



**SALIFORT
MOTORS**

EMPLOYEE TURNOVER ANALYSIS

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CONTENT

01 About Company

02 Problem & Objectives

03 Data Overview

04 EDA
(Exploratory Data Analysis)

05 Modeling

06 Recommendations

ABOUT COMPANY

Welcome to Salifort Motors, a top automotive industry leader with over 11,900 employees.

Our sales team of 3,289 ensures exceptional customer service, while 2,244 experts in our technical department drive innovation.

We prioritize collaboration, running multiple projects to stay competitive, and emphasize safety to ensure a healthy work environment.

Join us for innovation, excellence, and customer satisfaction!



PROBLEM & OBJECTIVES



The HR department at Salifort Motors wants to take some initiatives to improve the employees satisfaction levels at the company. Because it is time-consuming and expensive to find, interview, and hire new employees, increasing employee retention will be beneficial to the company.



- To address the question: What factors are most likely to contribute to an employee's decision to leave the company?
- Building a model that predicts whether or not an employee will leave the company.



Data Overview

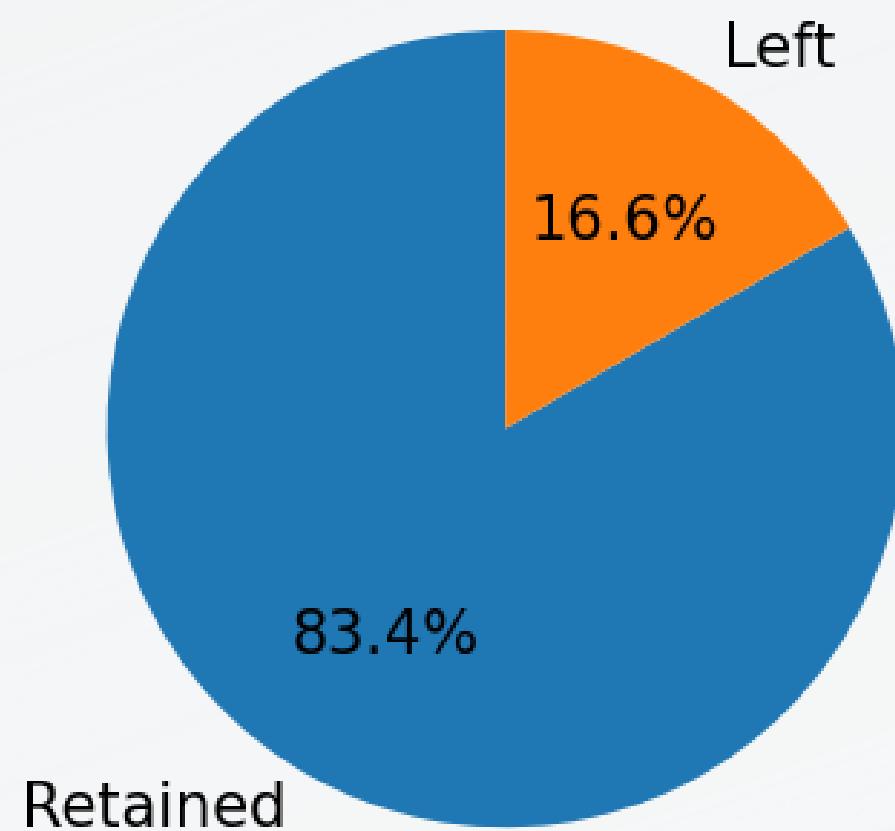
- Rename columns
- Remove duplicates (3008 rows, about 20% of the dataset)
- Consider addressing outliers when building predictive models

Data columns (total 10 columns):			
#	Column	Non-Null Count	Dtype
0	satisfaction_level	14999 non-null	float64
1	last_evaluation	14999 non-null	float64
2	number_project	14999 non-null	int64
3	average_montly_hours	14999 non-null	int64
4	time_spend_company	14999 non-null	int64
5	Work_accident	14999 non-null	int64
6	left	14999 non-null	int64
7	promotion_last_5years	14999 non-null	int64
8	Department	14999 non-null	object
9	salary	14999 non-null	object

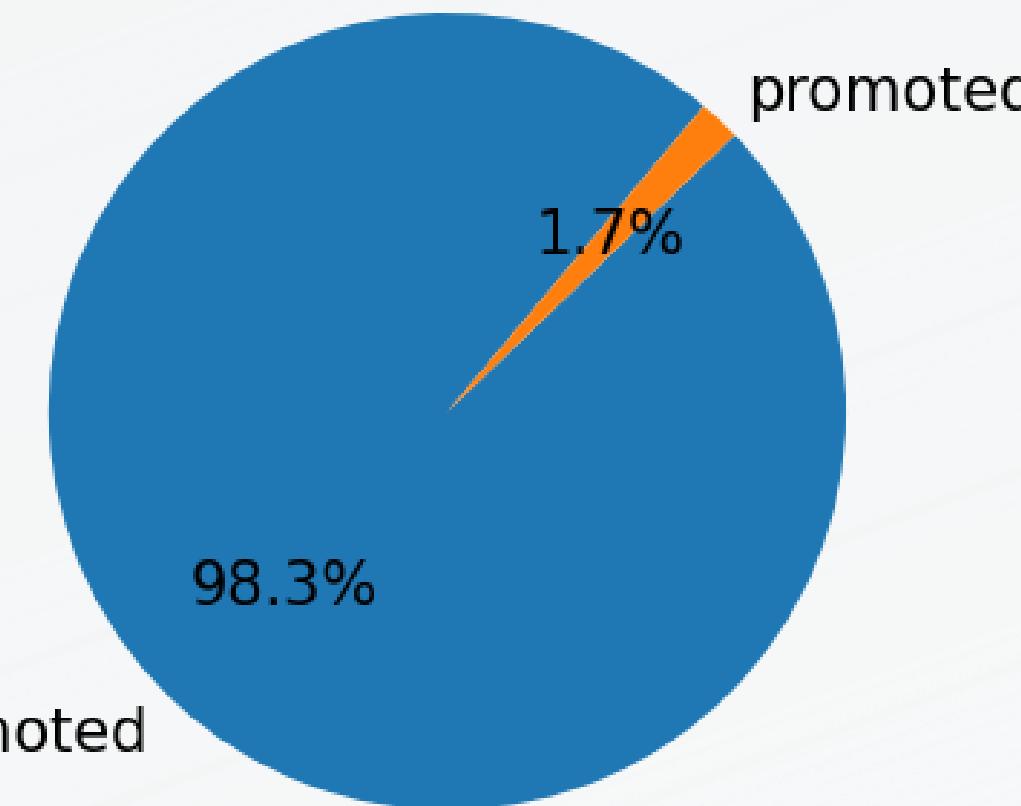
Variable	Description
satisfaction_level	Employee-reported job satisfaction level [0–1]
last_evaluation	Score of employee's last performance review [0–1]
number_project	Number of projects employee contributes to
average_monthly_hours	Average number of hours employee worked per month
time_spend_company	How long the employee has been with the company (years)
Work_accident	Whether or not the employee experienced an accident while at work
left	Whether or not the employee left the company
promotion_last_5years	Whether or not the employee was promoted in the last 5 years
Department	The employee's department
salary	The employee's salary (U.S. dollars)

EDA

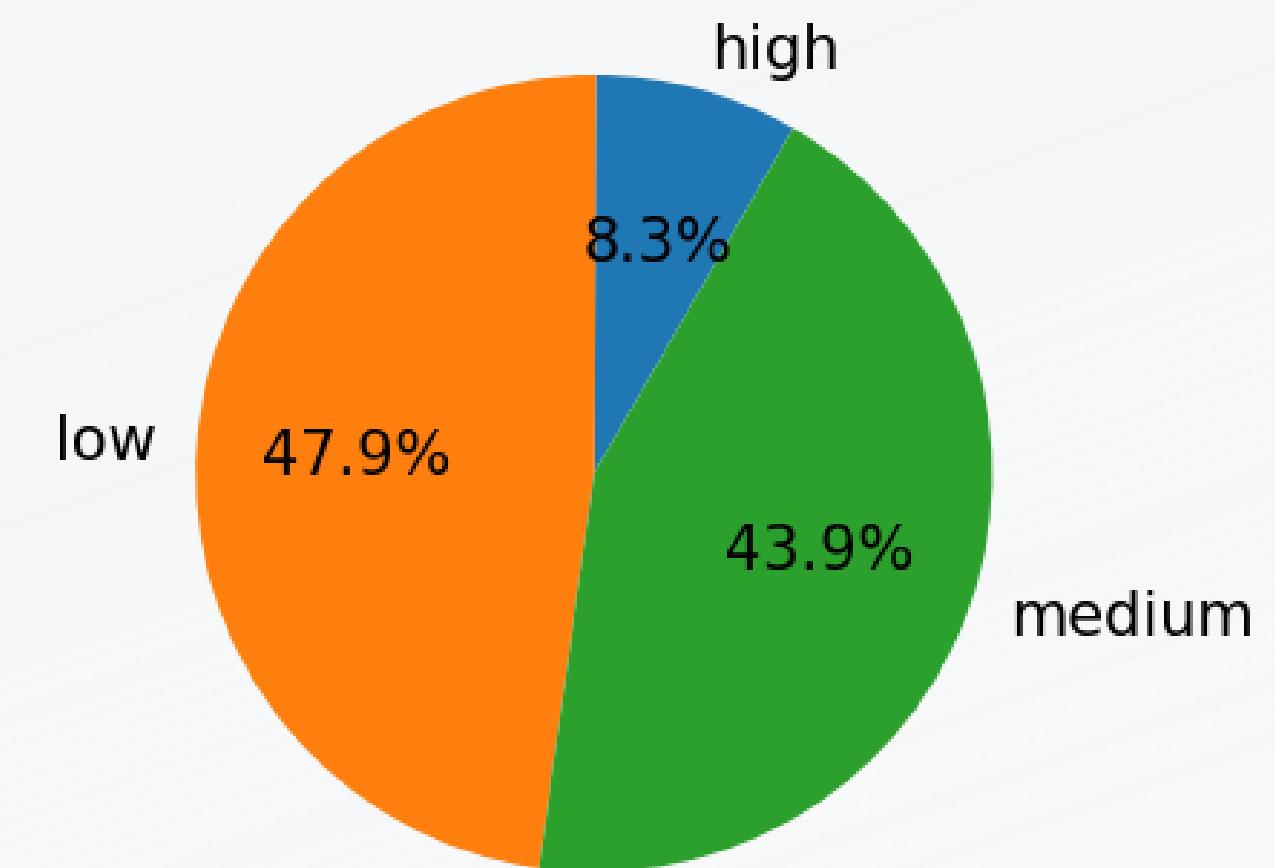
- Employee turnover rate is 16.6%, significant concern.
- Promotion rate over the last 5 years is low at 1.7% for 11,991 employees.
- Salaries are mainly low to medium.



Employee Turnover



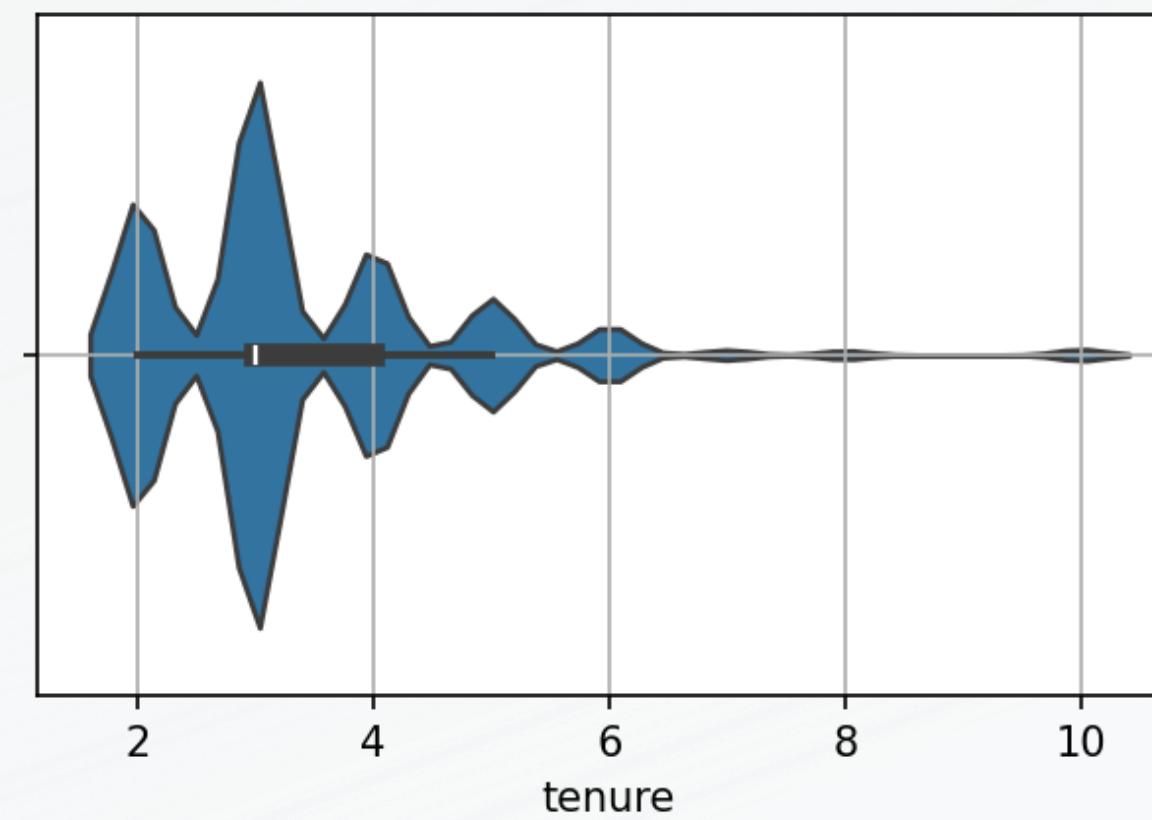
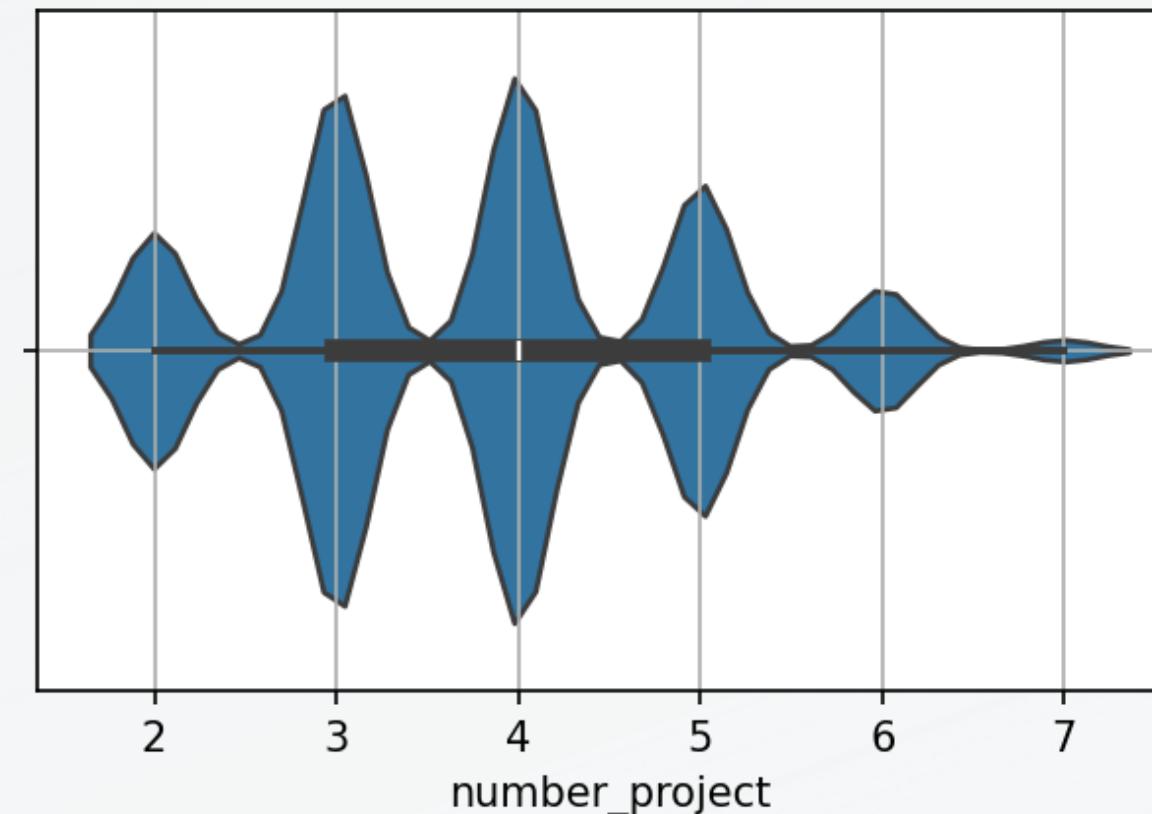
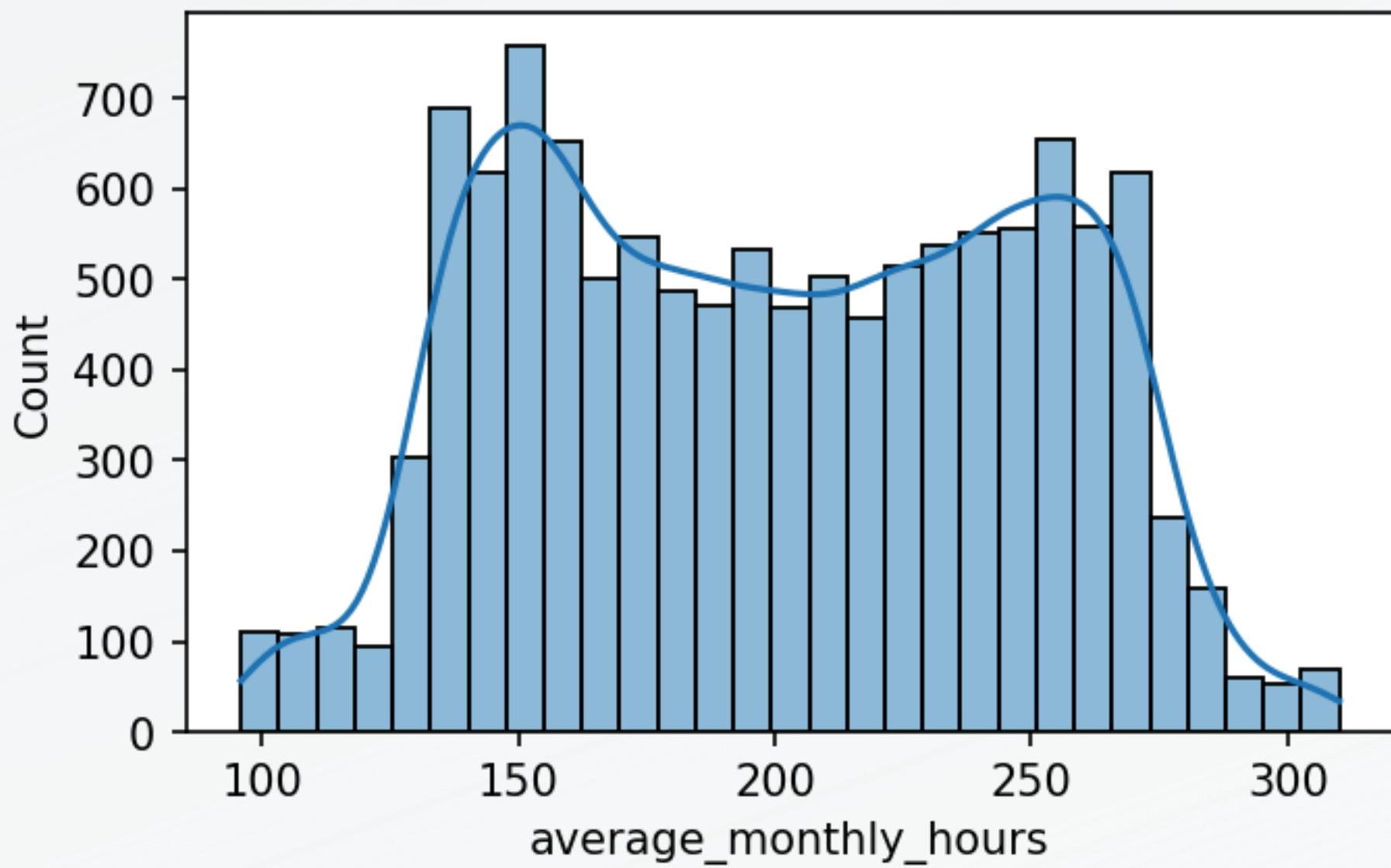
Promotion last 5 years



Salary

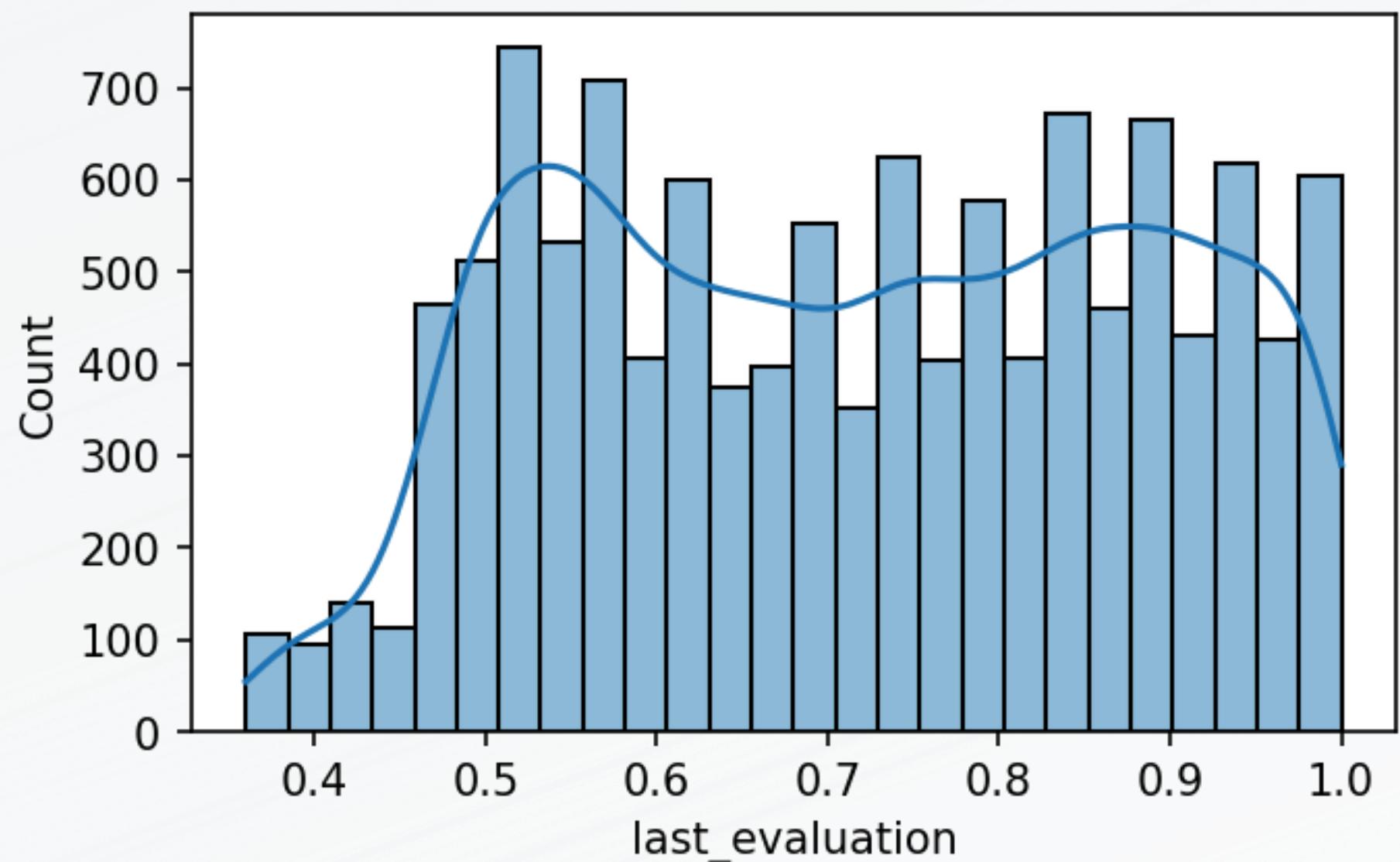
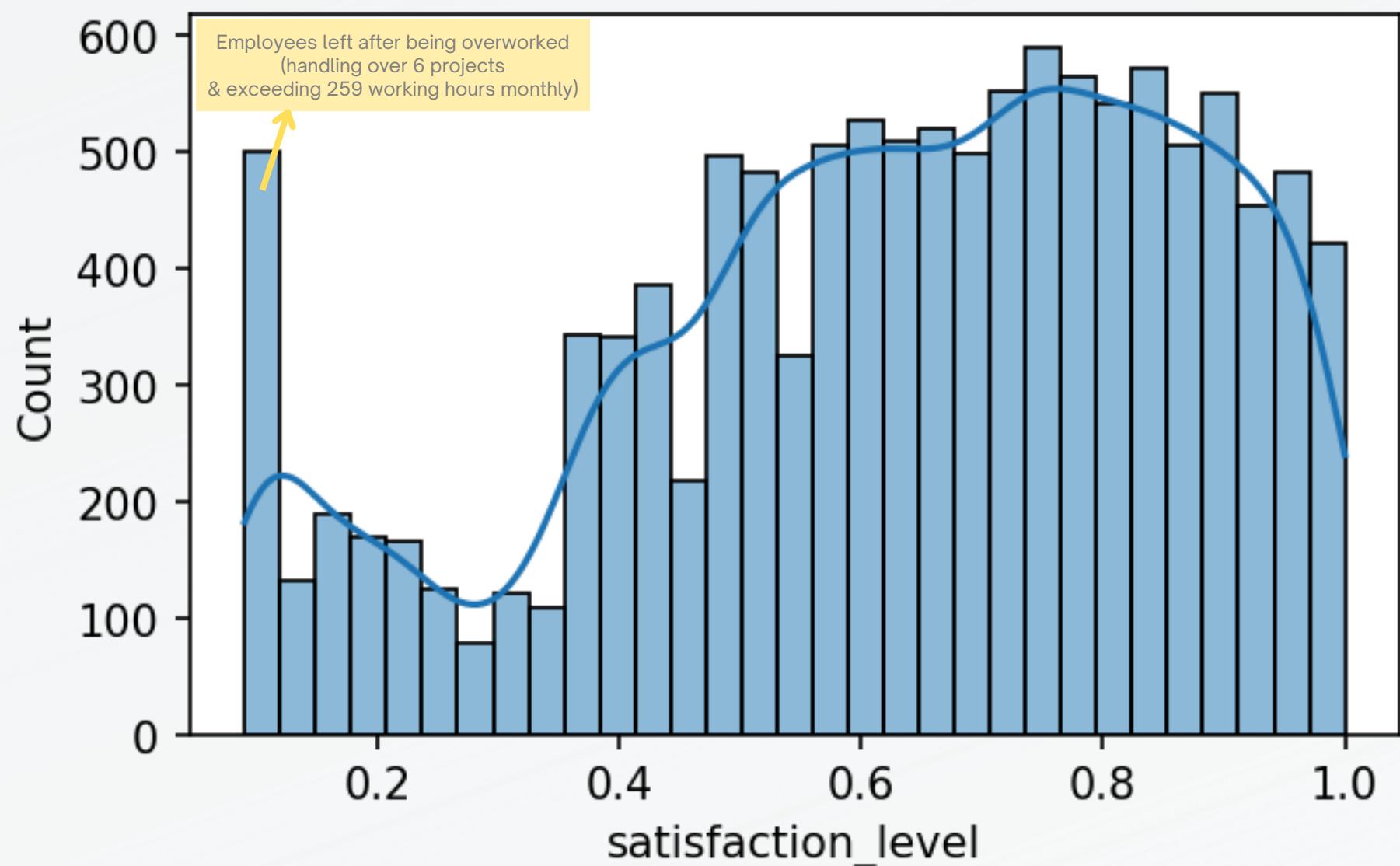
EDA

- Average monthly working hours: 150 to 250 hours.
- Employees expected to manage 3 to 5 projects.
- Tenure ranges from 2 to 4 years, with a median of 3 years.



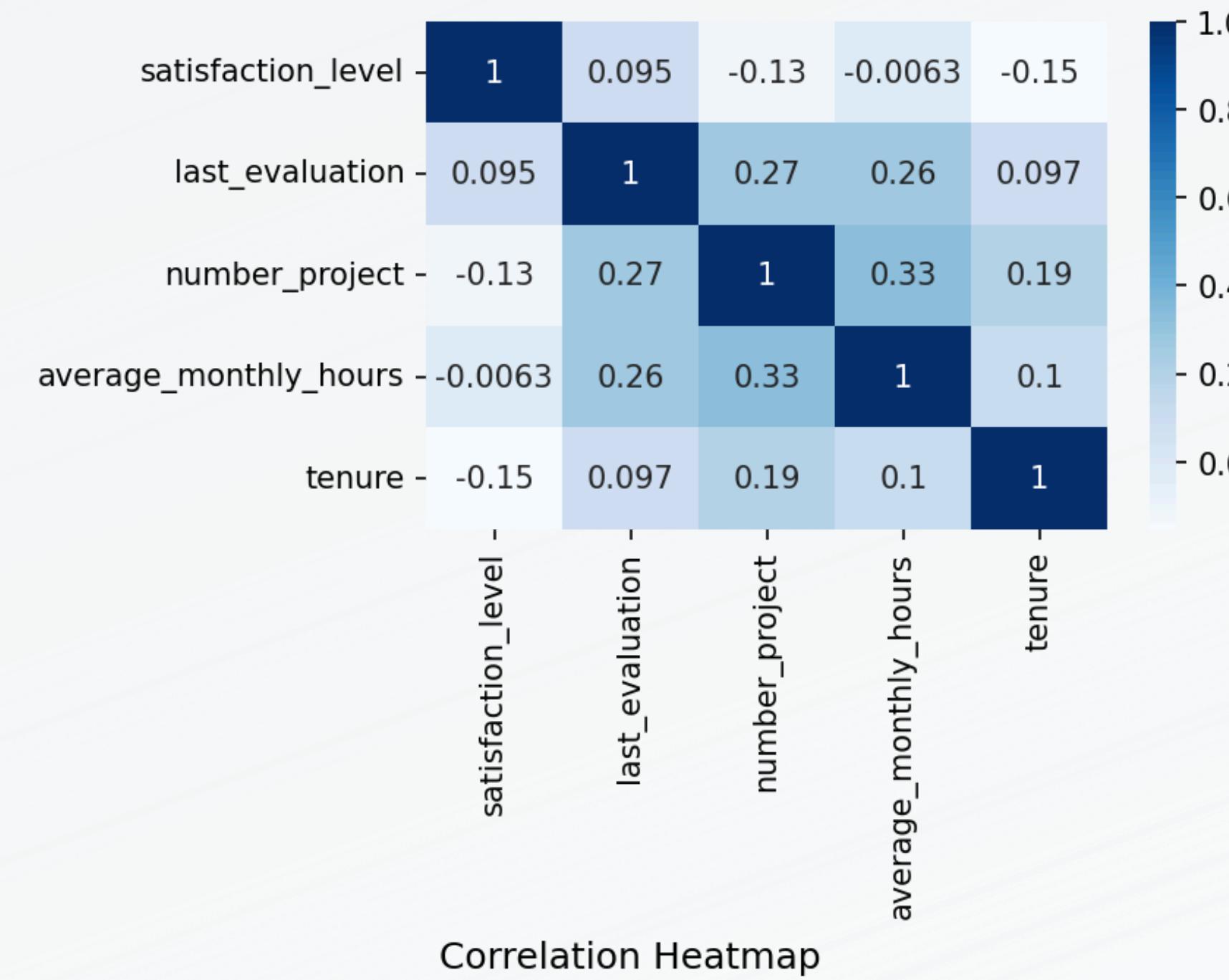
EDA

- Satisfaction rate is approximately 0.4 to 1.
- Last evaluation rate is mostly above 0.5.



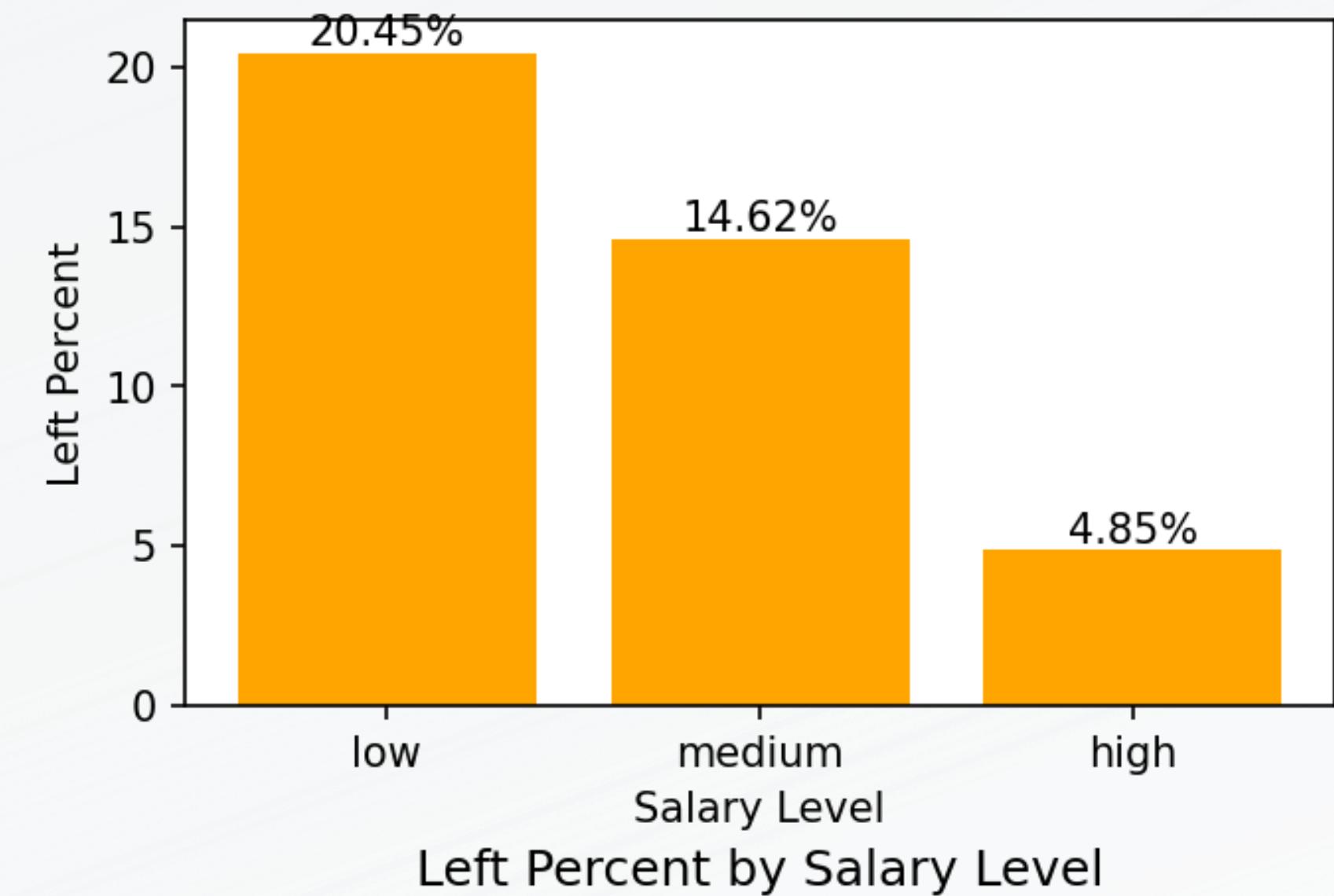
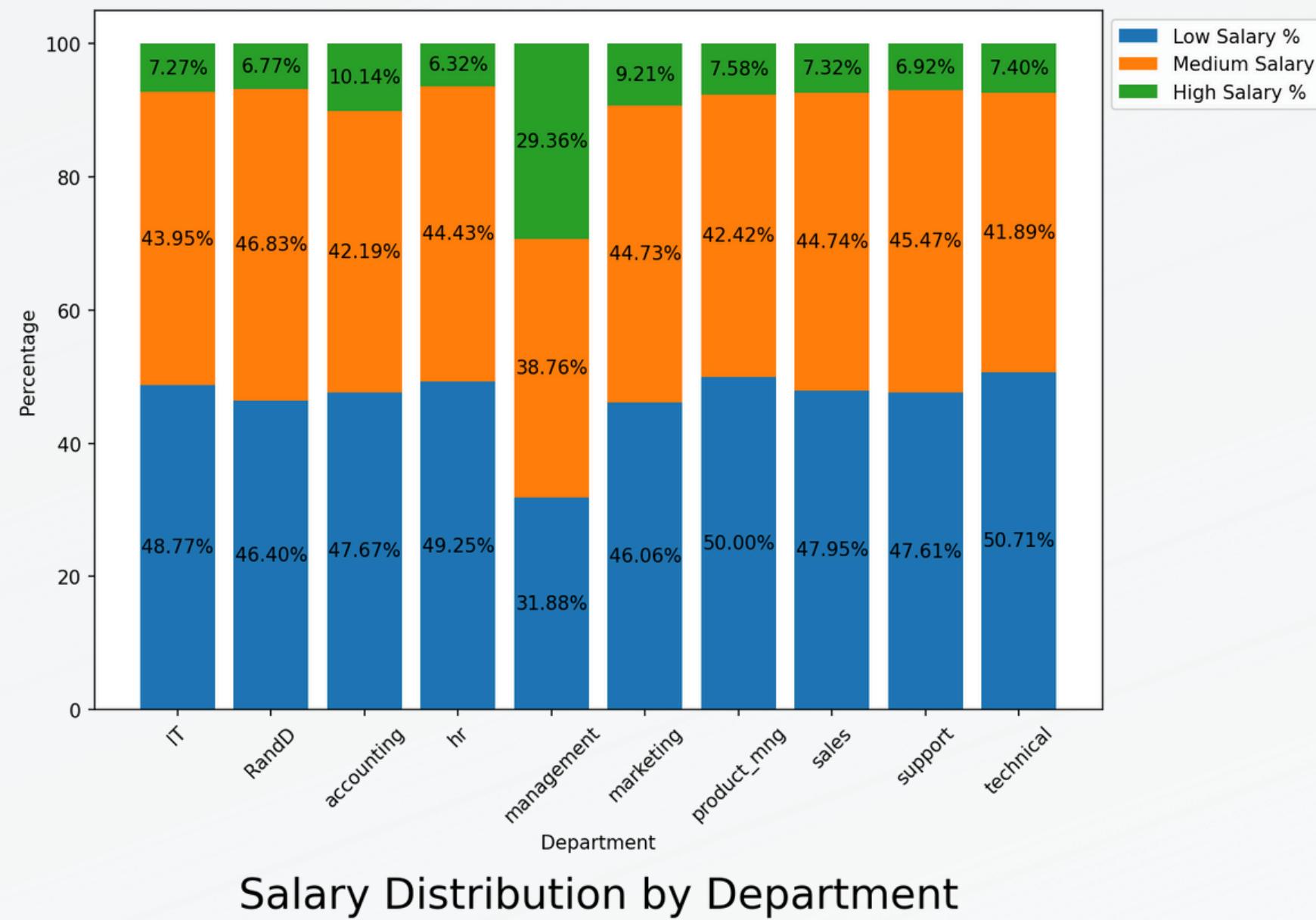
EDA

There is a significant correlation among the project number, evaluation rate, and average monthly working hours.



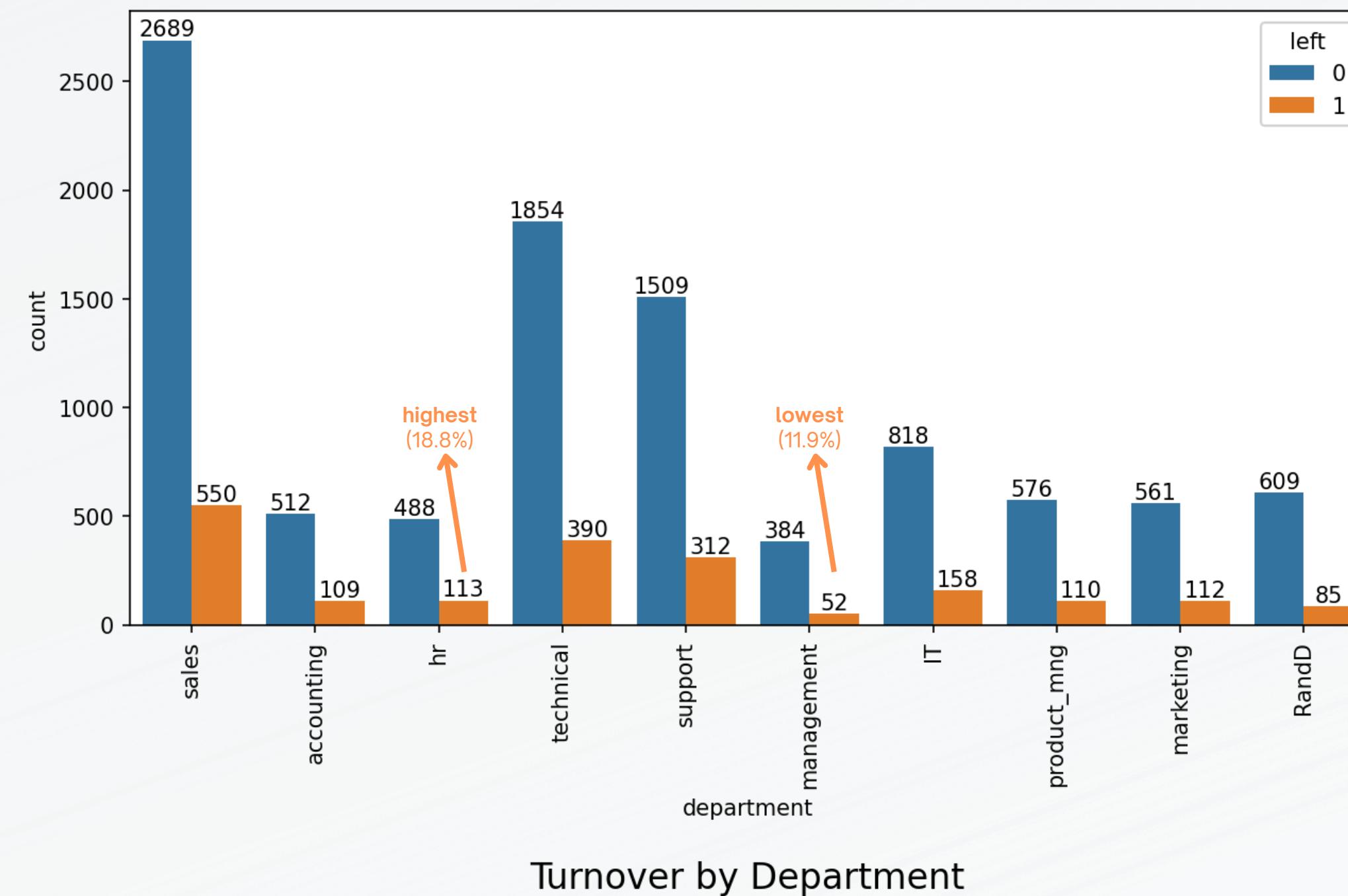
EDA

- Management salary is significantly higher than the others.
- Employees with low salaries have a high turnover rate (20.45%).



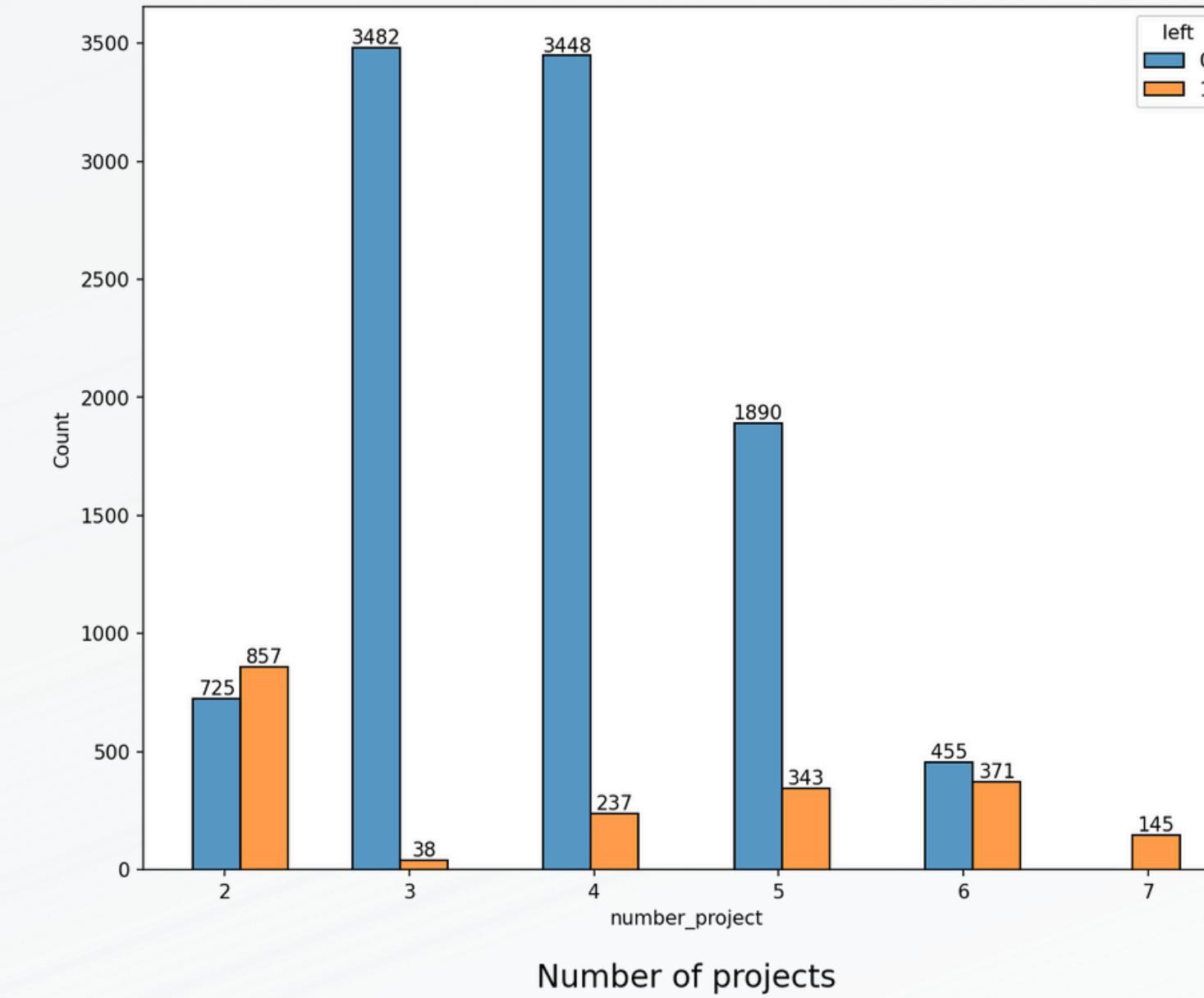
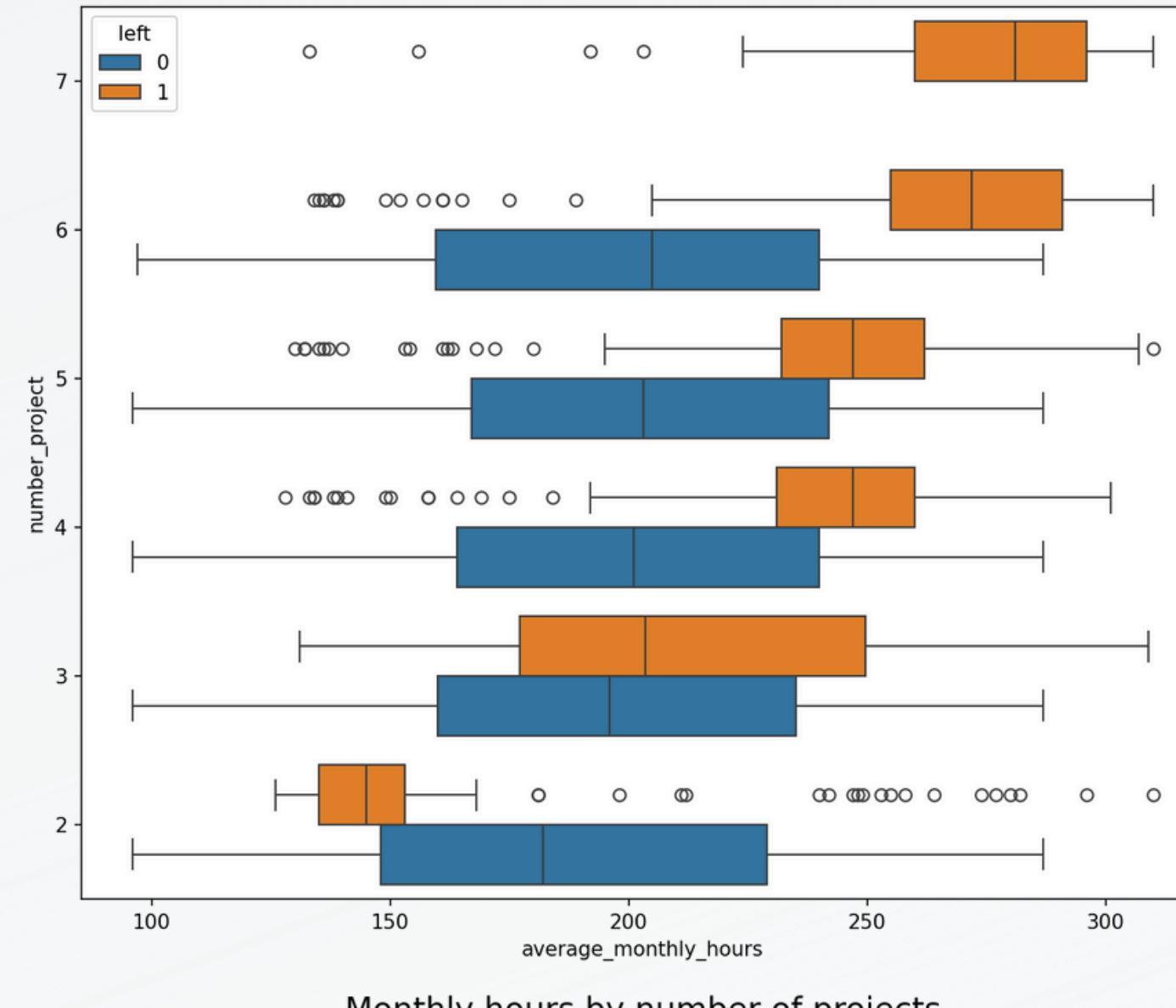
EDA

- Management has the highest retention rate
- HR has the lowest retention rate.



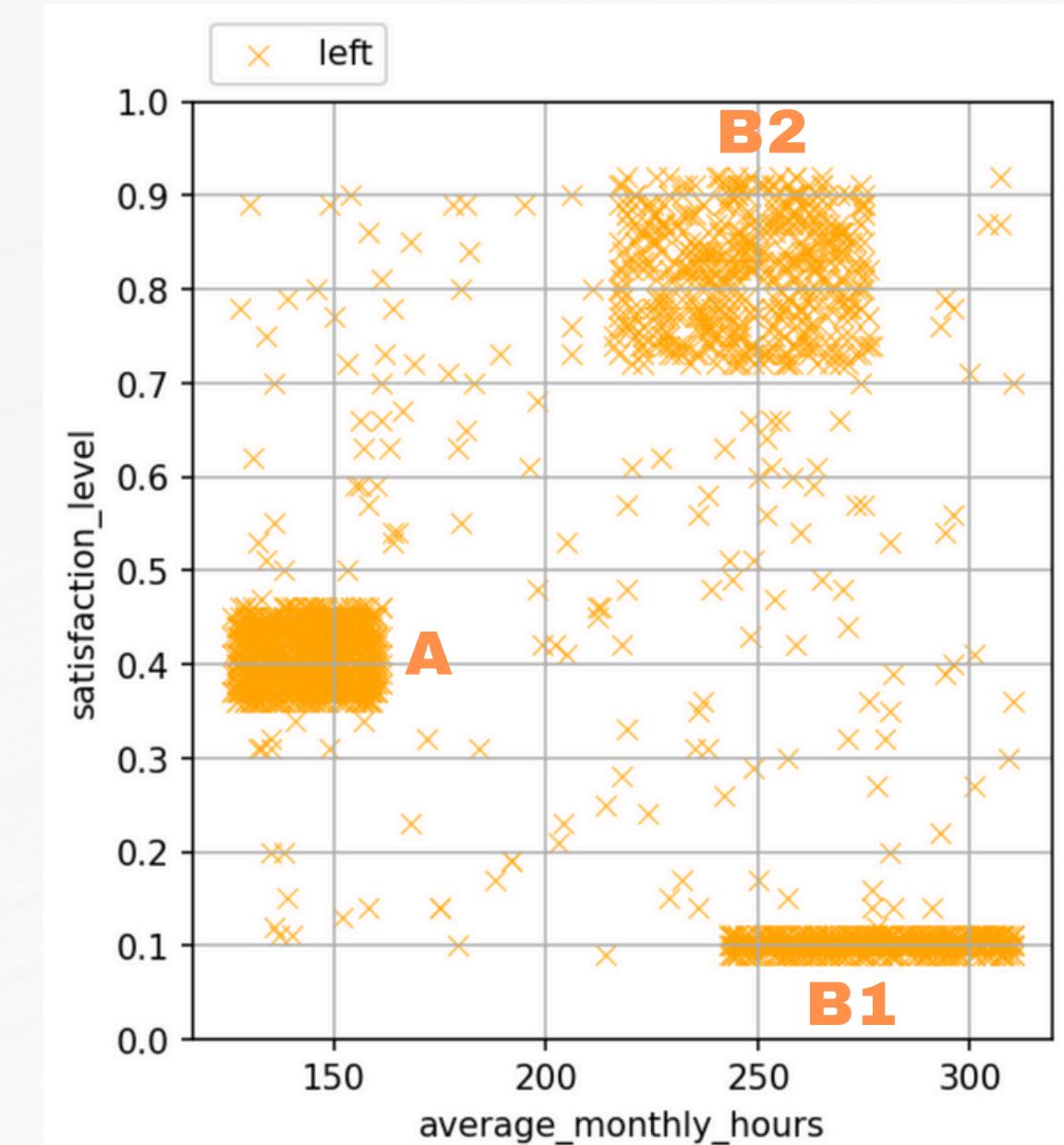
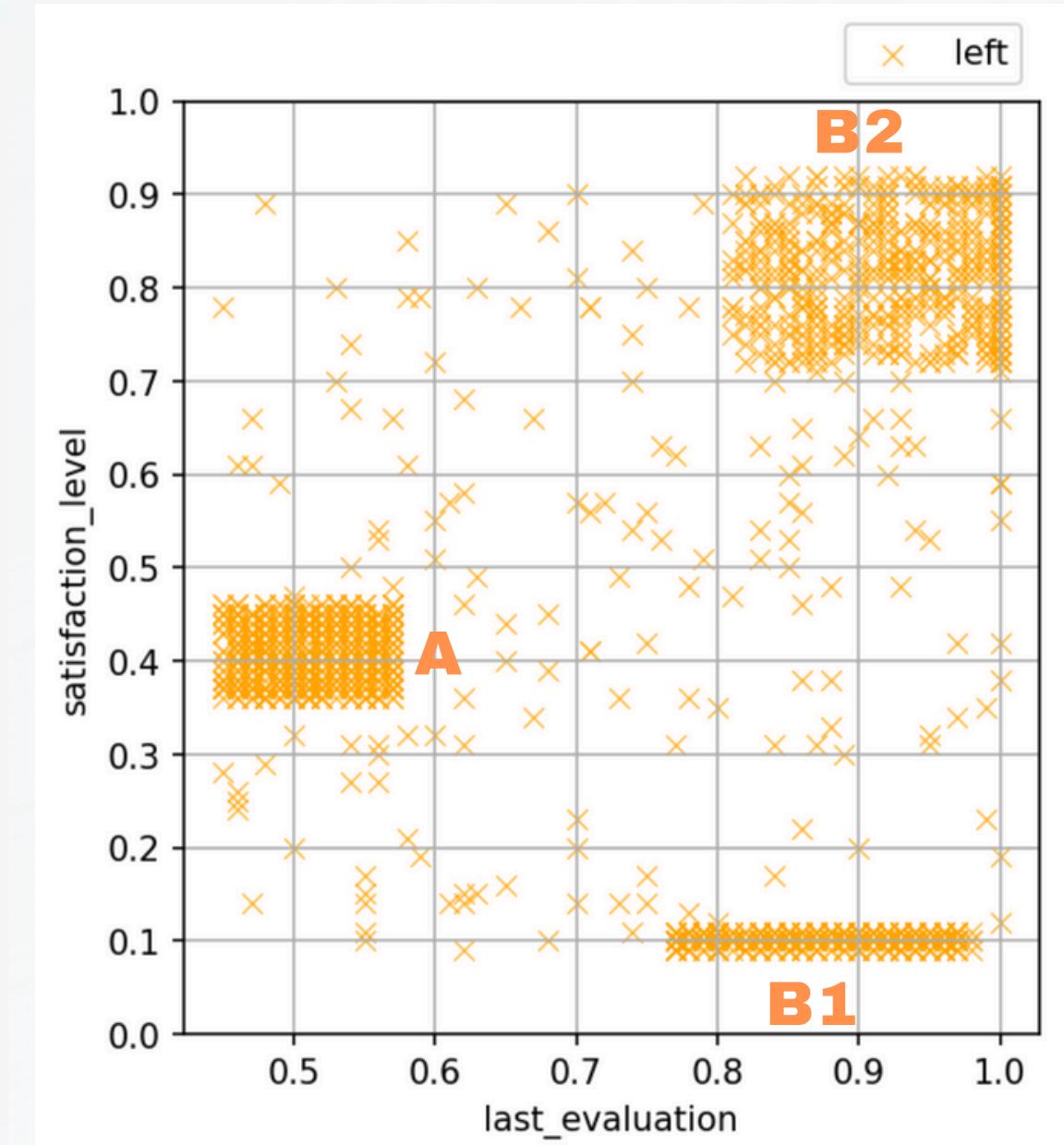
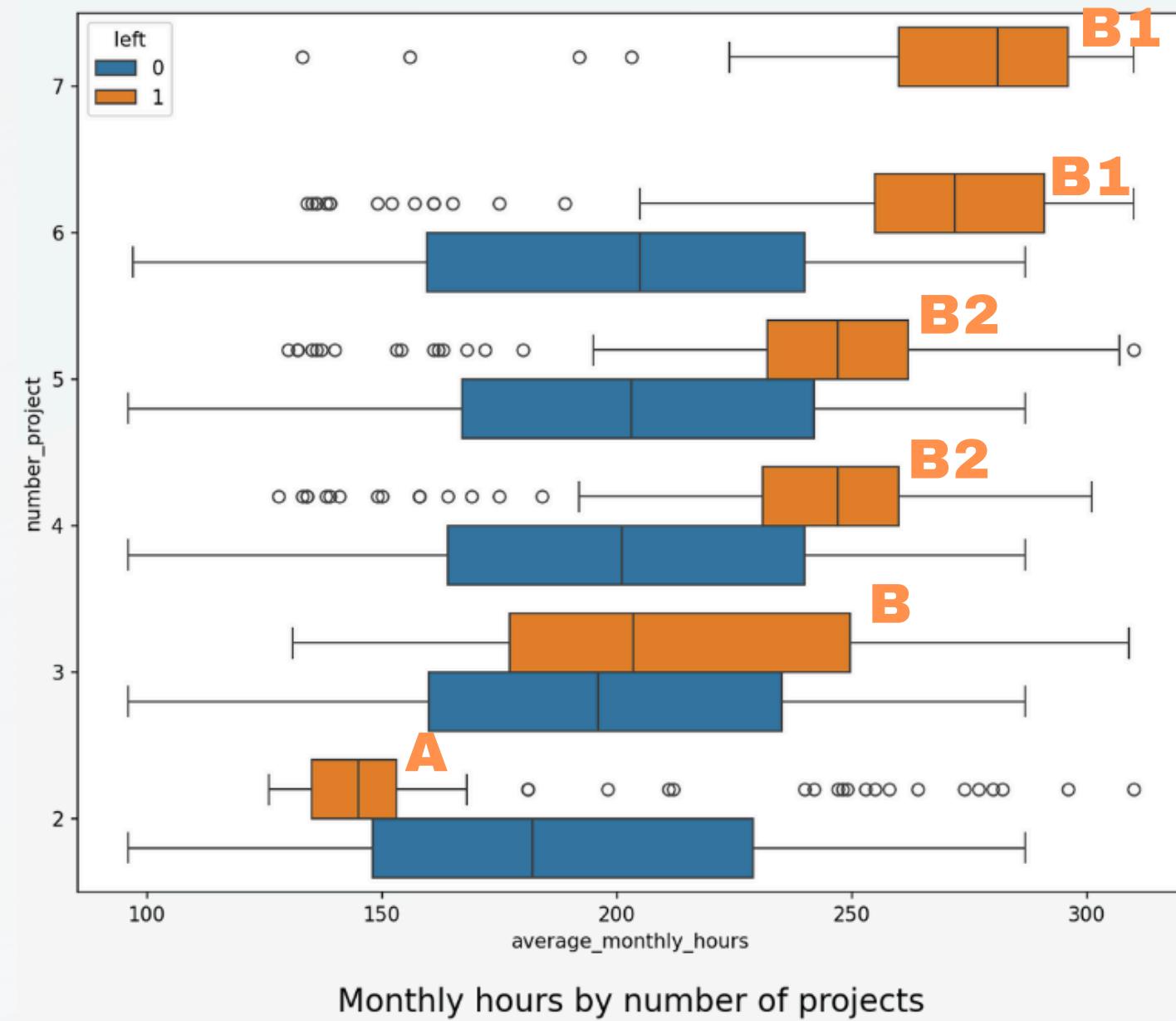
EDA

- 2 group of left employees:
 - A: those who worked considerably less than their peers with the same no. of projects.
 - B: those who contributed a lot to their project they worked in
- Everyone with 7 projects left the company. The optimal no. of projects seems to be **3**.
- Employees here are overworked.



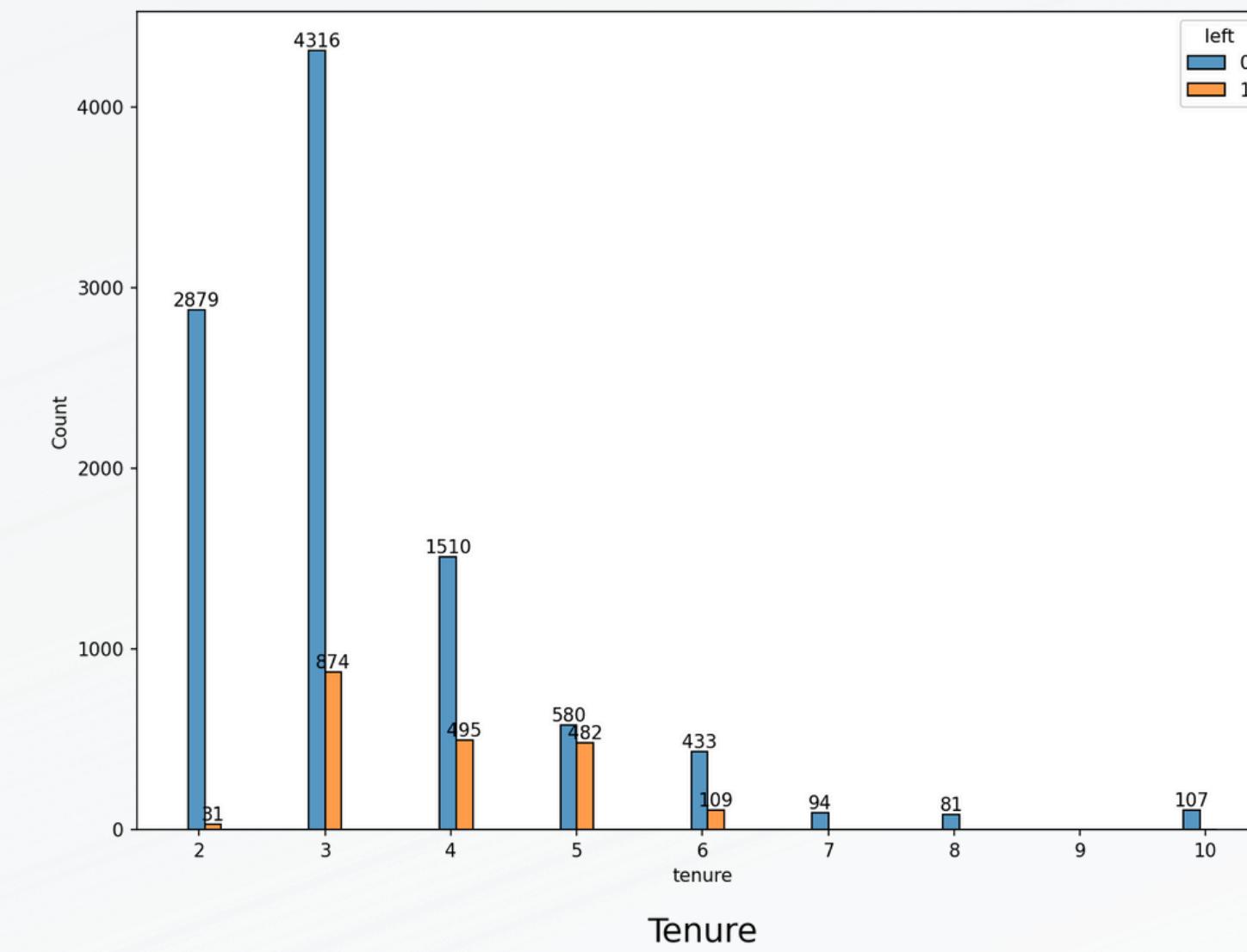
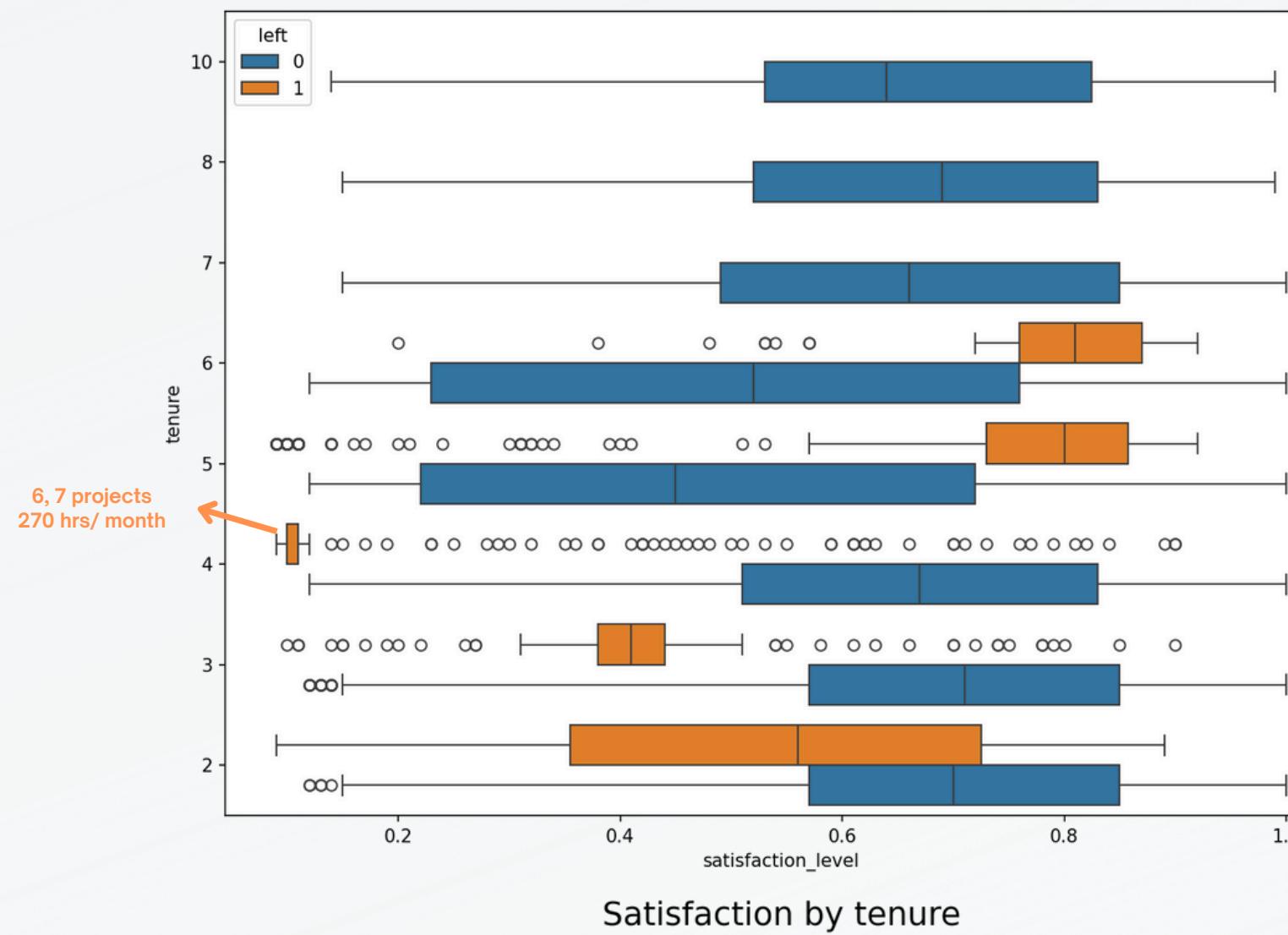
EDA

- There are two subgroups within group B :
 - B1: Mainly worked on 6 - 7 projects, mostly with 4 years tenure.
 - B2: Mainly on 4 - 5 projects, mostly with 5 - 6 years tenure.
- Group A worked around 150 hours with 2 projects, leading to low evaluations and satisfaction.



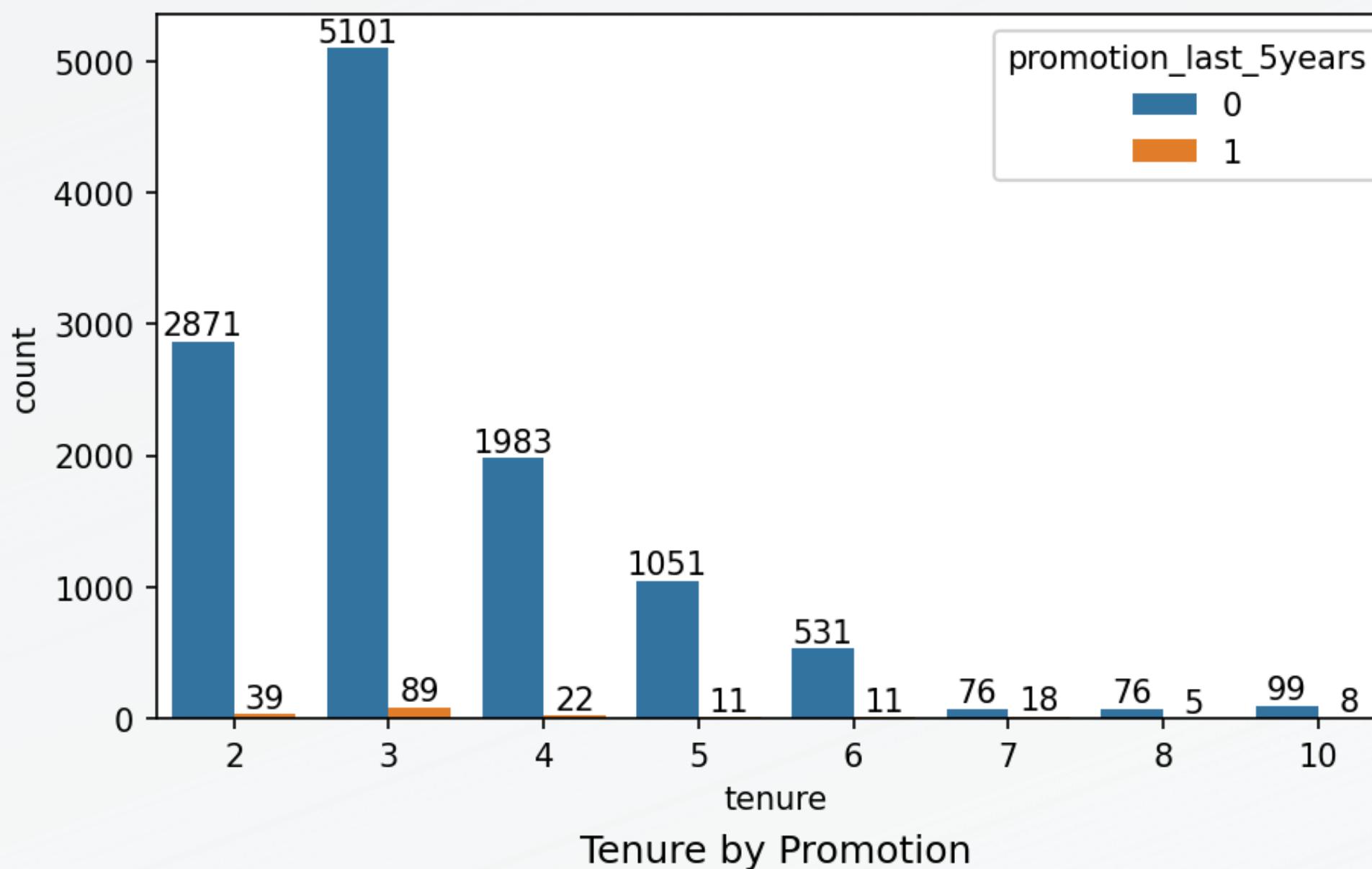
EDA

- Employees who left fall into two main categories:
 - Dissatisfied employees with short tenures (2 - 3 yrs)
 - Very satisfied employees with long tenures ($>=5$ yrs)
- For 4 years employees, further collaboration with stakeholders is needed to understand why they left.
- Notably, no employees with tenures over six years left.



EDA

High promotion rate for employees with 7 and more years of tenure.



tenure	promoted	
0	2	1.34
1	3	1.71
2	4	1.10
3	5	1.04
4	6	2.03
5	7	19.15
6	8	6.17
7	10	7.48

EDA

Insights summary:

- It appears that employees are leaving the company due to following reasons:
 - They worked longer hours than usual on many projects.
 - The longer you work, the more projects and hours you take on.
 - Despite significant contributions, they received few promotions.
- Only employees who have worked more than six year tend not to leave.
- HR should collaborate further with stakeholders to understand why group of employees with 2 years of tenure had low satisfaction and not performing well. Furthermore, they also need to review their own department as it had highest turnover rate.

Modeling

Initially building multiple models with GridsearchCV.

	model	accuracy_score	precision_score	recall_score	f1_score	roc_auc_score
0	LogisticRegression	0.80	0.45	0.88	0.59	0.85
1	DecisionTreeClassifier	0.97	0.90	0.92	0.91	0.95
2	SVC	0.84	0.51	0.50	0.50	0.59
3	RandomForestClassifier	0.98	0.96	0.93	0.94	0.98
4	GradientBoostingClassifier	0.98	0.94	0.94	0.94	0.98
5	KNeighborsClassifier	0.90	0.63	0.92	0.75	0.94
6	XGBClassifier	0.98	0.96	0.93	0.94	0.98

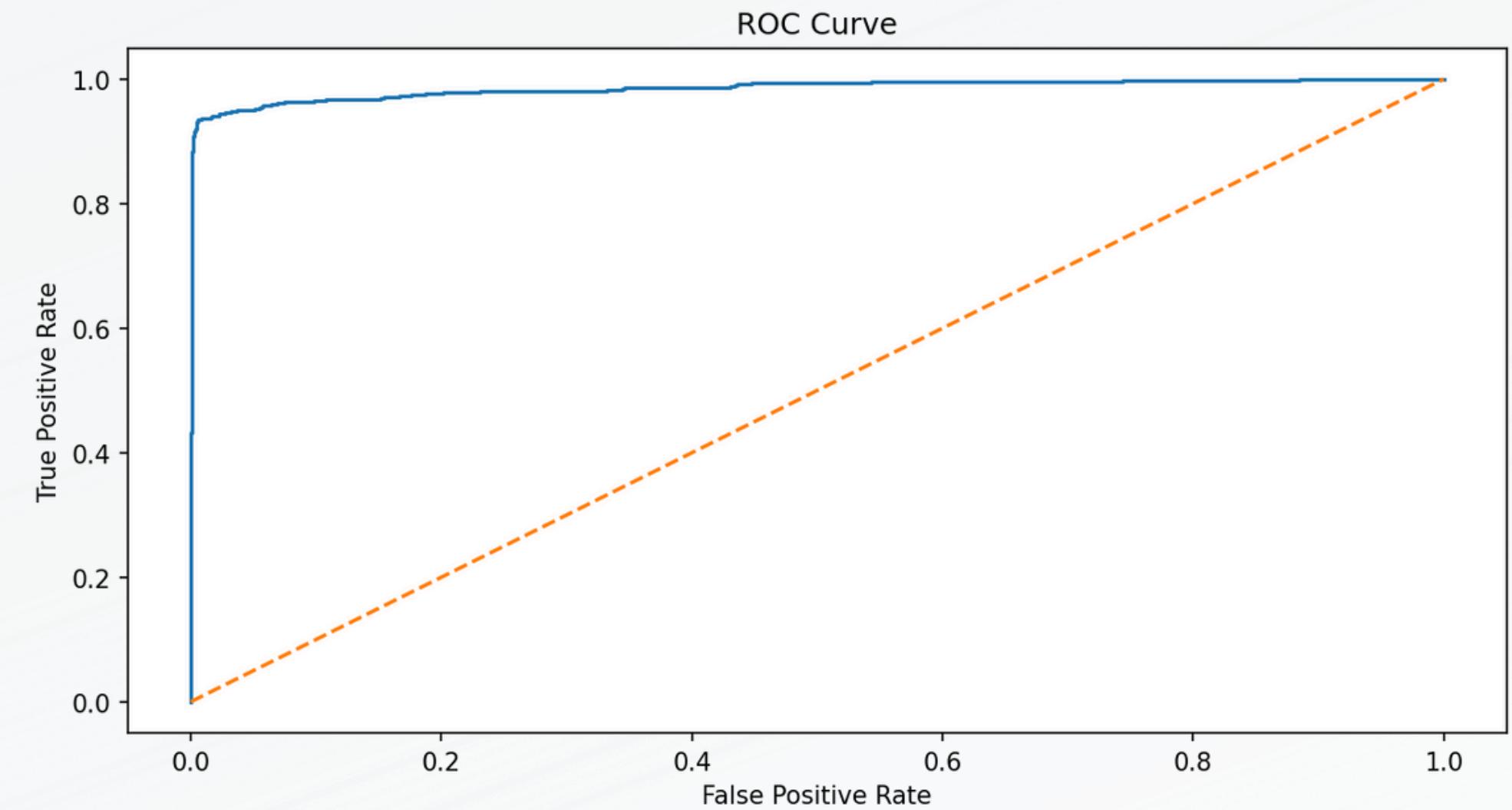
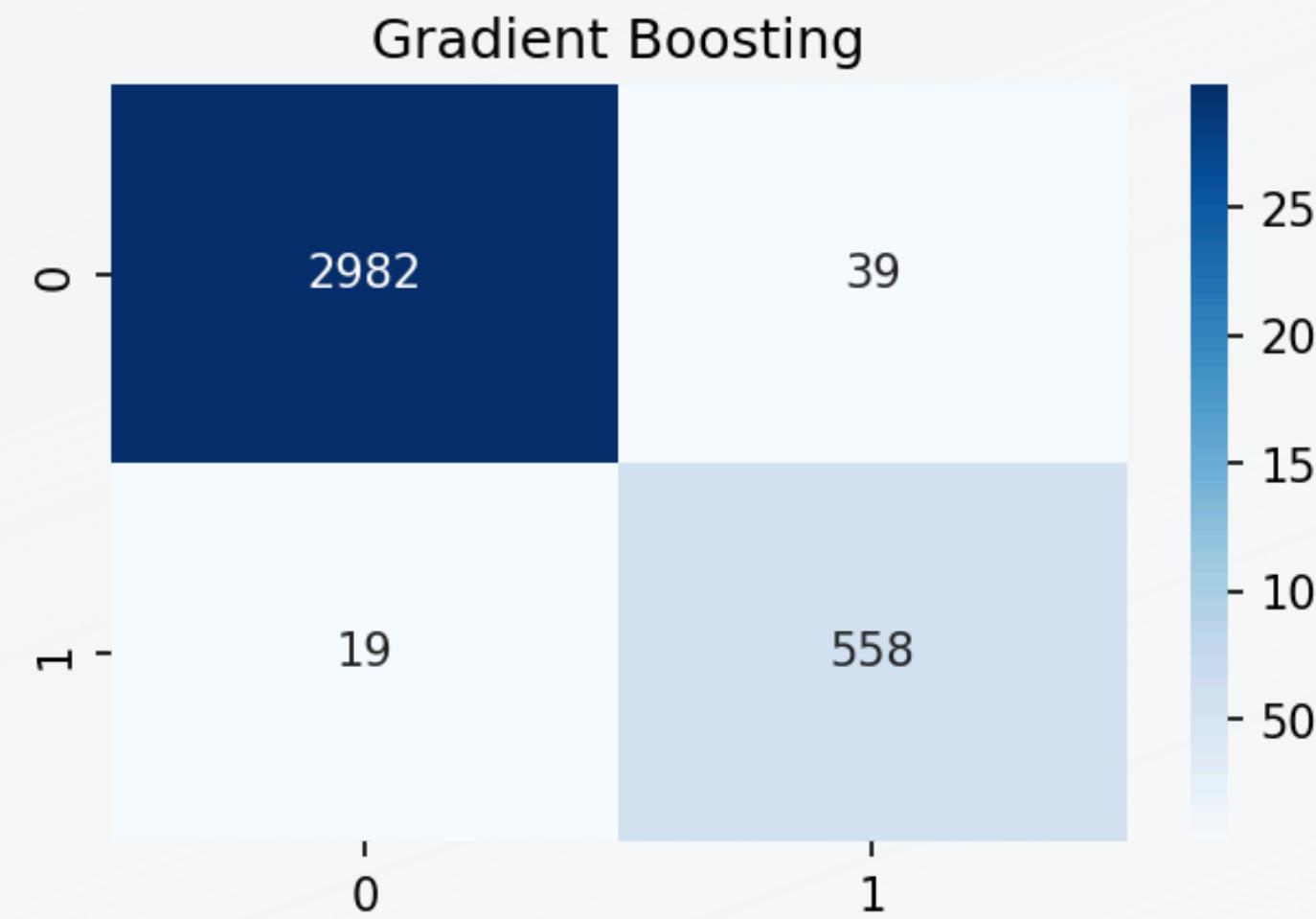
Modeling

After fine-tuning, The Gradient Boosting model delivered the best performance.

It achieved UAC of 98.6%, precision of 93%, recall of 97%, f1 of 95%, and accuracy of 98% on the test set.

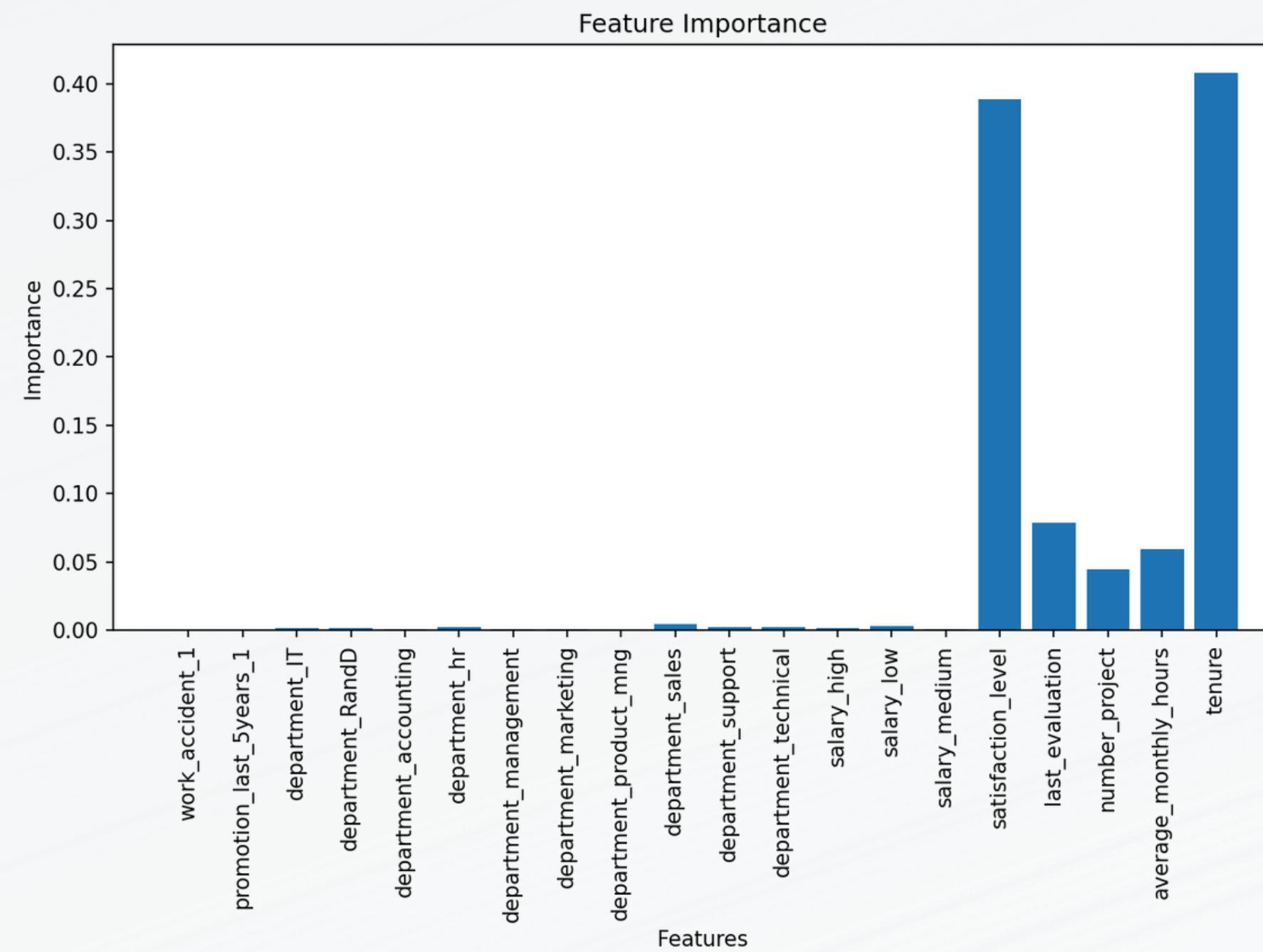
Best hyperparameters are:

- max_depth: 16
- n_estimators: 100
- min_samples_leaf: 3
- learning_rate: 0.4



Modeling

There are 5 main features play an important role in turnover rate.



Recommendations

According to above EDA, employees are overworked.

To retain employees, the following recommendations could be considered:

- **Employee satisfaction:**
 - Conduct regular surveys or stay interviews to measure and improve employee satisfaction levels. Identify the sources of dissatisfaction and address them accordingly.
 - Hold company-wide and within-team discussions to understand and address the company work culture, across the board and in specific contexts.
- **Workload Management and Well-being:**

Monitor and regulate the average monthly hours of employees. Ensure that they have a reasonable and balanced workload that matches their capabilities and preferences.
Avoid overloading or underloading employees with projects. It appears that handling three projects is ideal.
- **Retention and Recognition:**
 - Long tenure Recognition: Recognize and reward employees who have long tenure, as they may have valuable skills, experience, and knowledge that benefit the company.
 - Short tenure Regcognition: Provide opportunities for employees who have short tenure, as they may be looking for new challenges, learning, and growth.

Dani Martinez





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**THANK YOU
FOR LISTENING!**

Q & A