HR Attrition Analysis

1. Project Overview

This project analyzes HR attrition data to uncover insights into employee behavior, job roles, and organizational trends. It helps HR identify key factors driving employee turnover and supports data-driven decisions to improve engagement, satisfaction, and retention within the organization.

2. Dataset Summary

- Rows: 1,480
- Columns: 38
- Key Features:
  - Employee Demographics (EmpID, Age, AgeGroup, Gender, MaritalStatus, DistanceFromHome, Education, EducationField)
  - Job Details (Department, JobRole, JobLevel, BusinessTravel, YearsAtCompany, YearsInCurrentRole, YearsWithCurrManager, YearsSinceLastPromotion)
  - Compensation and Performance (DailyRate, HourlyRate, MonthlyIncome, MonthlyRate, PercentSalaryHike, StockOptionLevel, PerformanceRating)
  - Work Environment and Satisfaction (EnvironmentSatisfaction, JobSatisfaction, RelationshipSatisfaction, WorkLifeBalance, JobInvolvement)
  - Career and Experience (TotalWorkingYears, NumCompaniesWorked, TrainingTimesLastYear, OverTime)
  - Attrition Information (Attrition – Indicates whether an employee has left the company)

3. Exploratory Data Analysis using Python

We began with data preparation and cleaning in Python:

- **Data Loading:** Imported the dataset using pandas.

- **Initial Exploration:** Used df.info()to check structure and .describe()for summary statistics.

	Age	DailyRate	DistanceFromHome	Education	EmployeeCount	EmployeeNumber	EnvironmentSatisfaction	HourlyRate	JobInvolvement	JobL
count	1480.000000	1480.000000	1480.000000	1480.000000	1480.0	1480.000000	1480.000000	1480.000000	1480.000000	1480.000
mean	36.917568	801.384459	9.220270	2.910811	1.0	1031.860811	2.724324	65.845270	2.729730	2.064
std	9.128559	403.126988	8.131201	1.023796	0.0	605.955046	1.092579	20.328266	0.713007	1.105
min	18.000000	102.000000	1.000000	1.000000	1.0	1.000000	1.000000	30.000000	1.000000	1.000
25%	30.000000	465.000000	2.000000	2.000000	1.0	493.750000	2.000000	48.000000	2.000000	1.000
50%	36.000000	800.000000	7.000000	3.000000	1.0	1027.500000	3.000000	66.000000	3.000000	2.000
75%	43.000000	1157.000000	14.000000	4.000000	1.0	1568.250000	4.000000	83.000000	3.000000	3.000
max	60.000000	1499.000000	29.000000	5.000000	1.0	2068.000000	4.000000	100.000000	4.000000	5.000

...	RelationshipSatisfaction	StandardHours	StockOptionLevel	TotalWorkingYears	TrainingTimesLastYear	WorkLifeBalance	YearsAtCompany	YearsInCurrentRole
...	1480.000000	1480.0	1480.000000	1480.000000	1480.000000	1480.000000	1480.000000	1480.000000
...	2.708784	80.0	0.791892	11.281757	2.797973	2.760811	7.009459	4.228378
...	1.081995	0.0	0.850527	7.770870	1.288791	0.707024	6.117945	3.616020
...	1.000000	80.0	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000
...	2.000000	80.0	0.000000	6.000000	2.000000	2.000000	3.000000	2.000000
...	3.000000	80.0	1.000000	10.000000	3.000000	3.000000	5.000000	3.000000
...	4.000000	80.0	1.000000	15.000000	3.000000	3.000000	9.000000	7.000000
...	4.000000	80.0	3.000000	40.000000	6.000000	4.000000	40.000000	18.000000

- **Data Integrity Check:** Used df.isnull().sum().any() to check for missing values and df.duplicated().sum() to verify the uniqueness of records, confirming that the dataset has no missing or duplicate entries.
- **Column Standardization:** Renamed columns to **snake case** for better readability and documentation.
- **Database Integration:** Connected Python script to PostgreSQL and loaded the cleaned DataFrame into the database for SQL analysis.

4. Data Analysis using SQL (Employee Attrition Analysis)

We performed structured analysis in PostgreSQL to answer key employee attrition questions:

1. **Department Attrition Comparison** – Compared attrition percentages across departments to identify highest- and lowest-risk departments.

	department text	total_employees bigint	attrited_employees bigint	attrition_rate_percent numeric
1	Sales	450	93	20.67
2	Human Resources	63	12	19.05
3	Research & Development	967	133	13.75

2. **Job Role Income vs Attrition** – Examined how average monthly income varies across job roles and how it influences attrition trends.

	jobrole text	avg_income numeric	attrition_count bigint
1	Manager	17181.68	5
2	Research Director	16033.55	2
3	Healthcare Representative	7547.42	9
4	Manufacturing Director	7305.26	10
5	Sales Executive	6947.08	58
6	Human Resources	4235.75	12
7	Research Scientist	3241.83	47
8	Laboratory Technician	3239.09	62
9	Sales Representative	2630.05	33

3. **Gender-wise Attrition Breakdown** – Analyzed gender-wise attrition distribution to understand male and female turnover patterns.

	gender text	total_employees bigint	attrited_employees bigint	attrition_percent numeric
1	Female	591	87	14.72
2	Male	889	151	16.99

4. **Commute Distance Impact**– Evaluated how distance from home affects attrition likelihood among employees.

	attrition text	avg_distance_from_home numeric
1	No	8.94
2	Yes	10.71

5. **Experience by Education Field** – Assessed the average total working experience within each education background.

	educationfield text	avg_experience numeric
1	Marketing	11.96
2	Human Resourc...	11.59
3	Medical	11.55
4	Life Sciences	11.24
5	Other	10.29
6	Technical Degree	10.25

6. **Salary and Overtime Impact** – Explored how different salary slabs and overtime status impact employee attrition rates.

	salaryslab text	overtime text	total_employees bigint	attrited bigint	attrition_percent numeric
1	Upto 5k	Yes	205	88	42.93
2	5k-10k	Yes	127	27	21.26
3	10k-15k	Yes	53	10	18.87
4	Upto 5k	No	548	75	13.69
5	10k-15k	No	97	11	11.34
6	15k+	Yes	33	3	9.09
7	5k-10k	No	317	22	6.94
8	15k+	No	100	2	2.00

7. **Top 3 Job Role Risk by Department** – Identified 3 job roles within each department that show the highest attrition percentages.

	department text	jobrole text	attrition_rate numeric
1	Human Resources	Human Resources	23.08
2	Human Resources	Manager	0.00
3	Research & Development	Laboratory Technician	23.75
4	Research & Development	Research Scientist	16.04
5	Research & Development	Healthcare Representative	6.82
6	Sales	Sales Representative	39.29
7	Sales	Sales Executive	17.63
8	Sales	Manager	5.41

8. **Experience Range Correlation** – Analyzed how total working experience (in years) correlates with employee attrition.

	experience_range text	attrition_percent numeric
1	0–5 Years	32.89
2	5–10 Years	15.26
3	10–20 Years	11.66
4	20+ Years	7.69

9. **Business Travel vs Attrition** – Compared attrition rates by business travel frequency (None, Rarely, Frequently) to assess travel-related turnover.

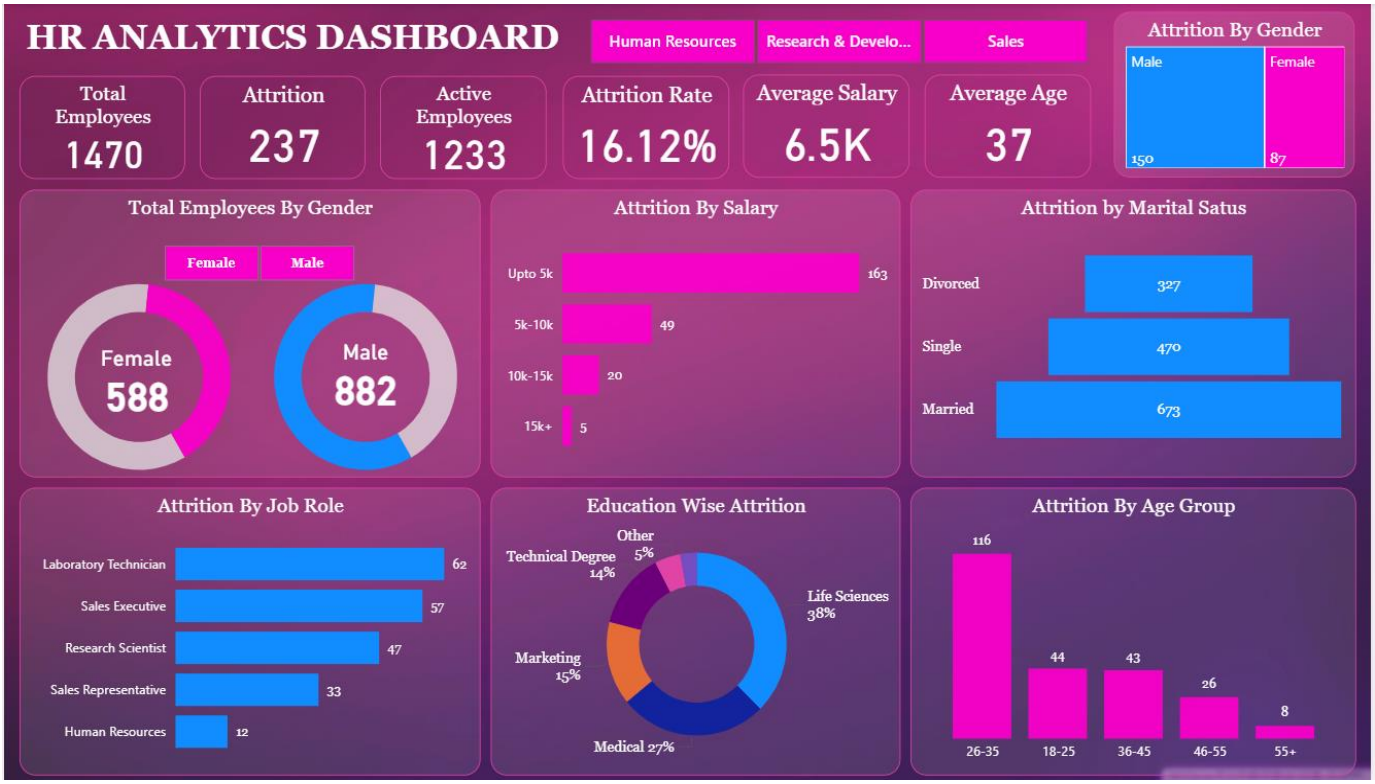
	businesstravel text	total_employees bigint	attrited_employees bigint	attrition_rate numeric
1	Travel_Frequently	279	69	24.73
2	Travel_Rarely	1042	157	15.07
3	Non-Travel	151	12	7.95
4	TravelRarely	8	0	0.00

10. **High-Risk Profile Combination** – Compared attrition percentages for combinations of department, job role, overtime, and salary slab to detect high-risk employee profiles.

	department text	jobrole text	overtime text	salaryslab text	attrition_percent numeric
1	Sales	Sales Representative	Yes	Upto 5k	69.57
2	Research & Development	Laboratory Technician	Yes	Upto 5k	55.77
3	Human Resources	Human Resources	Yes	Upto 5k	50.00
4	Sales	Sales Executive	Yes	10k-15k	46.67
5	Research & Development	Research Scientist	Yes	Upto 5k	37.50
6	Sales	Sales Executive	Yes	5k-10k	34.48
7	Sales	Sales Representative	No	Upto 5k	28.81
8	Sales	Sales Executive	Yes	Upto 5k	22.73
9	Human Resources	Human Resources	No	Upto 5k	21.43
10	Research & Development	Laboratory Technician	Yes	5k-10k	20.00

5. Dashboard in Power BI

Finally, we built an interactive dashboard in **Power BI** to present insights visually.



6. Recommendations

- **Enhance Employee Retention in High-Attrition Departments** – Focus on departments with the highest attrition rates by improving work culture, providing recognition, and reviewing workload distribution.

- **Review Compensation Structure** – Reassess salary slabs for roles with lower income but higher attrition. Ensure pay equity and introduce performance-based incentives.

- **Optimize Business Travel Policies** – Reduce travel frequency for employees with excessive travel demands, or offer compensatory benefits such as extra leave or travel allowances.

- **Promote Work–Life Balance** – Monitor overtime hours and ensure that employees working extra shifts are compensated fairly and given rest opportunities.

- **Career Growth and Development** – Offer training, upskilling, and promotion pathways for employees, especially in job roles and education fields showing higher turnover.

- **Encourage Flexible Work Options** – For employees living far from the workplace, introduce flexible hours or remote work options to reduce commute-related stress.

- **Strengthen Employee Engagement Initiatives** – Conduct regular feedback surveys and stay interviews to understand concerns before employees decide to leave.