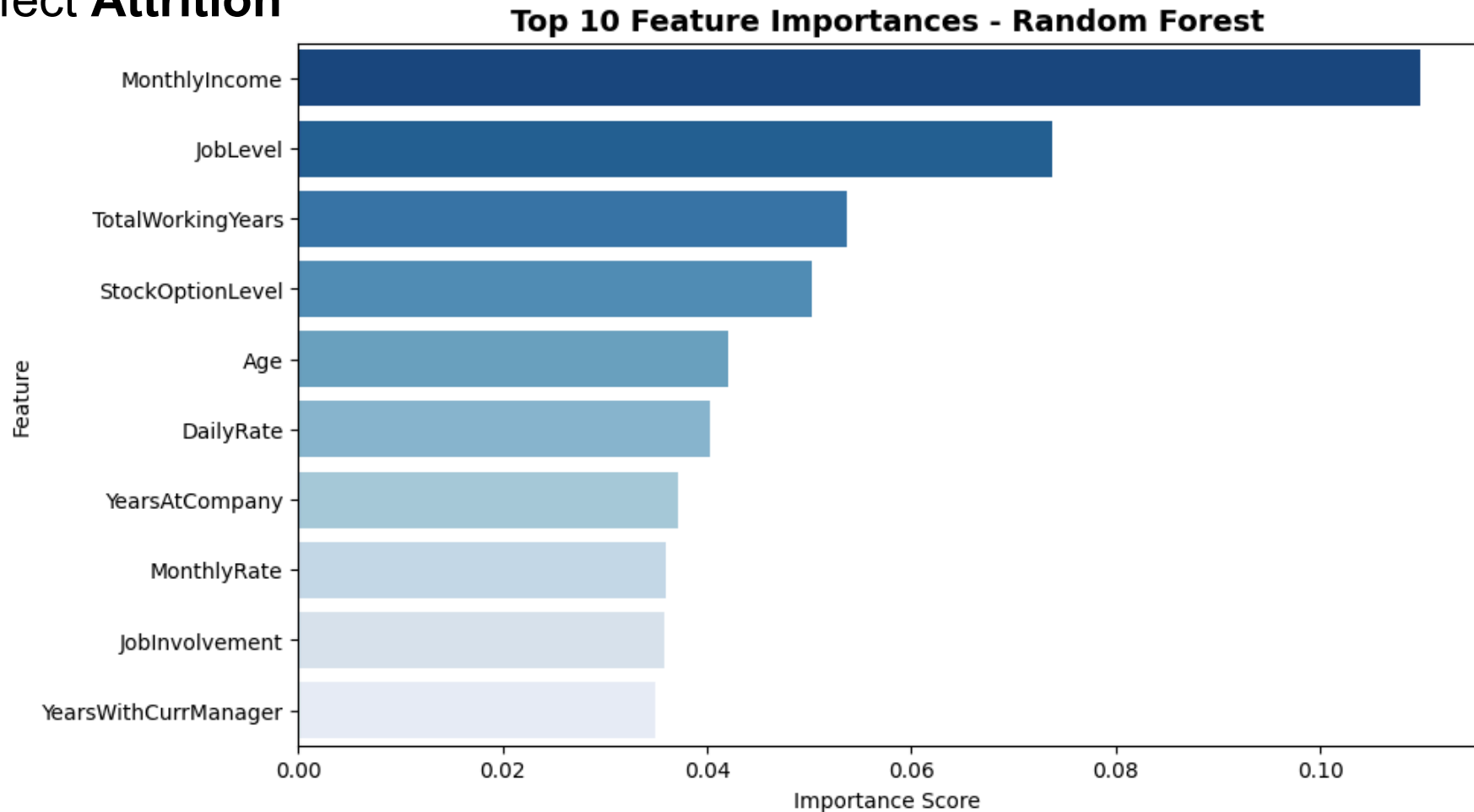
```
Train Accuracy: 0.9982949701619779
Test Accuracy: 0.9183673469387755
Classification Report:
              precision    recall  f1-score   support

     0           0.87       0.95       0.91         126
     1           0.96       0.89       0.93         168

 accuracy              0.92         294
 macro avg           0.92       0.92       0.92         294
weighted avg           0.92       0.92       0.92         294
```

# feature Importance

RandomForest is also used in Feature Selection, and the top 10 that affect **Attrition**

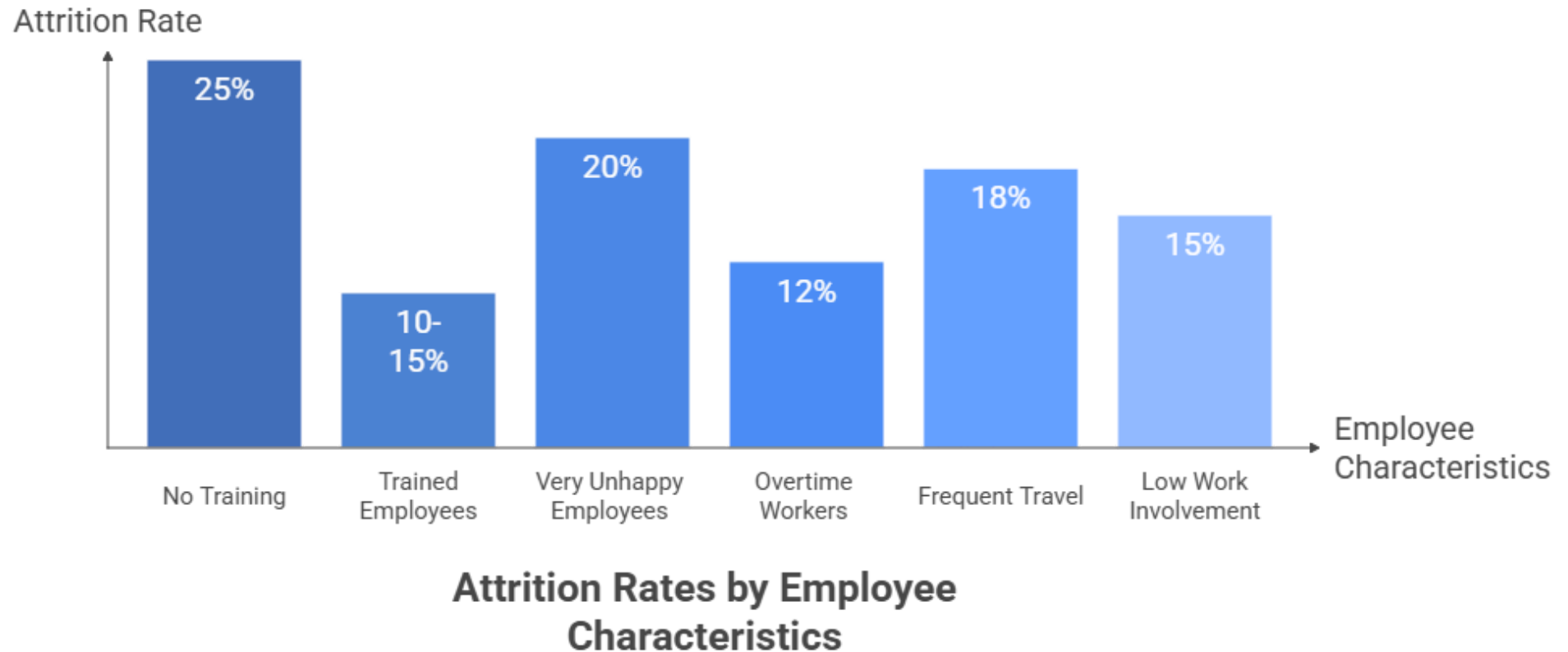






# Insights & summary

# Insights



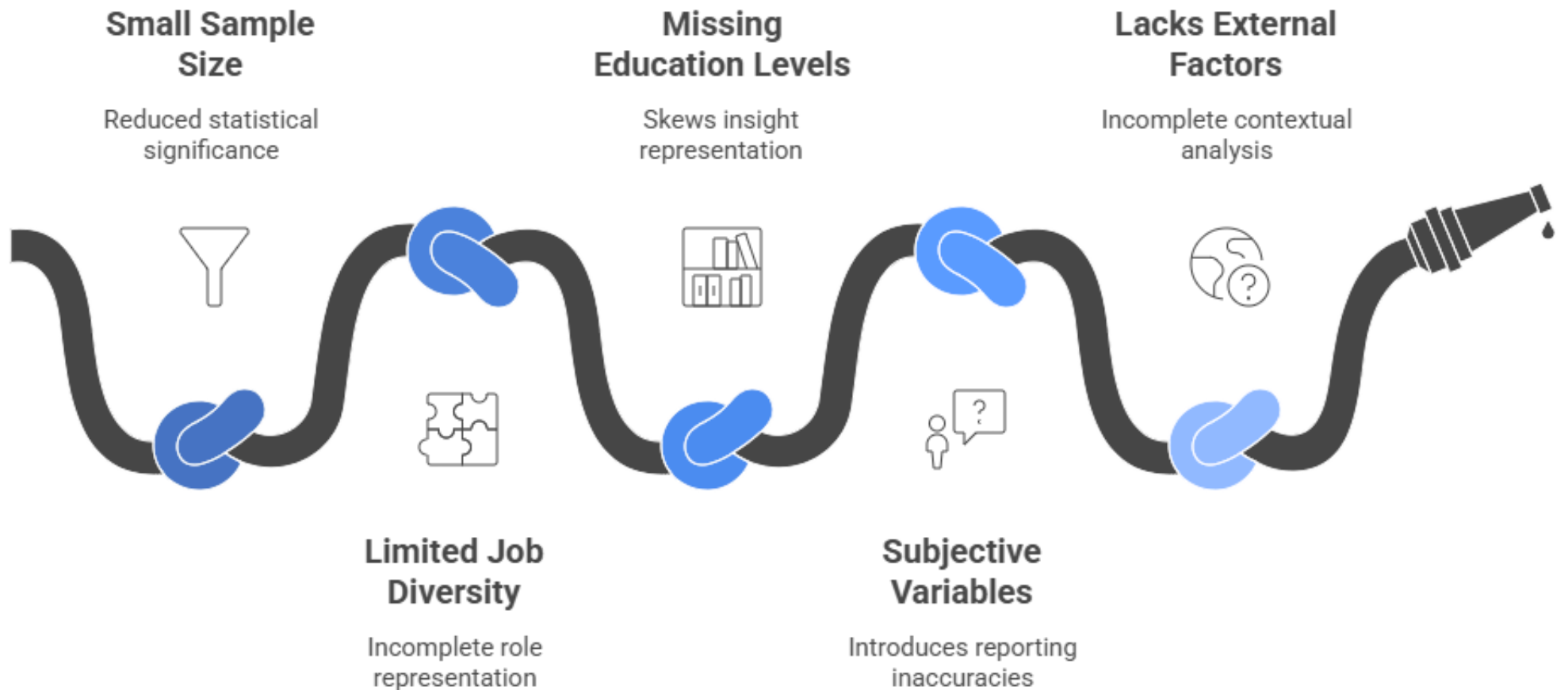
Made with Napkin



# Limitations

# limitations

## Addressing Data Limitations





# Demo

# Employee Attrition Predictor

Predict if an employee is likely to leave based on key factors.

Predict Attrition Risk

**High Attrition Risk** — This employee is likely to leave. Chance of leaving: 57.2%

## Prediction Probabilities

Stay: 0.43 | Leave: 0.57

### Employee Details

#### Personal & Commute

Age

21

Monthly Income

1000

Distance From Home (km)

39

#### Work Factors

Job Level

2

Percent Salary Hike (%)

7

Years With Current Manager

2

Number of Companies Worked

1

Total Working Years

5

**NoteBook Link :**

<https://www.kaggle.com/code/haneenmohammed13/hr-employee-attrition>

**Streamlit Link:**

<http://Employee-Attrition/>

**SAMSUNG**

**THANK  
YOU!**





Together for Tomorrow!  
**Enabling People**

Education for Future Generations

©2020 SAMSUNG. All rights reserved.

Samsung Electronics Corporate Citizenship Office holds the copyright of book.

This book is a literary property protected by copyright law so reprint and reproduction without permission are prohibited.

To use this book other than the curriculum of Samsung innovation Campus or to use the entire or part of this book, you must receive written consent from copyright holder.