



dataset: IBM | Kaggle.com

# Employee Attrition

PREDICTION | HR ANALYSIS

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# Employee Attrition



**WHAT IS ATTRITION  
| BUSINESS IMPACT**



**STAGES DATA ANALYSIS  
| MACHINE LEARNING PREDICITONS**



**CONCLUSION  
| HR STRATEGY**

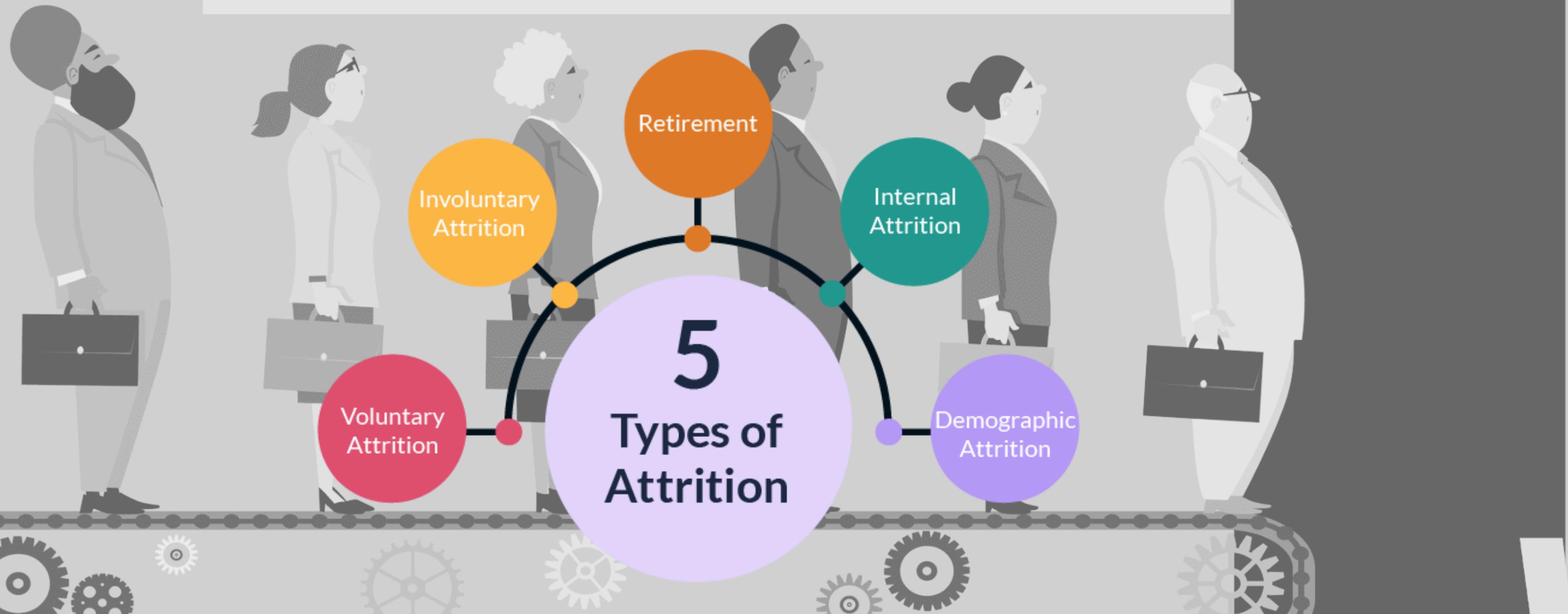




## WHAT IS ATTRITION | BUSINESS IMPACT

Employees leaving the workforce of an organization, which can occur through **voluntary** means like resignations and retirements, as well as **involuntary** actions such as terminations and layoffs.

EXIT





## WHAT IS ATTRITION | BUSINESS IMPACT



$$\text{Attrition rate} \quad (\%) = \frac{\text{number of employee departures}}{\text{average number of employees}} \times 100$$

### Factors impacting attrition

#### Internal factors



- Compensation
- Job satisfaction
- Learning & development

#### External factors



- Workforce demographics
- Industry shifts
- Economic conditions



## WHAT IS ATTRITION | BUSINESS IMPACT



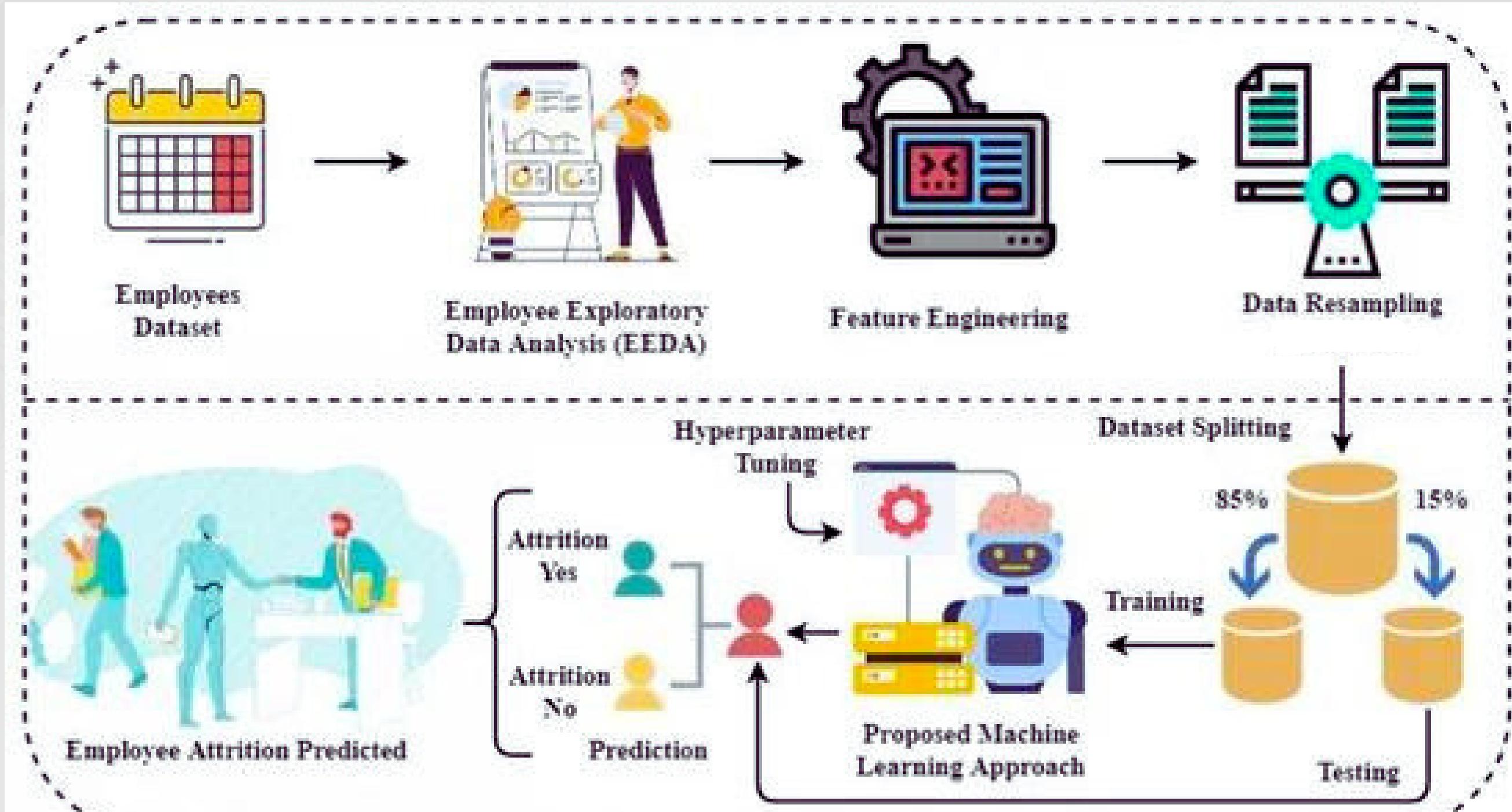
High attrition rates (**+20%**) can lead to:

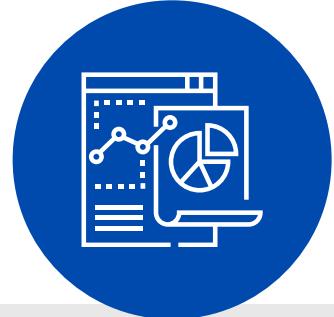
1. Knowledge and Skills Loss (Top Performers)
2. Recruitment & Onboarding
3. Legal and Compliance Cost
4. Productivity Loss (missing deadlines)
5. Company's Culture and Brand Image

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Estimated **average 10,000 - 20,000 Eur/\$**  
cost per employee ( usually per year)

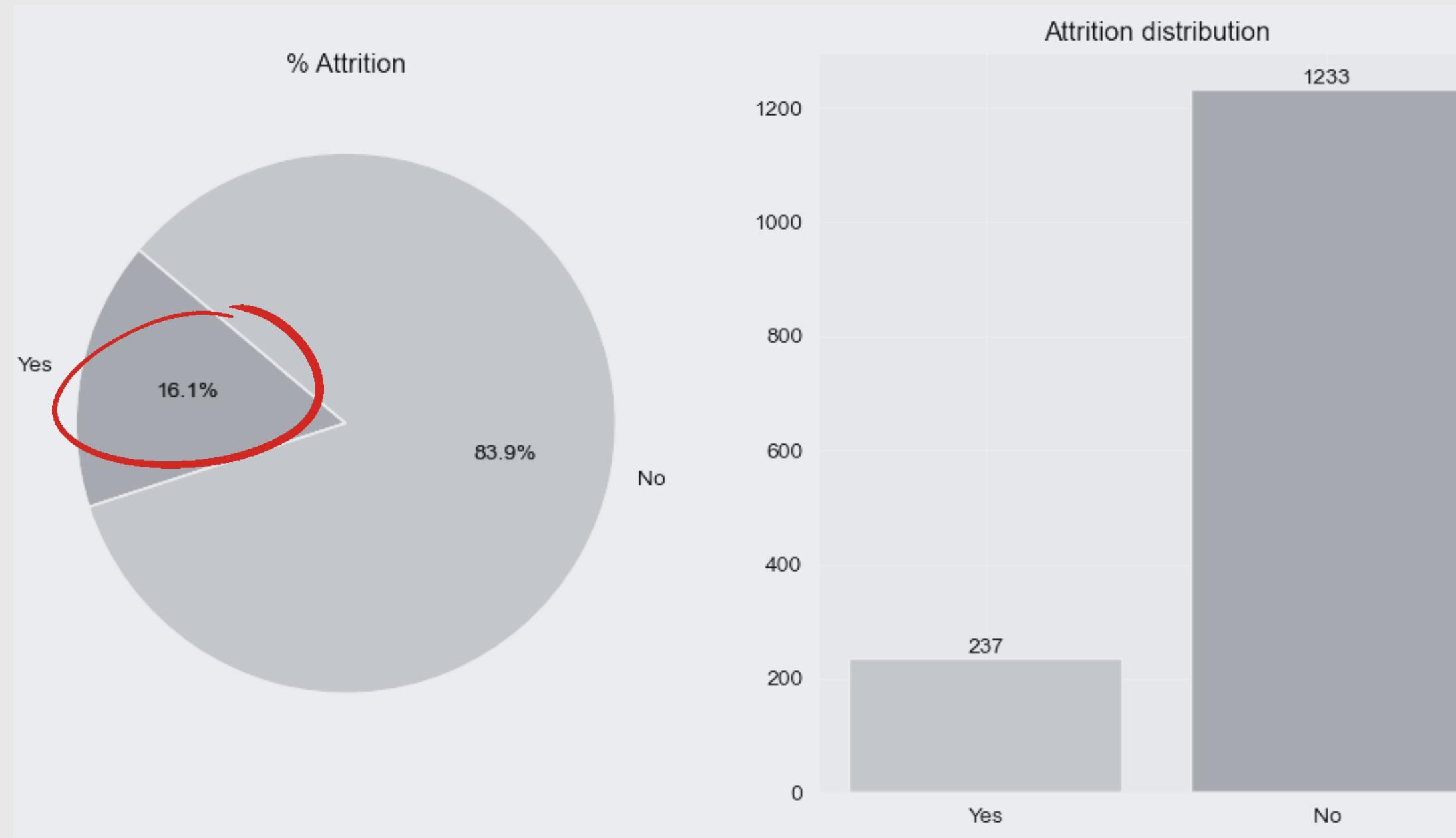
## STAGES DATA ANALYSIS | MACHINE LEARNING PREDICITONS



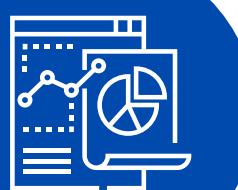


# Data Analysis – EDA

## Supervised Data | Class Imbalance



**1470 total**  
**16%**  
attrition  
**83% active**



# Attrition by Department

HR 63 | Sales 446 | R&D 961

HR **12** / 63 active -> **19%**

R&D **133** / 961 active -> 13%

Sales **92** / 446 active -> **20%**

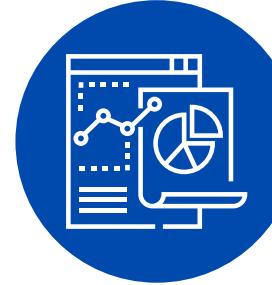
Attrition

No

Yes



**High attrition per department**



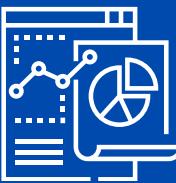
# Attrition by Job Role

Department	Job Role	Attrition	
		No	Yes
Human Resources	Human Resources	3,24% 40	5,06% 12
	Manager	0,89% 11	
Research & Development	Healthcare Representative	9,89% 122	3,80% 9
	Laboratory Technician	15,98% 197	26,16% 62
	Manager	4,14% 51	1,27% 3
	Manufacturing Director	10,95% 135	4,22% 10
	Research Director	6,33% 78	0,84% 2
	Research Scientist	19,87% 245	19,83% 47
	Manager	2,84% 35	0,84% 2
	Sales Executive	21,82% 269	24,05% 57
	Sales Representative	4,06% 50	13,92% 33



**High attrition  
job roles**

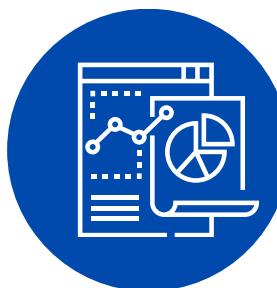
Labor. Technician  
Research Scientist  
Sales Executive



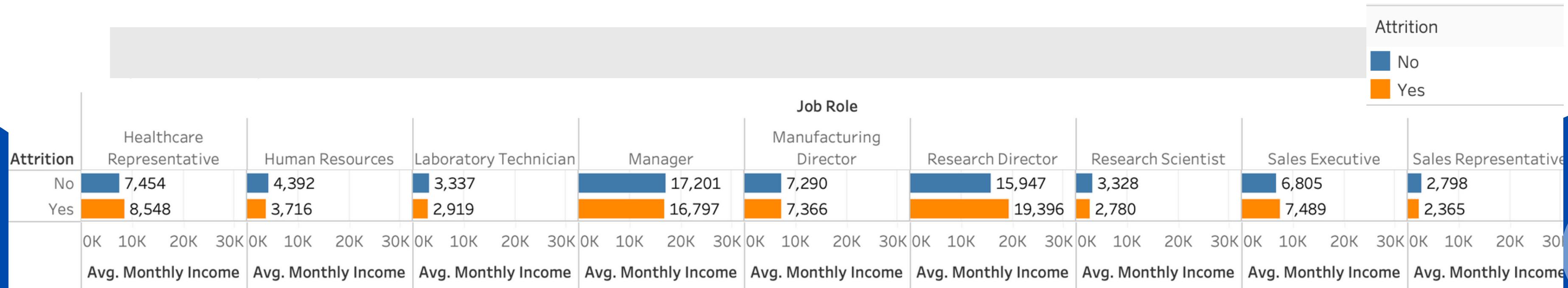
# Attrition by AVG Job Satisfaction & Performance Rating

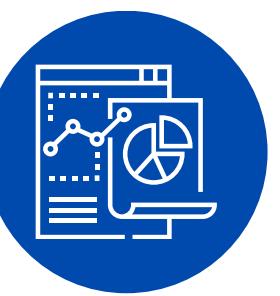


**1 'Low' 2 'Medium' 3 'High' 4 'Very high'**



# AVG Monthly Income by Job Role





# Feature Engineering

Preprocessing the data:

Feature selections:

One-Hot Encoding | KBest  
| StandardScaler





# ML Prediction Models

**Data resampling:**  
Random Oversampling |  
Unsampling | SMOTE

**Dataset Splitting:**  
80 % Train | 20% Test

**ML Model selection**

## ML Models

01

**Logistic Regression**

02

**Random Forest**

03

**K-Nearest Neighbors**



## CONCLUSION | HR STRATEGY

**KNN classifier with oversampling** demonstrates promising performance metrics, showcasing robustness in classifying employee attrition with **balanced precision** and **recall** scores.

**We could have identify in an early stage the 79% of our 237 attrited employees !**

Kappa Score in **TRAIN set**: **73%**

The expected accuracy of the model is **77%**

KNN Classifier - **TRAIN Resampled Data**:

	precision	recall	f1-score	support
No	0.98	0.75	0.85	978
<b>Yes</b>	<b>0.79</b>	<b>0.99</b>	0.88	978
<b>accuracy</b>	<b>0.87</b>		1956	



**! Save over \$1,870,000**  
(187 \*10K cost)

	KNN Classifier - <b>TEST Resampled Data</b> :			
	precision	recall	f1-score	support
No	0.87	0.68	0.76	255
<b>Yes</b>	0.14	0.33	0.19	39
<b>accuracy</b>				<b>0.63</b>
				294



## CONCLUSION | HR STRATEGY

01

### Exit interview

voluntary or involuntary?

Reasons for leaving ?

date started and finished employment?

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Work mode preference?

02

### Retain employees

Personalized L&D plans

Recognition & Rewards

review salaries vs market rate

Mentorship & Leadership

Work-life balance

Inclusive work environment

# Thank You

