

Project Title	IBM HR Analytics Employee Attrition & Performance
Tools	Python, ML, SQL, Excel
Technologies	Data Analyst & Data scientist
Project Difficulties level	intermediate

Dataset: Dataset is available in the given link. You can download it at your convenience.

Click here to download data set

# **About Dataset**

Uncover the factors that lead to employee attrition and explore important questions such as 'show me a breakdown of distance from home by job role and attrition' or 'compare average monthly income by education and attrition'. This is a fictional data set created by IBM data scientists.

#### Education

- 1 'Below College'
- 2 'College'
- 3 'Bachelor'
- 4 'Master'
- 5 'Doctor'

# EnvironmentSatisfaction 1 'Low' 2 'Medium' 3 'High' 4 'Very High'

## Joblnvolvement

- 1 'Low'
- 2 'Medium'
- 3 'High'
- 4 'Very High'

## **JobSatisfaction**

- 1 'Low'
- 2 'Medium'
- 3 'High'
- 4 'Very High'

## PerformanceRating

- 1 'Low'
- 2 'Good'
- 3 'Excellent'
- 4 'Outstanding'

## RelationshipSatisfaction

- 1 'Low'
- 2 'Medium'
- 3 'High'
- 4 'Very High'

## WorkLifeBalance

- 1 'Bad'
- 2 'Good'
- 3 'Better'
- 4 'Best'

<u>Example</u>		
what steps you should have to foll	<u>OW</u>	

# Sample code

# HR Attrition Analysis¶

In the business world, companies often face the challenge of retaining talented employees. One of the most pressing issues is the increasing rate of employee turnover, commonly known as HR attrition. Turnover can have a significant impact on a company's productivity, stability, and long-term sustainability. High attrition rates can lead to increased recruitment and training costs, disrupt team dynamics, and result in the loss of valuable institutional knowledge. Therefore, understanding the factors contributing to attrition and implementing effective retention strategies is crucial for maintaining a competitive edge and ensuring

Objectives of the Analysis

1. Understand Current Turnover Rates: Gain a comprehensive understanding of the current employee turnover rate and analyze the demographic distribution of attrition by age, gender, education, department,

- and job role.
- 2. Identify Key Factors Influencing Turnover: Examine the main factors contributing to employee attrition, including job satisfaction indicators (job involvement and work-life balance), salary factors (monthly income and salary hikes), and benefit factors (stock option levels), to uncover patterns and correlations that drive higher attrition rates.

## **Data Cleaning**

```
In [1]:
```

```
# import data manipulation package
import pandas as pd
import numpy as np

# import data visualization package
import matplotlib.pyplot as plt
import seaborn as sns

# importing the warnings library
import warnings
warnings.filterwarnings('ignore')
```

In [2]:

```
# set pandas options
pd.set_option('display.max_columns', 35)

# load dataset
df =
pd.read_csv('/kaggle/input/ibm-hr-analytics-attrition-dataset/WA_Fn-UseC_-HR-Employe
e-Attrition.csv')
df.head()
```

Out[2]:

_		)	
	4 9	4 1	
	Z 0	Y e s	
	Travel —Frequently	Travel -Rarely	a v e l
	2 7 9	1 1 0 2	
	Research & Development	0 a – e s	t
	8	1	m H o m e
	1	2	
	L i f e S c i e n c e s	L i f e S c i e n c e s	- e - d
	1	1	t
	2	1	
	3	2	sf ac tio n
	M a l e	F e m a l e	
	6 1	9 4	е
	2	3	m e n t
	2	2	
	ResearchScientist	SalesExecutive	
	2	4	c t i o n
	M a r r i e d	% : n g − e	t u s
	5 1 3 0	5993	o m e
	2 4 9 0 7	1 9 4 7 9	е
	1	8	W or ke d
	Y	Y	
	<b>Z</b> 0	Yes	
	2 3	1 1	a r y H i k e
	4	3	R a ti n g
	4	1	ac tio n
	8 0	8 0	u r s
	1	0	L e v e l
	1 0	8	n g Y e a r s
	3	0	a st Y e ar
	3	1	l ance
	1 0	6	p a n y

4	Э	
2 7	S S	
N o	0 Z	S
T r a v e l -R a r e		v e l R a r e l y
5 9 1	1 3 9 2	3
R e s e a r c h & D e	D e	e a r c h & D e v e I o p m e n t
2	J	
1	4	
M e d i c a l	Lifeのciesceの	e r
1	1	
7	5	
1	4	
M a l e	F e m a l e	е
	5 6	
3	3	
1	1	
L a b o r a t o r y T	Research Oc-ent-st	or a t or yT e c h n i c i a n
2	3	
M a r r i e d	M a r r i e d	g - e
		0
1 6 6 3 2	23159	6
9	1	
Υ	Υ .	
N o	s e 🖈	S
1 2	1 1	
3	ധ	
4	3	
8 0	8 0	
1	0	
6	æ	
3	3	
3	ß	
2	8	

y e l o p m e n t	e c h n i c i a n		
# check data shape df.shape			In [3]:
			Out[3]:
(1470, 35)  The output indicates that the DataFra	ame has 1,470 rows and	d 35 columns.	
# check number of dupliacted print(f'Number of duplicate		cated().sum()}')	In [4]:
Number of duplicated data:	0		
<pre># check missing values df.isnull().sum() / len(df)</pre>	* 100		In [5]:
	0.0		Out[5]:
Age Attrition BusinessTravel DailyRate Department	0.0 0.0 0.0 0.0 0.0		

DistanceFromHome Education EducationField EmployeeCount EmployeeNumber EnvironmentSatisfaction Gender HourlyRate JobInvolvement JobLevel JobRole JobSatisfaction MaritalStatus MonthlyIncome MonthlyRate NumCompaniesWorked Over18 OverTime PercentSalaryHike PerformanceRating RelationshipSatisfaction StandardHours	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
PerformanceRating	0.0
RelationshipSatisfaction	0.0

dtype: float64

There are any missing values in the dataset.

In [6]:

# check data types
df.dtypes

Out[6]:

Age int64
Attrition object
BusinessTravel object
DailyRate int64
Department object

DistanceFromHome	int64
Education	int64
EducationField	object
EmployeeCount	int64
EmployeeNumber	int64
EnvironmentSatisfaction	int64
Gender	object
HourlyRate	int64
JobInvolvement	int64
JobLevel	int64
JobRole	object
JobSatisfaction	int64
MaritalStatus	object
MonthlyIncome	int64
MonthlyRate	int64
NumCompaniesWorked	int64
Over18	object
OverTime	object
PercentSalaryHike	int64
PerformanceRating	int64
RelationshipSatisfaction	int64
StandardHours	int64
StockOptionLevel	int64
TotalWorkingYears	int64
TrainingTimesLastYear	int64
WorkLifeBalance	int64
YearsAtCompany	int64
YearsInCurrentRole	int64
YearsSinceLastPromotion	int64
YearsWithCurrManager	int64

dtype: object

All columns have appropriate data types, ensuring that the data is correctly formatted for analysis.

In [7]:

# check data decribe
df.describe()

Out[7]:

	D	Di	Е	E	E	En	Н	J	J	J	М	М	Nu	Р	Р	Re	8	s	Т	Tr	W	Y	Y	Ye	Ye
g	a	st	d	m	m	vir	o	o	o	o	o	o	m	er	er	lati	t	t	ot	ain	o	e	e	ars	ars
g	i	a	u	p	pl	on	u	b	b	b	n	n	Co	c	fo	on	a	o	al	ing	r	a	ar	Sin	Wit

	e 1 1 4	I y R a t e	nc e Fr o m H o m e	c a t i o n	I o y e e C o u n t	o y e e N u m b er	me ntS atis fac tio n	r I Y R a t e	I n v o l v e m e n t	L e v e l	S a ti s f a c ti o n	t h l y l n c o m e	t h l y R a t e	mp ani es Wo rke d	e nt S al ar y H ik e	r m a n c e R at in g	shi pS ati sfa cti on	n d a r d H o u r s	c k O p ti o n L e v el	W or ki n g Y e ar s	Ti me sL ast Ye ar	k L if e B a I a n c e	rs A t C o m p a n y	sl n C ur re nt R ol e	ceL ast Pro mo tion	
c o u n t	7 0 . 0 0 0 0 0 0	7 0 . 0 0 0 0 0 0	4 7 0. 0 0 0 0 0	7 0 . 0 0 0 0 0 0	1 4 7 0	4 7 0. 0 0 0 0 0	14 70. 00 00 00	7 0 . 0 0 0 0 0 0	7 0 0 0 0 0 0 0 0	7 0 . 0 0 0 0 0 0	7 0 0 0 0 0 0	7 0 0 0 0 0 0 0 0	7 0 0 0 0 0 0	14 70. 00 00 00	4 7 0. 0 0 0 0 0	4 7 0. 0 0 0 0 0	14 70. 00 00 00	1 4 7 0 0	7 0 . 0 0 0 0 0 0	4 7 0. 0 0 0 0 0	14 70. 00 00 00	7 0 0 0 0 0 0	7 0 0 0 0 0 0	4 7 0. 0 0 0 0 0	14 70. 00 00 00	- (
m e a n	3 6 . 9 2 3 8 1 0	8 0 2 4 8 5 7 1 4	9. 1 9 2 5 1 7	2 . 9 1 2 9 2 5	1 . 0	1 0 2 4. 8 6 5 3 0 6	2.7 21 76 9	6 5 . 8 9 1 1 5 6	2 7 2 9 9 3 2	2 . 0 6 3 9 4 6	2 7 2 8 5 7 1	6 5 0 2 9 3 1 2 9 3	1 4 3 1 3 1 0 3 4 0	2.6 93 19 7	1 5. 2 0 9 5 2 4	3. 1 5 3 7 4	2.7 12 24 5	8 0	0 . 7 9 3 8 7 8	1 1. 2 7 9 5 9 2	2.7 99 32 0	2 7 6 1 2 2 4	7 0 0 8 1 6 3	4. 2 9 2 5 2	2.1 87 75 5	
s t d	9 . 1 3 5 3 7 3	4 0 3 5 0 9 1 0	8. 1 0 6 8 6 4	1 . 0 2 4 1 6 5	0 . 0	6 0 2 0 2 4 3 3 5	1.0 93 08 2	2 0 3 2 9 4 2 8	0 7 1 1 5 6	1 . 1 0 6 9 4 0	1 1 0 2 8 4 6	4 7 0 7 9 5 6 7 8	7 1 1 7 7 8 6 0 4	2.4 98 00 9	3. 6 5 9 9 3 8	0. 3 6 0 8 2 4	1.0 81 20 9	0 . 0	0 8 5 2 0 7	7. 7 8 0 7 8 2	1.2 89 27 1	0 7 0 6 4 7 6	6 . 1 2 6 5 2 5	3. 6 2 3 1 3 7	3.2 22 43 0	;

		1													l		l	1	I	l			<u> </u>			
		0										3	4													
m i n	1 8 0 0 0 0	1 0 2 0 0 0 0	1. 0 0 0 0	1 . 0 0 0 0 0 0	1 . 0	1. 0 0 0 0	1.0 00 00 0	3 0 . 0 0 0 0 0 0	1 . 0 0 0 0 0 0	1 . 0 0 0 0 0 0	1 . 0 0 0 0 0 0	1 0 9 0 0 0	2 0 9 4 0 0 0 0	0.0 00 00 0	1 1. 0 0 0 0	3. 0 0 0 0	1.0 00 00 0	8 0	0 . 0 0 0 0 0 0	0. 0 0 0 0	0.0 00 00 0	1 . 0 0 0 0 0 0 0	0 . 0 0 0 0 0 0	0. 0 0 0 0	0.0 00 00 0	0.0 00 00 0
2 5 %	3 0 . 0 0 0 0 0	4 6 5 0 0 0 0	2. 0 0 0 0 0	2 . 0 0 0 0 0 0	1 . 0	4 9 1. 2 5 0 0 0	2.0 00 00 0	4 8 . 0 0 0 0 0	2 . 0 0 0 0 0	1 . 0 0 0 0 0 0	2 . 0 0 0 0 0 0	2 9 1 1 0 0 0 0	8 0 4 7 0 0 0 0	1.0 00 00 0	1 2. 0 0 0 0	3. 0 0 0 0	2.0 00 00 0	8 0	0.00000	6. 0 0 0 0	2.0 00 00 0	2 . 0 0 0 0 0 0	3 . 0 0 0 0 0 0 0	2. 0 0 0 0	0.0 00 00 0	2.0 00 00 0
5 0 %	3 6 . 0 0 0 0 0	8 0 2 0 0 0 0	7. 0 0 0 0 0	3 . 0 0 0 0 0	1 . 0	1 0 2 0. 5 0 0 0 0 0 0	3.0 00 00 0	66.00000	3 . 0 0 0 0 0	2 . 0 0 0 0 0 0	3 . 0 0 0 0 0	4 9 1 9 0 0 0 0	1 4 2 3 5 · 5 0 0 0 0 0	2.0 00 00 0	1 4. 0 0 0 0	3. 0 0 0 0	3.0 00 00 0	8 0	1 . 0 0 0 0 0 0	1 0. 0 0 0 0	3.0 00 00 0	3 . 0 0 0 0 0 0	5 . 0 0 0 0 0 0	3. 0 0 0 0	1.0 00 00 0	3.0 00 00 0
7 5 %	4 3 0	1 1 5 7	1 4. 0 0	4 0 0	1 . 0	1 5 5 5. 7	4.0 00 00	8 3 7 5	3 . 0 0	3 0 0	4 . 0 0 0	8 3 7 9	2 0 4 6 1	4.0 00 00	1 8. 0 0	3. 0 0 0	4.0 00 00	8 0	1 0 0	1 5. 0 0	3.0 00 00	3 0 0	9 . 0 0	7. 0 0 0	3.0 00 00	7.0 00 00

	0 0 0 0	0 0 0 0 0	0 0 0	0 0 0		5 0 0 0	0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0 0 0	5 0 0 0 0	0	0 0 0	0	0	0	0 0 0	0 0 0	0	0 0 0	0 0 0	0	0	0
m a x	0	1 4 9 9 . 0 0 0 0 0 0	2 9. 0 0 0 0 0	5 . 0 0 0 0 0	1 . 0	2 0 6 8. 0 0 0 0	4.0 00 00 0	1 0 0 . 0 0 0 0 0	4 . 0 0 0 0 0 0 0	5 . 0 0 0 0 0	4 . 0 0 0 0 0 0	1 9 9 9 0 0 0	26999.00000	9.0 00 00 0	2 5. 0 0 0 0 0	4. 0 0 0 0 0	4.0 00 00 0	8 0 . 0	3 . 0 0 0 0 0	4 0. 0 0 0 0	6.0 00 00 0	4 . 0 0 0 0 0 0	4 0 . 0 0 0 0 0 0	1 8. 0 0 0 0	15. 00 00 00	17. 00 00 00

Based on this summary, there are no apparent outliers in the dataset, as the values fall within expected ranges.

# **Exploratory Data Analysis**

In [8]:

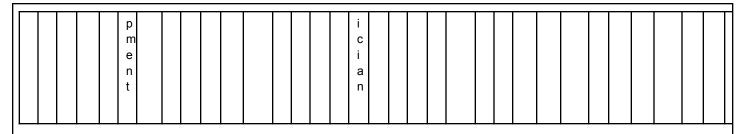
df.head()

Out[8]:

, , Q	DailyRate	D e p a r t m e n t	DistanceFromHom	E d u c a t i o n	EducationFiel	E m p l o y e e C o u n	E m p l o y e e N u m b e	E nv ir o n m e nt S ati sf ac tio	G e n d e r	0	b I n v o I v e	JobLevel	J о b R о l е	J o b S a t i s f a c t i o	M arital S tatu	M o n t h I y I n c o m	M o n t h l y R a t e	N u m C o m p a ni es W or ke	O v e r 1 8	v e r T	c e n t S	P e ff o r m a n c e R a ti n	R el ati o ns hi p S ati sf ac tio	S t a n d a r d H o u r	S t o c k O p ti o n L e v e	T o t a I W o r k i n g Y e	Tr ain g Ti m e s L a st Y e	W o r k L i f e B a l a n c	Y e a r s A t C o m p a n	
	BusinessTrave	U s i n e s s T r a v	D e p a r t m e n t D a i I y R a t e	B u s i n e s s T r a v e	Education is tanceFromHo Department DailyRate	Education Fiel Department O MH o Daily Rate	E d u c a t i o n F i e l E d u c a t i o n F i e l E d u c a t i o n F i e l D e p a r t m e n t D a i I y R a t e D a s i n e s s T r a v e	E m p l o y e e N u m b e  E d u c a t i o n F i e l  E d u c a t i o n F i e l  D e p a r t m e n t  D a i l y R a t e  v e	E m p l o n m e nt S ti f ac l l l l l l l l l l l l l l l l l l	Gender Stii sis t a p n o n m e n d e r l e s s T r e e l l e l e l e l e l e l e l e l e	B u s i i n e s s i n e s s T r a v e	HourrlyRate  E m pronmet at e men  D e a r t m e N y e e N u ati f e n t H o u n e tio	Joble E E N N ir O N M e e N U S i N e e N U S ati e e M e n t M e e n e n e n e n e e n e n e e n e n	Job Level  Emplopmir on mercation on Finer on Finer on Houles  Strane on Finer on Houles  Strane on Finer on Houles  From Houles  From Plob Role  From Plob Role  From Plob Role  From Houles  Strane on Finer on Houles  From Hou	O b S a t i s f a C t i s f a C t i s f a C t i s s T r a v e e C o u n e t o n t e u n e l o v e e l v e l v e l v e l v e m e n t e l v e l v e l v e l v e m e n t e l v e l v e l v e l v e l v e l v e m e n t e l v e l	M a r i t a I S t a t u  J o b S a t i s f a c t i  J o b I n v o I v e I  H o u r I y R a t e m e n  G e n d e r  E m p I o y e e N u m b e e  E d u c a t i o n F i e n  D e p a r t m e n t  D a i I y R a t e  D a i I y R a t e  I o m b e  S s T r a v e	B u s is t e E E M nv n d o b R o I e e I I y I n c o m sf a t e n t e m e I o m e tio	M M O n t h I y R a t e  I D e p a r c e F N u m b a r i t m e s s T r a v e  B u s i n e s s T r a v e  O M M M O n t h I y I n c o m  M M O n t h I y I n c o m  M M O n t h I y I n c o m  M M O n t h I y R a t e  I D O D O D I	B u s i i c e e n d u c a t i o n f a a i es worke e e n t f a e n t f a v e e n t o m h ac v e e l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n b ac v e e m e n l u n e	B u s i i c e e nt r a i e e n e e n t r a v e e n t r a v e e n t r a v e e n e n e tio e e n e e e n e e e e n e	B u s is t E E E M nv ir G O V e r T i M O O V e r T i M O O V e r T i M E B C O V e r T i M E S S T t e e N S S T t e e n e e tio o n e tio o n e e e n e e e n e e e n e e e n e e e n e e e n e	B u s i i c e nt s s i n e s s r t e e nt s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t s s r t e e n t r a v e e r r r e e r r r r e e r r r r e e r r r r e e r r r r e e r r r r e e r r r r e e r r r r e e r r r r e e r r r r e e r r r r e e r r r r e r r r e r r r e r r r e r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r r r r e r	B u s i i c e e ff o r m a n c e e ff o r m a n c e e ff o r m a n c e e n t s s i n c e e n t i o n c e n t t t o e e n t t t o m e tio e n t t e e m t t e e m t t e e m t t e e m t t e e n t t e e m t t t e e m t t e e m t t t e e m t t t e e m t t t e e m t t t e e m t t t e e m t t t e e m t t t e e m t t t e e m t t t e e m t t t e e e m t t e e m t t t e e m t t t e e m t t t e e m t t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t t e e m t e e e m t t e e e m t t e e e m t e e e m t e e e m t e e e e	B u s i i c e e nt r a i e e nt r a a e n t e e n n n o n n i u b ac r a v e e n n t o n n i e e n n e tio e n n e tio e n n e e n n e e n n e e n e e n e e n e e n e e n e e n e e n e e n e e n e	B u s i i D e e n c e e R E E m nv ir O v e e n t a n o d a r t h l l y R a i e e n t o n o h i e e n t o n o h i e e n t o n o h e s s f a a c u u y R a e e n t o n o h e tio r a v e e n t t o n o h e tio r a v e e n t t o n o h e tio r a v e e n t t o n o h e tio r a v e e n t t t t u m v e e n t t t t t t t t t t t t t t t t t	B u s is t E E E M nv   J o o M M M o n u m C o ati a c c o o ati a c c o o o ati a c c o o o ati a c c o o o o o o o o o o o o o o o o o	B u s i i D i is t a i D e e a a i i a o y m d d y o i i o a i i o e e n t o a i i o e e n t o a t i o e e n t o a t i o e e n t o a t i o e e n t o e e n o e e n t o e e n t o e e n t o e e n t o e e n t o e e n t o e e n t o e e n t o e e n t o e e n t o e e n t o e e n t o e e n o e e e n t o e e e n t o e e n t o e e n t o e e n t o e e e n t o e e e n t o e e e n t o e e e n t o e e e n t o e e e n o e e e n t o e e e n t o e e e e n t o e e e n t o e e e e n t o e e e e n t o e e e n t o e e e e n t o e e e e n t o e e e e n	B u s is c E E E M nv p ir o b b a o o n C o ati a c a a n g c a a i a c a a n g c a a i a c a a n g c a a i a c a a n g c a a i a c a o y m d y o e e n m ns d o o w e r t t a a l l l p a a c c a a i e e n t y e e e nt r a e e n t o e e n t e e m s t t e e m t n c a t t e e m t n e t n n e t o m s f e e m s t u b ac v e e m w s f v e e n m s f v e e n m s f v e e n m s f v e e n m s f v e e n m s f v e e n m m s f v e e n m m s f v e e m t t t o e e w y ti tio r v y y y y y y y y y y y y y y y y y y	B u D is E E E M nv   H O D e t d u D P I O O N M M O O N O O V C O O Ati A C A O O W Ti I I O O O O O O O O O O O O O O O O O	B u s is c E E E M nv p ir o b o M M M N u c c a a i o c a a n n k I o c a a i o c a a n n k I o c a a i o c a a n n k I o c a a i o c a a n n k I o c a a i o c a a i t t h h h m c c a a i o c a a i t t h h l m c c a a i o c a a i v y e e e nt r a u c a o y y m d y y o e e n m ns d o o w m f a a c c a a n n f t c o m y R a i o e e nt r a t e e m r o n f o o m sf b a c c a a c e e m t t e e m t t t o o e o r a a a c u u e g st a a c v e e m t t u m b ac v e e m w sf o o m p a n e fio e e
		a i l y R a t	e part men	D e p a r t m e n t o m H o	Education  istanceFromHo  Department  pailyRate	EducationFiel Education Department DailyRate	E d u c a t i o n F i e l E d u c a t i o n F i e l D a i l y R a t e D a i l y R a t e	E m p l o y e e N u m b e E m p l o y e e N u m b e e C o u n r t m e n t e l e l e l	D a i is t a a n c e e R u m p l o n m e nt S ti f a c e l l y R a t e n t e l l e l	Gender E E NV ir on ment Stii fac i on F i e n t e l t e l e l e l e l e l e l e l e l	D a i l y R a t e l l l y R a t e l l l y R a t e l l l l l l l l l l l l l l l l l l	HourlyRate Departon D	J o b I n v o I v e H o u r t m p I o n m o n o n o n o n o n o n o n o n o	Job Role  E m ployRate E m ployRate E m ployRate E m ployRate E ducation ployRate E nv e e N u stist o n F i e n t e n t o n e e n e n	O b S a t i s f a C t i  D a i I V R a t e n  D a i I V R a c r  D a i I V	O b S a t i t a I S t a t u  J O b I n v O I v e I  H O u r I y R a t e  E m p I O y e e N u m b e  E d u c a t i o n F i e n  D e p a r t F r O m  H O u r I y R a t e  E d u c a t i o n F i e n  D e p a r t m e n t  D e p a r t m e n t  O b S a t i i o n F i e n  D e p a r t m e n t  O b S a t i i o n F i e n  D e p a r t m e n t  O b S a t i i o n F i e n  O c e F r O m  H O u r I y R a t e  O c e n d e r  E d u c a t i o n F i e n  O c e F r O m  H O u r I y R a t e  O c e n d e r  O c e n d e	D e is t e e nt r e e n t e e n t e e n t e e n t e e n t e e n t e e n t e e n t e e n e n	M M O n t h I y R a t e  E m p I O b L e v e I  B d u c a t i o n F i e n t  D a i I y R a t e  D a r t m e n t  H O u r I y R a t e  E d u c a t i o n F i e n t  H O u r I y R a t e  D e p a r t m e n t  H O u r I y R a t e  E m p I O y e e N u ati t a c t u u  D a i I y R a t e  I y R a t e  I y R a t e  I o n b L e v e I  I y R a t e  I u b acc  I u u u u u u u u u u u u u u u u u u	D a i I y R a i es W or ke l l o l l l l l l l l l l l l l l l l	O v e r 1 8  D e p n c c t y e e n t c o m p a i es W or ke  D a i l r t e m e n t e n e n	O v e r T i m e n t H o l l y R a i e s w or ke l l u m l v l e l l u m l v l e l l u m l w sf e l l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l e m l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l e m l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e e m l l v l e e m l e l u m l v l e e m l e l u m l v l e e m l e l u m l v l e e m l e l u m l v l e e m l e l u m l v l e e m l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u m l v l e l u l m l v l e l u l l v l e l u l l v l e l u l l v l e l l u m l v l e l u l l v l e l l u l m l v l e l l u l m l v l e l u l l v l e l l u l m l v l e l l u l m l v l e l l l u l m l v l e l l l u l m l v l e l l l u l m l v l e l l l u l m l v l e l l l l v l e l l l l u l m l l v l e l l l l l l l l l l l l l l l	D   E   E   E   E   N   N   N   N   N   N	D a is t E E E M NV B A O O O W B C O V B C O V B C O V B C O V B C O O V B C O O V B C O O V B C O O V B C O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O V B C O O O O V B C O O O O O O O O O O O O O O O O O O	D a is	N   W   M   M   M   M   M   M   M   M   M	D is	D a i I V R a a c c a t v y e e nt t e e n t t o n e fio n fi u u b ac t e n t t t u m e n t t e e n e e e e R S t t o t t o t t t t u m e e n t e e n e e e e R S t t o t t t t t u m e e n t t e e m e e n e e e e R S t t o t t t t t t t t t t t t t t t t	D a is   E   E   E   M   N   N   N   N   N   N   N   N   N	D is t d m p ir o b b a o o n n C o ati a c a n n k l g d u p l o o b l b t t h h h m r r t a hi a c a o y m n n l v e e n m r t a hi a p o o m f t e a t o e e nt r a v e e n t e e n n r a t e e n n r o n r t e e a t o m s f e e a t o m s f e e a t t o e e n m s f e e a t t o m e e n n e fio e a c a c a c e a c v y ti tio r v y y n a a c c a a c u e e g st a a c c a a c c e a c c	D e is

			Ι			е		d	t	r	n			t			n	S	е		d			i k e	g	n	S	I	a r s	ar	е	у
0	4 1	Y e s	Travel  Rarely	1 1 0 2	ഗa — e ഗ	1	2	L i f e S c i e n c e s	1	1	2	F e m a l e	9 4	З	2	SalesExecutive	4	ω − α α − e	5 9 9 3	1 9 4 7 9	8	Y	Y e s	1 1	ന	1	8 0	0	8	0	1	6
1	4 9	N o	Travel —Frequently	2 7 9	Research & Develop Eent	8	1	L i f e S c i e n c e s	1	2	3	M a l e		2	2	ResearchScientist	2	Marri e d	5 1 3 0	2 4 9 0 7	1	Y	Z 0	2 3	4	4	8 0	1	1 0	3	3	1 0
2	3 7	Y e s	T r a v e l –	1 3 7 3	Researc	2	2	O t h e r		4	4	M a l e	9 2	2	1	L a b o r a t	3	S : n g − e	2 0 9 0	2 3 9 6	6	Y	Y e s	1 5	3	2	8 0	0	7	3	3	0

			R a r e l y		h & D e v e l o p m e n t										oryTechnician																
3	3 3		Travel _Frequently	1 3 9 2	e s e a r c h & D e	0	4	L i f e S c i e n c e s	1	5	4	F e m a l e	3	1	ResearchScientist	3	M a r i e d	2 9 0 9	2 3 1 5 9	1	Y	Y e s	1 1	3	3	8 0	0	8	3	3	8
4	2 7	N o	T r a v e l -R a r e l y	5 9 1	Research & Develo	2	1	M e d i c a l	1	7	1	M a l e	3	1	L a b o r a t o r y T e c h n	2	M a r i e d	3 4 6 8	1 6 6 3 2	9	Υ	N o	1 2	3	4	8 0	1	6	3	3	2



### **Attrition Rate**

Attrition rate: The attrition rate measures the percentage of employees who leave the company in a given period of time. It is usually calculated within a year and is expressed as a percentage of the total number of employees.

In [9]:

```
df['Attrition'].value_counts(normalize=True)
```

Out[9]:

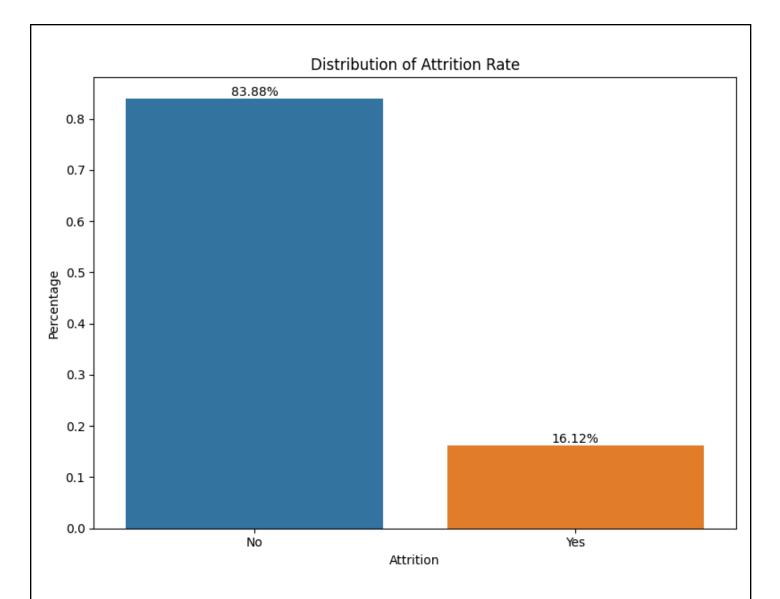
Attrition

No 0.838776 Yes 0.161224

Name: proportion, dtype: float64

The output displays the proportion of employees with regard to attrition status in the dataset. Let's visualize it!

```
In [10]:
```



Based on the analysis, the company's attrition rate is 16.12%. This means that about 16.12% of the employees decided to leave the company during the analyzed period.

## Average of Tenure

Average tenure: The average tenure measures the average number of years an employee stays with the company before leaving. It can provide insight into workforce stability and employee satisfaction within the organization.

```
In [11]:
avg_tenure = df['YearsAtCompany'].mean()
print(f'Average years of employee to leave the company is {avg_tenure} years')
```

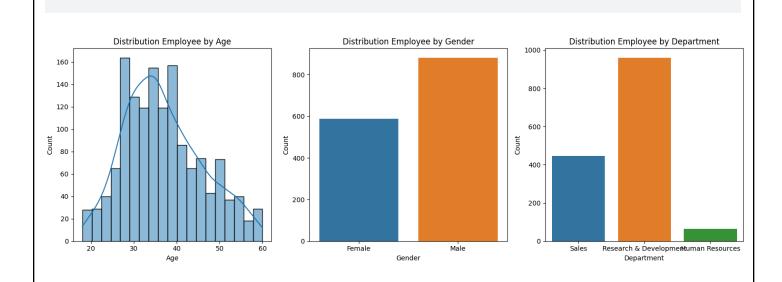
Average years of employee to leave the company is 7.0081632653061225 years

The average tenure of employees before they decided to leave was 7.01 years. With this average tenure, it can be concluded that many employees feel comfortable and have been with the company for a long time.

## **Employee's Demographics**

```
In [12]:
```

```
fig, axes = plt.subplots(nrows=1, ncols=3, figsize=(15,5))
sns.histplot(data=df, x='Age', kde=True, ax=axes[0])
axes[0].set_title('Distribution Employee by Age')
axes[0].set_xlabel('Age')
axes[0].set_ylabel('Count')
sns.countplot(data=df, x='Gender', ax=axes[1])
axes[1].set_title('Distribution Employee by Gender')
axes[1].set_xlabel('Gender')
axes[1].set_ylabel('Count')
sns.countplot(data=df, x='Department', ax=axes[2])
axes[2].set_title('Distribution Employee by Department')
axes[2].set_xlabel('Department')
axes[2].set_ylabel('Count')
```



1. Age: Most of the company's employees are in the 30-35 age group. This indicates that the company has

- many employees who are at a productive and experienced age.
- 2. Gender: The majority of employees at this company are male. There are significantly more male employees than female employees.
- 3. Department: Most of the company's employees are concentrated in the research and development department. This indicates that the company is heavily focused on product or service research and development activities.

In [13]:

```
df_attrition = df[df['Attrition'] == 'Yes']
df_attrition.head()
```

Out[13]:

	A g e	A t t r i t i o n	Bus:ness+ra>e-	Dail y Rate	D e p a r t m e n t	D is t a n c e F r o m H o m e	Education	EducationField	E m p l o y e e C o u n t	E m p l o y e e N u m b e r	E nv ir o n m e nt S ati sf ac tio n	G e n d e r	r	_ n	Joblesel	JobRole	J o b S a t i s f a c t i o n	Marital Status	M o n t h I y I n c o m e	M o n t h I y R a t e	N u m C o m p a ni es W orke d	O v e r 1 8	O v e r T i m e	P e r c e n t S a I a r y H i k e	P e ff o r m a n c e R a ti n g	R el ati o ns hi p S ati sf ac tio n	StardardHours	S t o c k O p ti o n L e > e l	T o t a I W o r k i n g Y e a r s	Tr ai ni n g Ti m e s L a st Y e ar	W o r k L i f e B a l a n c e	Y e a r s A t C o m p a n y
0	4	Yes	Travel  Rarely	1 1 0 2	% a − e %	1	2	L i f e S c i e n c e s	1	1	2	F e m a l e	9 4	3	2	SalesExecutive	4	S i n g l e	5 9 9 3	1 9 4 7 9	8	Y	Yes	1 1	3	1	8 0	0	8	0	1	6

T r a r c h a	R e s e a r c h & D e r O t h e r O t h e r e l o p m e n t R e s e l o R e s e l o p m e n t R e s e l o p m e n t R e s e l o p m e n t d R e s e l o p m e n t d l e r l o p m e n t
Y   1   1   1   D   2   3   C   1   1   9   3   M   5   2   1   T   T   T   T   T   T   T   T   T	Y e s e a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c h & D c f h a r c c
T       1	e s e a r c h & D e r e l y me n t R e s a
1       0       1       0       1	e s e a r c h Ma a r c h A A A A A A A A A A A A A A A A A A
a       1	e s e a r c c h & D e v e e l o o p m e n t   R e s s
2 4 3 1 1 9 3 M 3 5 2 1 N 7 S 1 2 9 5 Y P S 1 4 3 2 8 0 0 6 4 1 1 9 3 M 3 1 0 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 2 h 1 4 4 a 9 l 2 e
L i f e S 1 1 9 3 M a 5 2 1 T 3 N M a 5 2 1 1 1 2 8 0 0 6 4 1 1 2 7 3 M a 8 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2 h 1 4 4 a 9 l 2 e
L i f e S c i 1 1 9 3 4 5 2 1 7 7 8 6 7 7 7 8 8 7 8 8 0 6 6 7 7 8 8 8 7 8 8 7 8 8 8 0 1 1 2 8 8 9 1 1 2 8 8 9 1 1 2 8 8 9 1 1 2 8 8 9 1 1 2 8 8 9 1 1 2 8 9 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	t
1 2 3 M a 8 2 2 1 S a n 0 7 S S S S S S S S S S S S S S S S S S	1 4 4 a 9 I 2
1 9 3 M a 5 2 1 1 7 8 9 8 7 5 Y e 1 3 2 8 0 0 6 4 4 7 5 Y e 1 4 3 2 8 0 0 6 4 4 7 5 Y e 1 4 3 2 8 0 0 6 4 4 7 5 Y e 1 4 3 4 3 4 5 8 8 0 0 6 4 4 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	4 4 a 9 I 2
3	4 a 9 1 2
M a 5 2 1	a 9 I 2
5 2 1 7 3 8 2 1 2 9 5 Y 8 1 3 2 8 0 6 4 7 6 8 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9 2
2 1	
1       r at too rate of a too or a	2
r a t oo r y T e c h n n i c c i a a n l e s s a l l n o g g l e s s a l l n o g g l e s s l n o g g l e s	1
S 3 6 1 N N 2 4 2 8 0 0 1 0 4	LaboratoryTechnician Labo
S 3 6	3
3 6	Ø − n g − e
9 5 Y e 1 3 2 0 0 6 2 7 7 8 8 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	2 0 9 0
	2 3 9 6
	6
	Y
	Yes
	1 5
	3
	2
	8 0
	0
	7
1	3
3	3
5	0

			R a r e I y					i e n c e s						e p r e s e n t a t i v e		e														
2 4	3 4	Yes	Travel  Rarely	699	Research & De > e — o p E en t	6	1	M e d i c a l	3 1	2	M a l e	3	1	ResearchScientist	1	0 - c σ − e	2 9 6 0	1 7 1 0 2	2	Y	Z 0	1 1	3	3	8 0	0	8	2	3	4

**Demografic Factors** 

```
In [14]:
# Fungsi untuk Menghitung Attrition Rate
def calculate_attrition_rate(df, column):
    attrition_counts = df.groupby([column,
'Attrition']).size().unstack(fill_value=0)
    attrition_rate = attrition_counts['Yes'] / attrition_counts.sum(axis=1) * 100
    attrition_rate_df = attrition_rate.reset_index()
    attrition_rate_df.columns = [column, 'AttritionRate']
    return attrition_rate_df
```

```
In [15]:
fig, axes = plt.subplots(nrows=1, ncols=2, figsize=(15,6))
# Plot 1: KDE plot of Age with Attrition hue
sns.kdeplot(data=df_attrition, x='Age', fill=True, ax=axes[0])
axes[0].set_title('Attrition by Age')
axes[0].set_xlabel('Age')
axes[0].set_ylabel('Density')
# Plot 2: Bar plot of Gender count with Attrition hue
attrition_rate_df = calculate_attrition_rate(df, 'Gender')
sns.barplot(data=attrition_rate_df, x='Gender', y='AttritionRate', ax=axes[1])
axes[1].set_title(f'Attrition Rate by Gender')
axes[1].set_xlabel('Gender')
axes[1].set_ylabel('Attrition Rate (%)')
plt.tight_layout()
plt.show()
                     Attrition by Age
                                                                  Attrition Rate by Gender
  0.05
                                                 16
  0.04
                                                 12
  0.03
                                                Attrition Rate (%)
                                                 10
  0.02
  0.01
  0.00
                                                            Female
```

## 1 Reference link