

People Analytics

Project Report

at the Faculty of Business, Economics, and Law
Friedrich-Alexander-Universität Erlangen-Nürnberg
Schöller Endowed Chair for Information Systems
Prof. Dr. Sven Laumer

Presented by: Ibne Sayad
Am Europakanal 36
Erlangen
+49 163 6976593
ibne.sayad@fau.de
23365652

Final Date of Submission: 2024-07-31

Content

Content	2
1 Well-Being	3
1.1 The importance of well-being (<i>4 Points</i>)	3
1.2 Stress induced by technology (<i>7 Points</i>)	4
1.3 Employee well-being dataset (<i>8 Points</i>)	5
1.4 Predictive well-being algorithm (<i>6 Points</i>)	8
2 Turnover	11
2.1 Employee Turnover (<i>4 Points</i>)	11
2.2 Employee Turnover Theories (<i>6 Points</i>)	12
2.3 Employee Turnover Dataset (<i>10 Points</i>)	14
2.4 Turnover prediction (<i>5 Points</i>)	17
References	VII
Declaration of Academic Integrity at the Schöller Endowed Chair for Information Systems ...	VIII

1 Well-Being

1.1 The importance of well-being (4 Points)

Monitoring representative well-being is vital for organizations like FAU Bank for a few reasons. Essentially, well-being altogether impacts worker execution and efficiency. Representatives who feel esteemed and solid are more likely to be locked in, propelled, and beneficial, specifically profiting from the company's general execution. Furthermore, a center on well-being can decrease turnover rates and non-appearance, as representatives are less likely to take off an organization that prioritizes their well-being and fulfillment. Besides, dismissing well-being can lead to expanded healthcare costs, as representatives beneath stretch or encountering burnout may require more restorative consideration.

Several factors can lead to low levels of employee well-being and an unhealthy work-life balance:

Work Environment Stressors: This incorporates long working hours, intemperate workloads, and high-pressure situations. Such conditions can lead to burnout and diminished work fulfillment.

Technostress: The weight from a steady network and the have to adjust to new technologies can cause stretch. Technostress is especially concerning because it can obscure the lines between work and individual life, driving an undesirable work-life adjustment.

Work Uncertainty: Concerns around work soundness, such as potential cutbacks or the fear of being supplanted by innovation, can cause critical push and uneasiness among workers.

Clashes Between Work and Family Life: Challenges in adjusting work responsibilities with individual life can lead to stretch and contrarily influence general well-being. Typically especially important when work requests meddled with family time or individual unwinding.

Recommended approaches that FAU Bank can embrace to monitor employee wellbeing :

Well-Being Programs: Arranging programs that advance physical well-being, mental well-being, and monetary soundness can offer assistance. This incorporates advertising exercise center participation, mental well-being days, monetary arranging workshops, and stretch administration courses.

Flexible Work Arrangements: Giving adaptable working hours or further work alternatives can offer assistance to representatives superior oversee their work-life balance, reducing stretch and expanding work fulfillment.

Supportive Management Practices: Preparing managers to recognize signs of burnout and push can empower them to back their groups more viably. This incorporates cultivating a comprehensive work environment where representatives feel secure and esteemed.

By centering on these procedures, FAU Bank can cultivate a more advantageous, more beneficial work environment, eventually profiting both workers and the organization as an entirety.

1.2 Stress induced by technology (7 Points)

Introducing a new Transaction Processing System (TPS) at FAU Bank, FAU Bank, supplanting the existing bequest framework, seems to possibly lead to an assortment of challenges and impacts, especially on worker push levels. After administration writing and pondering on work environment push propose that such moves can be full with both specialized and human asset challenges.

Potential Challenges and Stressors:

Learning Curve and Training: Employees accustomed to the legacy system may find the new TPS difficult to learn, leading to frustration and decreased productivity during the initial phases. It can cause anxiety and stress, especially among those less comfortable with technological changes.

Technological Anxiety: Technological changes can induce stress among employees, particularly if they feel unprepared or inadequately trained. This stress can be exacerbated if the new system is perceived as more complex or less intuitive than the legacy system.

Increased Workload: During the transition period, employees might experience an increased workload as they navigate both the old and new systems. This dual-system phase can lead to longer working hours, heightened stress, and potential burnout.

Consequences that can occur:

The consequences of heightened stress levels among employees due to the introduction of a new TPS can be significant. Increased stress can lead to reduced job satisfaction, lower productivity, and higher absenteeism. Furthermore, chronic stress is linked to health problems, which can increase healthcare costs and affect overall employee well-being. In extreme cases, this stress can lead to higher turnover rates, particularly if employees feel that their concerns are not being addressed.

Strategies and Recommendations:

Comprehensive Training: To mitigate these stressors, FAU Bank should invest in comprehensive training programs that are accessible and tailored to different learning styles. This training should not only cover the technical aspects of the new TPS but also include stress management techniques.

Effective Communication: Clear, consistent, and transparent communication is crucial. Employees should be informed about the reasons for the change, the benefits of the new system, and how it will impact their roles. Regular updates and an open channel for feedback can help alleviate anxiety.

Support Systems: Establishing support systems, such as help desks and peer support networks, can provide employees with resources to address issues as they arise. This can include technical support as well as counseling services for those struggling with the transition.

So, transitioning to a new TPS at FAU Bank presents both opportunities and challenges. By acknowledging the potential for increased stress and proactively addressing it through training, communication, support, and inclusive practices, the bank can facilitate a smoother transition, minimizing negative impacts on employee well-being and maintaining operational efficiency.

1.3 Employee well-being dataset (8 Points)

The dataset “FAU_Bank_Employee_Wellbeing.csv” has been considered for this task. Through data preprocessing, visualization, and correlation analysis, we aim to understand the main determinants of work-life balance and how different demographics and job roles experience work-related stress and leisure time differently.

Checking Missing Values: The code checks for missing values using the specific function “`wellbeing_data.isnull().sum()`”. It's crucial to assess missing data to determine if imputation or removal is necessary.

Feature Selection: The column “**Employee_ID**” has been dropped from the table. This decision is justified because “**Employee_ID**” typically serves as an identifier and does not contain information that would contribute to the analysis of work-life balance or other factors.

Mapping Categorical to Numeric Values:

Age: Converted from string categories to numeric values using a mapping dictionary. This conversion facilitates numerical analysis and correlations.

Gender: Similarly, gender was mapped to numeric values (‘0’ for Male and ‘1’ for Female), making it easier to analyze and visualize.

Data Visualization: Daily Stress by Gender

The bar chart illustrates daily stress levels by gender. It shows that females are slightly more stressed.



Figure 01: Daily Stress by Gender

Daily Stress by Job Role: The bar chart visualizes daily stress by job role. It shows that job role like Human resources & Loan processors faces more stress than others.

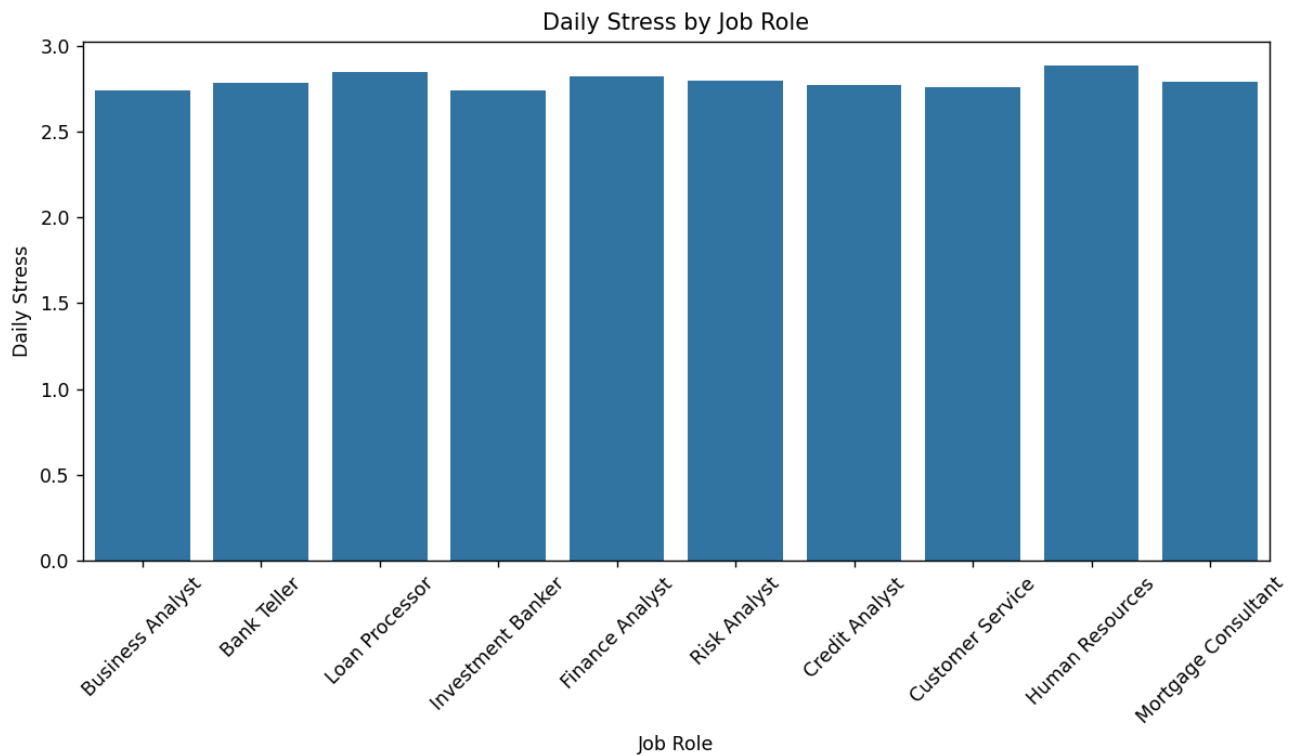


Figure 02: Daily Stress by Job Role

Average Time Dedicated to Hobbies by Gender: The bar chart represents who dedicates more time to hobbies, men or women. It shows that male spends a little more time than females on their hobbies.

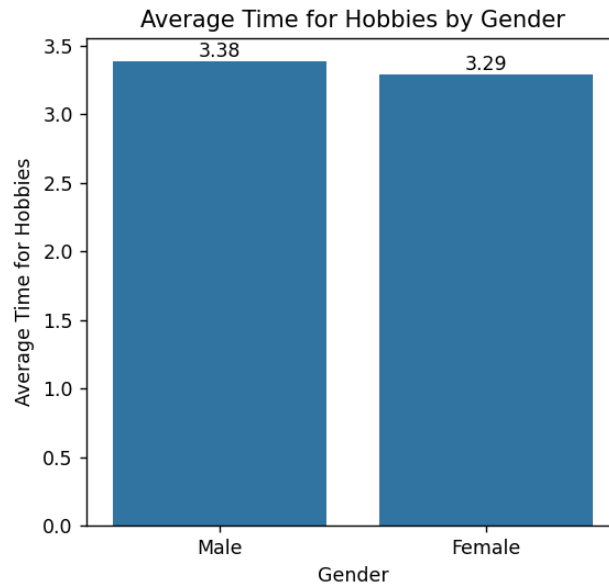


Figure 03: Avg. time dedicated to hobbies by Gender

Correlation Heatmap: The correlation heatmap helps identify the variables most related to the “WORK_LIFE_BALANCE_SCORE”.

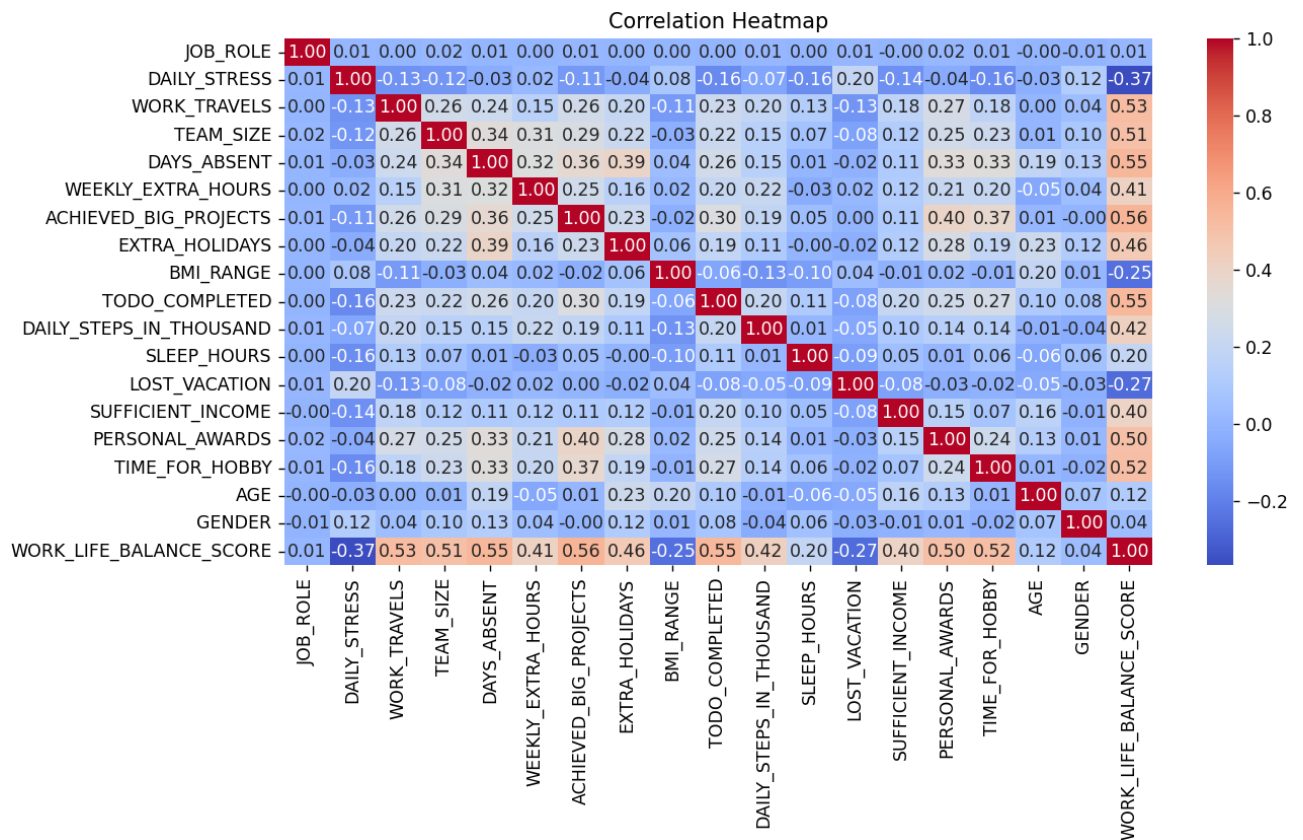


Figure 04: Correlation Heatmap

Most Correlated Factors: The heat map clearly shows the correlated attributes related to WLB. The list completed list has also been printed in the console. Where it shows that the most **positively** correlated values. These are the top 5 : ACHIEVED_BIG_PROJECTS: 0.56, DAYS_ABSENT: 0.55, TODO_COMPLETED: 0.56, WORK_TRAVELS: 0.53, TIME_FOR_HOBBY: 0.52.

On the other hand, the **negatively** correlated values are: GENDER: 0.04, JOB_ROLE: 0.01, BMI_RANGE: -0.25, LOST_VACATION: -0.27, DAILY_STRESS: -0.36

1.4 Predictive well-being algorithm (6 Points)

The goal is to build and train a predictive model using the provided dataset to forecast the “WORK_LIFE_BALANCE_SCORE” (WLB) for employees. Here are the steps taken:

Data Preprocessing: Categorical data (age, gender, job role) was mapped to numerical values to facilitate analysis. Missing values in the dataset were imputed using the mean strategy to maintain numerical stability.

Model Training: A Linear Regression model was trained using the dataset, with the “WORK_LIFE_BALANCE_SCORE” as the target variable.

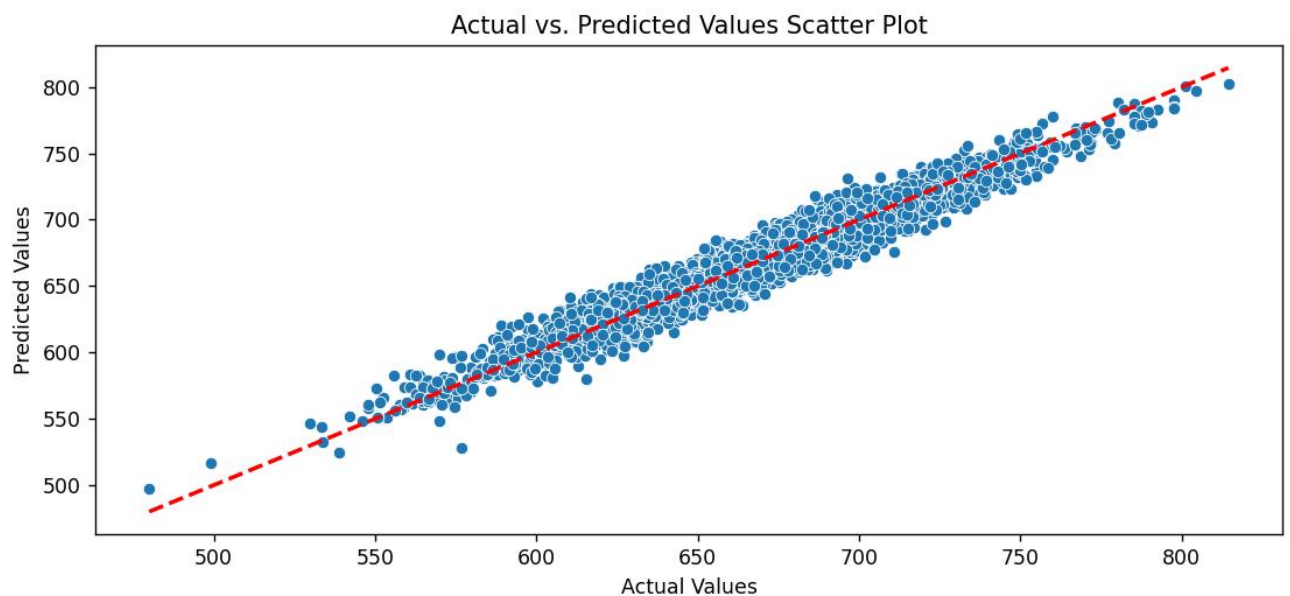


Figure 05: Scatter plot of the predicted values

Evaluation: The R^2 score, or coefficient of determination, measures the proportion of variance in the dependent variable that can be explained by the independent variables in a regression model. Based on the code, it evaluates how well the features in the dataset explain variations in the employees' work-life balance (WLB) scores. A higher R^2 value indicates a better fit of the model to the data. The model fetches accuracy in terms of R^2 score is around **95%**.

```
R2 score: 0.9465037660407525

Comparison of actual vs. predicted values:
R2 score: 0.9465037660407525
```

Figure 06: R^2 score for the model

Comparison of Actual vs. Predicted Values: The comparison of actual versus predicted values was facilitated using a confusion matrix, accuracy score, and classification report. This comparison is crucial for understanding the model's predictive accuracy and identifying areas where it may be misclassifying employees' intentions.

```
Comparison of actual vs. predicted values:
  Actual Predicted Difference
0      644.3 635.019329 9.280671
  Actual Predicted Difference
0      644.3 635.019329 9.280671
0      644.3 635.019329 9.280671
1      563.7 582.669530 -18.969530
2      621.2 626.002128 -4.802128
3      704.3 694.480040 9.819960
4      694.5 674.565173 19.934827
...      ...      ...      ...
3190    724.2 723.340662 0.859338
3191    677.0 664.221966 12.778034
3192    702.4 693.158378 9.241622
3193    622.0 630.061154 -8.061154
3194    632.7 631.571993 1.128007
```

Figure 07: Comparison of Actual vs. Predicted Values

Predicting the WLB Score for a New Employee: The model also allows for predicting the WLB score for new employees based on new records that are provided. This feature demonstrates the practical application of the model beyond the evaluation of past data. It shows that the score is **611.84**.

```
Predicted Work-Life Balance score for the new employee: 611.8448618651942
```

Figure 08: Predicting WLB score for new employee

Suggested Steps for FAU Bank: Based on the findings from the predictive model and data analysis, the following steps are recommended to improve employees' work-life balance.

Stress Management Programs: Implement stress reduction initiatives, especially targeting roles identified with higher stress levels.

Flexible Work Options: Introduce or expand flexible work schedules and remote work opportunities, particularly for employees in job roles with lower WLB scores.

Health and Wellness Programs: Promote health and wellness programs, including mental health support, fitness activities, and hobby clubs, to encourage employees to engage in activities outside of work.

Recognition and Reward Systems: Enhance recognition and reward systems to acknowledge employees' achievements, which can improve job satisfaction and work-life balance.

Implementing these measures can help create a more supportive and balanced work environment, contributing to overall employee satisfaction and productivity.

2 Turnover

2.1 Employee Turnover (4 Points)

Deliberate worker turnover refers to the method wherein workers select to remove an organization from their claim agreement. This sort of turnover is particularly different from automatic turnover, where the manager starts the partition due to components such as cutbacks or dismissals. Voluntary turnover could be a basic metric for organizations since it can show representative disappointment, or that competitors offer more appealing openings. The suggestions of tall intentional turnover are multifaceted and for the most part antagonistic for organizations. To begin with and preeminent, the coordinated monetary fetched is related to enlisting, enlisting, and preparing unused representatives, extending from 30% to 400% of the leaving employee's yearly compensation. Moreover, turnover can lead to a misfortune of regulation information, disturbances in benefit or generation, and diminished resolve among remaining workers, possibly driving advanced turnover.

Causes of Voluntary Employee Turnover:

The reasons behind why representatives take off are complex and can be impacted by various components. Concurring with the Organization Balance Hypothesis proposed by Walk and Simon (1958), turnover happens when the esteem of an employee's commitments surpasses the motivations advertised by the organization. This bungle can be due to insufficient recompense, the need for career headway openings, or inadmissible working conditions. Another noteworthy hypothesis is the Unfurling Show of Turnover by Lee and Mitchell, which recommends that turnover can be activated by particular "shocks"—events that disturb an employee's connection to the organization. These stuns can run from individual issues, such as family migration, to proficient ones, like clashes with administration or changes in work parts. The show also highlights that turnover can result from both sound decision-making forms and more rash responses to prompt occasions.

Addressing Voluntary Turnover:

For organizations like FAU Bank, which confront noteworthy intentional turnover, it is vital to get it these basic causes to create viable maintenance techniques. Data-driven approaches can be instrumental in foreseeing turnover and distinguishing at-risk workers. By analyzing designs in turnover information, organizations can pinpoint particular offices or statistic bunches that are more inclined to take off and examine the fundamental reasons, whether they be work disappointment, need for progression, or outside showcase components.

Executing comprehensive maintenance plans that address recognized issues can altogether diminish turnover rates. Such plans might incorporate changing recompense structures, upgrading career advancement programs, making strides in working environment culture, and guaranteeing superior arrangement between employees' parts and their individual and proficient yearnings. Also, keeping up a solid organizational culture that cultivates a sense of having a place and engagement can be a capable obstacle to turnover.

In rundown, deliberate worker turnover could be a basic concern for organizations due to its budgetary and operational impacts. Understanding and tending to the causes of turnover through data-driven methodologies and focused on mediation can offer assistance to organizations that hold profitable ability and keep up a steady workforce.

2.2 Employee Turnover Theories (6 Points)

Case 1: Jane's Situation

Turnover Theory: Job Embeddedness

The case of Jane, a bank teller at FAU Bank, can be best caught on through the focal point of the Work Embeddedness Hypothesis. This hypothesis proposes that representatives are more likely to remain in their employment when they feel a solid sense of "fit" and "links" to their organization and community. "Fit" alludes to how well an employee's values, career objectives, and plans for the end of the adjustment are with those of the organization. "links" are the formal or casual associations that tie representatives to their organization and community, counting connections with colleagues and social ties exterior of work.

In Jane's circumstance, whereas she adjusts to the bank's need for personalized client benefit, her need for important social associations and connections inside the working environment means a frail "connect" component. This sense of disengagement can altogether impact her deliberate regulations, despite any arrangement with organizational objectives or values.

Retention Strategies for Jane: FAU Bank should focus on strengthening workplace relationships and fostering a supportive community to retain employees like Jane. This can be achieved through-

Team-Building Activities: Regular team-building exercises can help employees connect on a personal level, improving camaraderie and mutual support.

Mentorship Programs: Establishing mentorship or buddy systems for new employees can facilitate integration and provide ongoing support, helping to build stronger interpersonal connections.

Encouraging Social Interactions: Creating spaces and opportunities for informal social interactions, such as social events or casual get-togethers, can help employees bond and feel more connected to their colleagues.

Employee Resource Groups: Supporting the formation of employee resource groups based on shared interests or demographics can provide additional support networks and a sense of belonging.

Case 2: John's Situation

Turnover Theory: Unfolding Model of Turnover

John's case can be best clarified by utilizing the Unfolding Model of Turnover. This hypothesis states that employees' choices to take off are frequently activated by particular "shocks" or occasions that cause them to re-evaluate their relationship with their manager. These stuns can be individual, such as changes in family circumstances, or organizational, such as shifts in company arrangement or structure.

In John's case, the securing of his imaginative program company by FAU Bank represented a significant shock. His trouble and ensuing choice to take off were activated by the misfortune of independence and a move towards a more varied corporate structure, which clashed with his values of autonomy and adaptability.

FAU Bank could implement strategies to mitigate the impacts of such organizational changes:

Clear Communication and Involvement: During significant organizational changes, clear communication about the reasons for changes and how they will be managed is crucial. Involving employees in decision-making processes where possible can help them feel valued and maintain a sense of control over their work environment.

Maintaining Autonomy: Even within a larger corporate structure, efforts can be made to preserve elements of autonomy and innovative culture. This could include allowing flexible working arrangements, supporting independent projects, and fostering a culture of innovation.

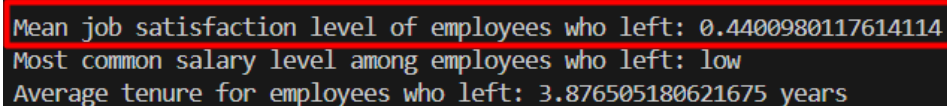
Transition Support: Providing support during transitions, such as counseling services, career coaching, and workshops on adapting to change, can help employees navigate new organizational landscapes and reduce turnover due to shock.

In both cases, understanding the underlying psychological and social factors that influence turnover decisions is critical for effective management and retention strategies. By addressing these specific needs and concerns, FAU Bank can create a more supportive and engaging work environment, reducing turnover and fostering long-term employee loyalty.

2.3 Employee Turnover Dataset (10 Points)

The "FAU_Bank_turnover.csv" dataset provides information on various factors related to employee turnover at FAU Bank, including job roles, salary levels, job satisfaction, and tenure. The primary focus is on understanding the attributes that contribute to employees leaving the company, indicated by the "left" column (1 for those who left, 0 for those still employed).

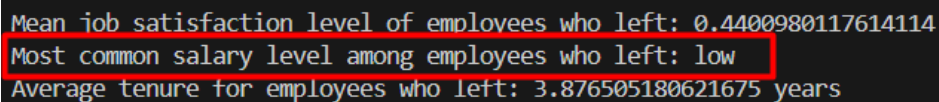
Average Job Satisfaction Level of Employees Who Left: The average job satisfaction level among employees who left the company was calculated. This metric provides insight into whether dissatisfaction in the workplace contributed to their departure.



```
Mean job satisfaction level of employees who left: 0.4400980117614114
Most common salary level among employees who left: low
Average tenure for employees who left: 3.876505180621675 years
```

Figure 09: Avg. job satisfaction level of employees who left

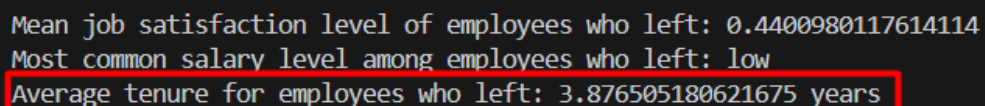
Average Salary Satisfaction Level of Employees Who Left: The most common salary level among employees who left was identified. This helps to understand if salary was a significant factor in turnover, especially if a particular salary band has a higher departure rate. It shows that **low** salaries impact those employees who leave.



```
Mean job satisfaction level of employees who left: 0.4400980117614114
Most common salary level among employees who left: low
Average tenure for employees who left: 3.876505180621675 years
```

Figure 10: Common salary level of employees who left

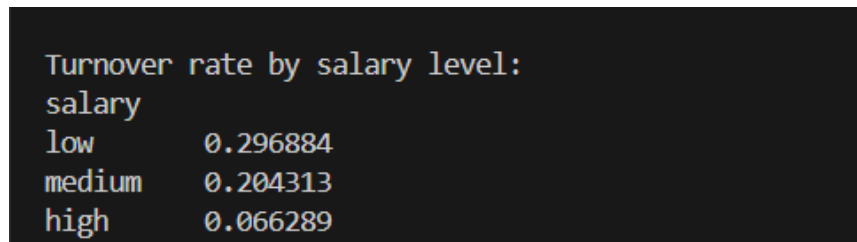
Average Tenure of Employees Who Left: The average duration (tenure) that employees stayed with the company before leaving was calculated. This information is crucial for understanding the typical employee lifecycle and potential turnover timing. The avg. Tenure who left was around 3.88 Years.



```
Mean job satisfaction level of employees who left: 0.4400980117614114
Most common salary level among employees who left: low
Average tenure for employees who left: 3.876505180621675 years
```

Figure 11: Avg tenure for employees who left

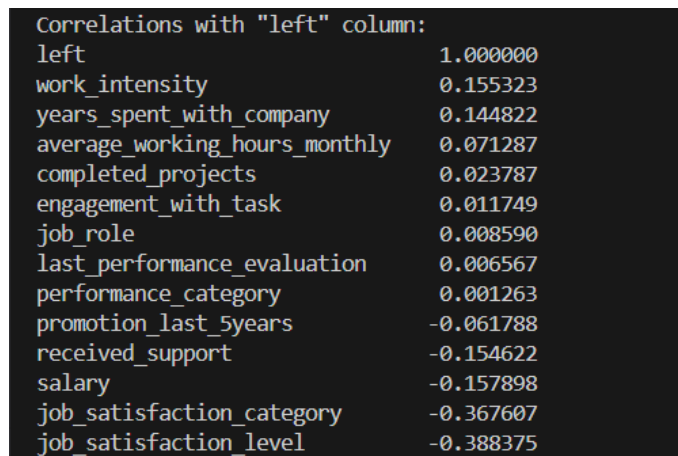
Impact of Salary on Turnover: Turnover rates were analyzed by salary level to assess if compensation influences the decision to leave the company. A higher turnover rate in lower salary bands could indicate dissatisfaction with compensation.



Turnover rate by salary level:	
salary	
low	0.296884
medium	0.204313
high	0.066289

Figure 12: Turnover rate by salary level

Correlation Analysis with 'Left' Column: A correlation matrix was created to identify attributes most strongly associated with the likelihood of an employee leaving the company. Key correlations can reveal significant factors contributing to turnover, such as job satisfaction, work intensity, or performance evaluations. The findings from the correlation matrix help prioritize areas for intervention. For example, a strong negative correlation between job satisfaction and leaving indicates that improving job satisfaction could reduce turnover.



Correlations with "left" column:	
left	1.000000
work_intensity	0.155323
years_spent_with_company	0.144822
average_working_hours_monthly	0.071287
completed_projects	0.023787
engagement_with_task	0.011749
job_role	0.008590
last_performance_evaluation	0.006567
performance_category	0.001263
promotion_last_5years	-0.061788
received_support	-0.154622
salary	-0.157898
job_satisfaction_category	-0.367607
job_satisfaction_level	-0.388375

Figure 13: Correlations with the "Left" column

Visualizing the Correlation Matrix: A heatmap is generated for better visualization.

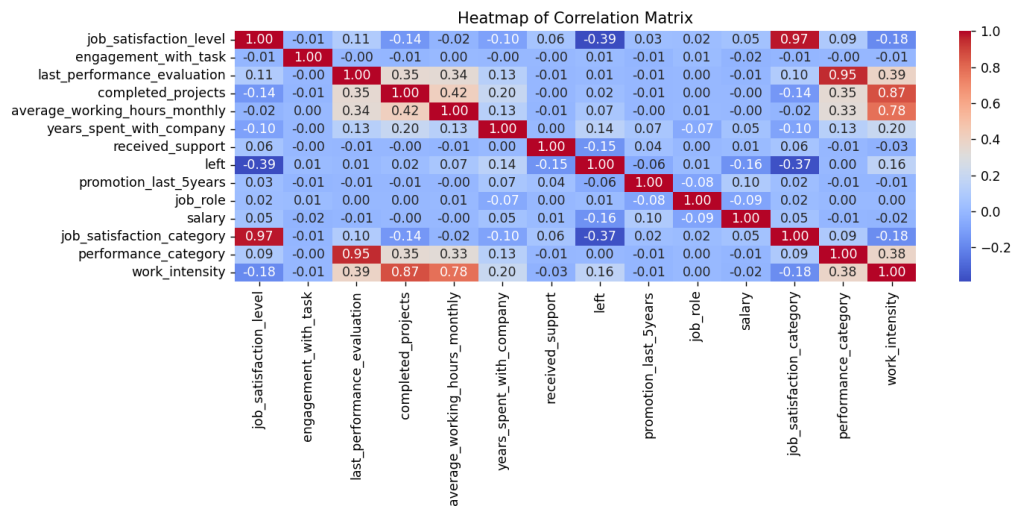


Figure 14: Heatmap of the Correlation matrix

Data Preprocessing Steps that considered:

Convert Job Roles to Numeric Data Type: Facilitate quantitative analysis by encoding categorical job roles into numeric form. A mapping dictionary was created to convert job roles from strings to integers. For example, 'bank_teller' was mapped to 1, 'business_analyst' to 2, and so on.

Convert Salary from Categorical to Numeric Data Type: Standardize salary levels to numerical values for consistency in analysis. Salary categories ('low', 'medium', and 'high') were mapped to integers 1, 2, and 3, respectively.

Data Binning for Continuous Variables: Simplify continuous data (job satisfaction and performance evaluation) into categorical bins to reduce variability and highlight patterns. Both job satisfaction and last performance evaluation were divided into 5 bins, each representing a range of values.

Create a New Feature for Work Intensity: Combine related variables (number of projects and average working hours) into a single feature, reflecting overall work intensity. A new column "work_intensity" was calculated by multiplying the number of completed projects by the average monthly working hours.

These preprocessing steps transformed the data into a more analysis-friendly format, facilitating the identification of key factors influencing employee turnover. The process ensured that all data was in a numeric format, binned appropriately, and incorporated new features that better represented employee experiences.

2.4 Turnover prediction (5 Points)

For predicting employee turnover, a **Gradient Boosting Classifier** was chosen due to its robustness in handling various types of data and its ability to capture complex relationships between features. This algorithm is particularly effective in dealing with non-linear data and is known for providing good accuracy and interpretability through feature importance scores.

Performance Evaluation

Accuracy: The model's accuracy is a basic metric showing the proportion of correctly predicted instances. However, it's essential to consider other metrics for imbalanced datasets (like turnover prediction). The accuracy of the model came to **97%** for this model.

Accuracy: 0.9733333333333334

Confusion Matrix: This matrix provides insight into the types of errors the model makes, showing the counts of true positives, true negatives, false positives, and false negatives. It helps in understanding the model's performance in each class.

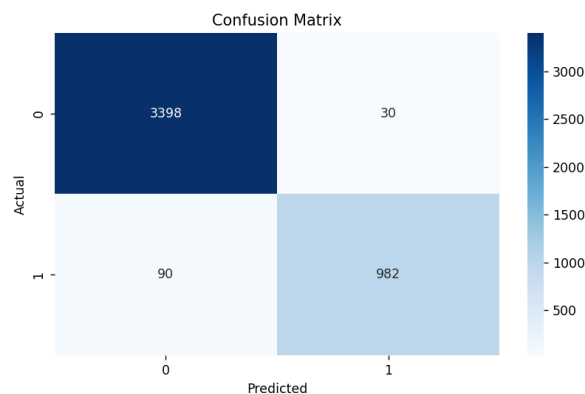


Figure 15: Plotting of confusion matrix

Classification Report: Includes precision, recall, and F1-score for each class, offering a more detailed view of the model's performance, especially on how well it distinguishes between employees who will leave and those who will stay.

Classification Report:					
	precision	recall	f1-score	support	
0	0.97	0.99	0.98	3428	
1	0.97	0.92	0.94	1072	
accuracy			0.97	4500	
macro avg	0.97	0.95	0.96	4500	
weighted avg	0.97	0.97	0.97	4500	

Figure 16: Classification report

Key Predictive Factors: From the feature importance analysis, factors like job satisfaction level, last performance evaluation, and engagement with tasks were significant predictors of turnover. This indicates that employees with lower satisfaction and engagement levels are more likely to leave.

Confusion Matrix Insights: The confusion matrix revealed that the model can distinguish fairly well between those who will leave and those who will stay, but there may be some instances of misclassification that need further investigation.

Recommendations for FAU Bank

Improve Job Satisfaction: Since job satisfaction is a strong predictor of turnover, the bank should focus on initiatives to improve workplace satisfaction, such as regular feedback, career development opportunities, and a positive work environment.

Enhance Performance Evaluation Processes: Regular and constructive performance evaluations can help identify and address issues early, potentially reducing turnover.

Employee Engagement Programs: Increasing employee engagement through recognition programs, team-building activities, and clear communication can help retain employees.

Tailored Retention Strategies: Analyzing the data further to understand specific issues for different job roles or salary levels could lead to more targeted retention strategies. For instance, if lower salary levels are linked to higher turnover, reviewing compensation packages might be necessary.

The Gradient Boosting model provides a good balance between predictive accuracy and interpretability. By understanding the significant factors contributing to turnover, FAU Bank can implement targeted interventions to retain talent and reduce turnover costs.

References

- Mitchell, T. R., Holtom, B. C., Lee, T. W., Sablinski, C. J., & Erez, M. (2001). Why people stay: Using job embeddedness to predict voluntary turnover. *Academy of Management Journal*, 44(6), 1102-1121.
- Lee, T. W., & Mitchell, T. R. (1994). An alternative approach: The unfolding model of voluntary employee turnover. *Academy of Management Review*, 19(1), 51-89.
- Allen, D. G., Bryant, P. C., & Vardaman, J. M. (2010). Retaining talent: Replacing misconceptions with evidence-based strategies. *Academy of Management Perspectives*, 24(2), 48-64.
- Meyer, J. P., & Allen, N. J. (1991). A three-component conceptualization of organizational commitment. *Human Resource Management Review*, 1(1), 61-89.
- Rousseau, D. M. (1995). *Psychological contracts in organizations: Understanding written and unwritten agreements*. SAGE Publications.
- Eisenberger, R., Huntington, R., Hutchison, S., & Sowa, D. (1986). Perceived organizational support. *Journal of Applied Psychology*, 71(3), 500-507.

Declaration of Academic Integrity at the Schöller Endowed Chair for Information Systems

I hereby certify that I have prepared the submitted work independently, and without the unauthorized assistance of third parties, as well as without the use of unauthorized aids. The work has not been submitted in the same or similar form to any other examination authority, nor has it been accepted by any other examination authority as part of an examination.

The passages in the work, which have been taken from other sources in terms of wording or meaning, are identified by indicating the origin. This also applies to drawings, sketches, picture representations, and sources from the Internet.

I am aware that the use of artificial intelligence is permitted for work at the Schöller Endowed Chair of Information Systems, Digitalization in Business and Society (esp. to improve the text written by myself). However, the intellectual core of the respective work has been developed by me, and the scientific methods that are part of the work have been carried out by myself. Furthermore, I have transparently communicated the aids used in the work.

Violations of the above-mentioned rules are to be qualified as deception or attempted deception and lead to an assessment of the examination with "failed". Further sanctions are possible in the case of multiple or particularly drastic violations of the rules by the examination board.

_____ Ibne Sayad _____

First name Middle names Surname

Erlangen, 2024-07-31