People Analytics

Project Report

at the Faculty of Business, Economics, and Law
Friedrich-Alexander-Universität Erlangen-Nürnberg
Schöller Endowed Chair for Information Systems
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Content

1 Personnel Planning

1.1 Future workforce needs *(4 Points)*

FAU Bank needs a new workforce for its new physical branch. The bank can identify its future workforce needs by following a structured approach. It's possible to estimate the future workforce using the HR Staffing Model. If we calculate the Gross Employee Requirements (GER) the bank needs from Net Employee Requirements (NER) and Reserve Employee Requirement (RER) then we can determine the Expected hires (EH) or number of employees needed. There are several methodological processes involved in examining the current workforce, forecasting future workforce requirements, determining the gap between the present state and future needs, and implementing solutions. These processes help the organization achieve its mission, goals, and objectives.

Here are the steps of effective workforce planning:

1. **Define Strategic Direction**: Align workforce planning with long-term business goals.
2. **Scan Environments:** Analyze internal workforce capabilities and external market conditions.
3. **Model Current Workforce**: Understand existing staff skills, demographics, and productivity.
4. **Assess Future Needs:** Anticipate the number and type of tellers required.
5. **Identify Gaps:** Compare the current workforce with future needs.
6. **Develop Strategies:** Gap-closing strategies are needed and revised when needed.

1.2 Recruiting new hires *(4 Points)*

Passive and Active recruiting, are the two types of recruiting policies that any organization can follow. Where Active recruiting is a proactive approach, in this process, the recruiters actively search for potential candidates. Those candidates usually portray their desired skills on job boards, professional networking platforms, and direct approaches. On the other hand, Passive recruiting is recruiting those people who are not actively searching for new jobs. In these circumstances, this type of recruiting implies to them. This way of recruiting can be done through company branding, social media presence, referral programs, and more.

FAU Bank should primarily employ active sourcing for hiring bank tellers.
These employees play a vital role in their jobs. So, the right skills and necessary experiences matter in this role. Active sourcing will allow to target directly those candidates who have the essential skill set and appropriate experiences. Channels that FAU bank can use for active sourcing are-

- **Job Boards:** Utilize platforms like Indeed, Glassdoor, and Stapestone to post job openings and actively search for candidates.
- **Social Media:** Leverage social media channels like LinkedIn, Facebook, and Twitter to promote job openings and connect with potential candidates.
- **Campus Recruitment:** Partner with local colleges and universities to attract recent graduates looking to start their careers in banking.
- **Employee Referrals**: Encourage the current employees to refer candidates. This can be incentivized through referral bonuses or other rewards.
- **Recruiting Agencies**: Recruitment agencies can also play a vital role in active recruiting.

1.3 Employee Need *(5 Points)*

The FAU Bank is planning to open a new branch in their location in Nürnberg and seeks to determine the optimal number of bank tellers required for each shift. The bank has two shifts and each shift will last for 4 hours. It's required to provide service to 8 customers per hour at the service level. Using fau_bank_shifts.csv datasets and employing the Python pulp module, we are calculating the number of bank tellers needed for this new branch.

The approach is taken to find the employee needed for each shift-
Solve the Linear Programming Problem: The problem was formulated as a Linear Programming (LP) problem. We introduced LpVariable for each shift, to find the number of bank tellers needed for that shift.
• **Constraints:** We applied constraints to ensure that the total number of bank tellers assigned to each shift satisfies the service level demand. The number of bank tellers needed for each shift is calculated based on the data from an existing branch.
• **Objective Function:** The objective function was set to minimize the total number of bank tellers required for all shifts. This ensures optimal utilization of employee resources while meeting customers' needs efficiently.
• **Solution:** After solving the LP problem using the pulp module, we obtained the optimal number of bank tellers needed for the two shifts.
Findings and Implications for FAU Bank: The results indicate the optimal number of bank tellers required for each shift for the new branch-

- The number of bank tellers needed for shift 1 is 6 and for shift 2 is 4.

```
Result - Optimal solution found

Objective value:                10.00000000
Enumerated nodes:               0
Total iterations:               0
Time (CPU seconds):             0.01
Time (Wallclock seconds):       0.01

Option for printingOptions changed from normal to all
Total time (CPU seconds):       0.03   (Wallclock seconds):       0.03

Status: Optimal
Objective value: 10.0
Shift 1: Tellers Needed = 6
Shift 2: Tellers Needed = 4
Total time (CPU seconds): 0.25 (Wallclock seconds): 0.25
```

Figure 01: Output for the employee Need problem

The solution is marked as "Optimal," indicating that it meets all constraints and provides the most efficient allocation of bank tellers to shifts based on customer demand. The results have significant implications for the FAU Bank's workforce planning. The optimal number of bankers assigned to each shift ensures efficient resource utilization while maintaining high-quality customer service. These are the benefits that the new branch will get from these recommendations-
• **Cost-Efficiency:** The optimal bank teller allocation ensures that resources are utilized effectively, minimizing unnecessary expenses.
• **Enhanced Customer Service:** Adequate banker staffing improves customer service by reducing wait times and ensuring sufficient attention to each client.
• **Employee Satisfaction:** Proper employee allocation fosters a balanced workload and improves job satisfaction in the new branch

1.4 Digital Proficiency Enhancement *(5 Points)*

FAU Bank is facing the challenge of a skills gap in its workforce concerning the effective use of new digital tools and technologies introduced by its online banking platform. This is a common issue in digital transformation projects where the existing employees may not have the necessary expertise or experience with advanced digital tools like mobile banking applications, digital payment systems, and AI-powered customer service solutions.

To effectively address this challenge, FAU Bank can undertake the following strategies:

Comprehensive Training Programs: Fau Bank can take the initiative for Skill Development Workshops. They can organize training sessions on new digital tools and technologies that will include hands-on training, webinars, and e-learning modules tailored to different departments.
In addition to that, they can create an environment to establish constant learning with regular updates on new features and advancements in digital banking technology.

Hiring and Onboarding Experts: Recruit digital experts with expertise in digital banking and technology to fill knowledge gaps and lead digital transformation efforts. In addition, implement mentorship programs where experienced digital experts can guide and support existing employees in adapting to new tools.

User-Friendly Tools and Interfaces: Ensure the new digital tools have user-friendly interfaces that make it easier for employees to learn and use them effectively. In addition, implement feedback mechanisms to understand employee challenges and continuously improve the tools and training programs based on their input.

By addressing this obstacle, FAU Bank can reap several benefits:

Enhanced Efficiency and Productivity: Employees equipped with the necessary skills can utilize digital tools more efficiently, leading to improved productivity and faster service delivery.

Improved Customer Service: Well-trained customer service representatives can better assist customers using advanced digital tools, leading to higher customer satisfaction and loyalty.

Competitive Advantage: Embracing digital transformation effectively can position FAU Bank as a leader in digital banking, attracting more tech-savvy customers and differentiating it from competitors.

Innovation and Agility: A workforce proficient in digital tools can drive innovation within the bank, enabling it to quickly adapt to market changes and customer needs.

Cost Savings: Automation and efficient use of digital tools can reduce operational costs in the long run by streamlining processes and minimizing errors.

Overall, by investing in employee training and support, FAU Bank can successfully navigate its digital transformation, leading to a more agile, customer-centric, and innovative organization.

1.5 Find the Best Candidate *(7 Points)*

FAU Bank is looking for a digital transformation manager. The manager will lead the digital transformation initiative within the bank. The manager's primary responsibility will be to improve efficiency, innovation, and competitiveness. We'll follow a structured approach to compile the required skills for the Digital Transformation Manager position and then evaluate the skills of the current employees at FAU Bank.

Step 1: Determine the Required Skill Set for the Digital Transformation Manager Position.

As a head of HR, let's identify the key skills and competencies required for the Digital Transformation Manager role. These will be categorized into technical skills, managerial and soft skills.
Technical Skills: Python, Scikit-learn, SQL, Excel, MS Office, Google Sheets, software QA Knowledgebase, Digital Strategy Development, Project Management, Data Analytics.
Managerial & Skills Soft: Leadership, Change Management, Strategic Planning, Innovation, Adaptability, Problem-Solving and Communication.

Step 2: Evaluate the Skills of Current Employees

Next, we'll assess the skills of current FAU Bank employees to identify potential candidates for the Digital Transformation Manager position. To do this, we need to compile employee skills data. In addition, we need to extract and categorize the skills from the existing employees' CVs.
After that we need to analyze skills match to compare the employees' skills with the required skill set for the Digital Transformation Manager. Using the skills.csv file as a template, we can create a table that captures the skills of each employee.

Step 3: Step 3: Analyze Skills Match
Finally, we'll analyze which employee(s) best match the required skills for the Digital Transformation Manager position.

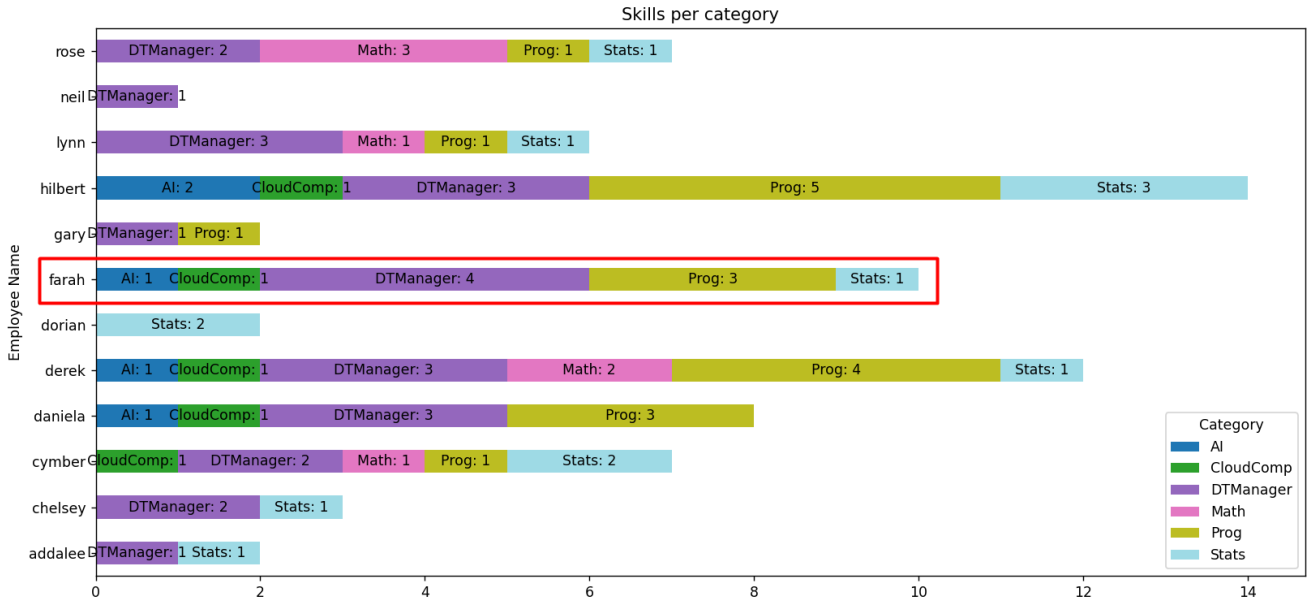

Figure 02: Output for the finding best candidate

Here are the explanations of the functions that are used to solve the problem:

read_skills_from_csv(csv_file): In this function, we read the CSV file containing lists of skills categorized into different skill sets and process the CSV file into a data frame.

extract_text_from_pdf(pdf_path): Using this function, we extract all text content from a PDF file, open the PDF file, and initialize a PdfReader object. Extracts text from each page and concatenates it into a single string.

extract_skills_from_text(text, required_skills): Using this function, we identify and extract skills from the text based on the required skills. Iterates over each category and skill in the required skills dictionary. Used regular expression matching to find occurrences of each skill in the text.

process_cvs_and_visualize(skills_csv, cv_folder): With this function, we mainly read skills, process CVs, extract relevant skills, and visualize the results. Reads the required skills from the CSV file. Iterates over each PDF in the specified folder, extracts text using extract_text_from_pdf, and identifies skills using extract_skills_from_text. Finally, we have visualized the number of relevant skills per employee using a bar chart.

Based on the skills data, **Farah Martin** appears to be the best fit for the role, as she has most of the required skills, including key technical skills (Python, Pandas, Scikit-learn, SQL, Excel, Google Sheets, Google analytics, and A/B Testing) and managerial skills (Experimentation, planning, Leadership Experience), and have a sufficient amount of work experience in the relevant fields. By addressing the skills gap through proper evaluation and training, FAU Bank can ensure that its Digital Transformation Manager is well-equipped to lead the bank's digital initiatives successfully.

2 Onboarding and Performance

2.1 A new hire *(5 Points)*

During the onboarding process, socialization plays the most vital role for a new employee to integrate into the organization's culture, understand the inter-team relationships, and make relationships with colleagues. It helps a new employee to become productive and committed to their respective organization.

Main Factors Leading to Successful Onboarding-

Understanding Organizational Goals: A new employee must know about the company's mission, vision, and values. It gives the foundation to create a strong bond with the organization. This alignment fosters motivation and commitment, as employees are more likely to act by a shared vision (Feldman, 1981; Fisher, 1986).

The clear image about the role: Role clarity is a crucial factor in successful onboarding. Bauer et al. (2007) articulated that, emphasized that clear understanding of job roles and expectations reduces ambiguity and stress, enabling new employees to perform their duties more effectively. From that, it gets easier for an employee to build their self-efficacy.

Social Acceptance: Social acceptance and the development of workplace relationships are critical for the integration of new employees. According to Bauer et al. (2007), social acceptance contributes significantly to job satisfaction and commitment.

Based on the scientific literature, for the socialization approach, FAU Bank should adopt a comprehensive socialization approach that includes structured onboarding programs and opportunities for informal interactions. Bauer et al. (2007) expanded on these by emphasizing role clarity, self-efficacy, and social acceptance.

Recommendations for Onboarding Events-

A warm orientation and team introduction: A warm orientation and team introduction: Host an orientation for the new employee to meet with the employee hierarchy and organizational goals. In addition, a proper team introduction would be a must-end for that new employee

Mentorship Programs and Training Sessions: A solid collaboration is needed between the new employees and experienced mentors who can provide guidance and navigate the organization’s culture. In addition, comprehensive training sessions will ensure essential job functions, company policies, and tools and technologies they are using.

Long-Term Results of Successful Onboarding-

For the Company: The process will increase the productivity and contribution of the organization. Proper onboarding enhances job satisfaction which leads to reduced turnover rates. Successful onboarding fosters a positive organizational culture where employees feel valued and engaged.

For the Employees: Well-integrated and supported employees are more satisfied with their jobs, leading to better performance and loyalty. Clear role expectations and support from mentors help employees grow and advance in their careers.

2.2 Recommender System *(5 Points)*

Onboarding is not just about training new employees but also about helping them integrate into the social fabric of the organization. FAU Bank recognizes this and aims to leverage data from its internal social media platform to create a recommender system that provides personalized recommendations for new employees to connect with existing employees. The dataset **fau_onboarding.contains** necessary information about the employees, including the department they belong to, the topics of articles they have published and liked, and their level of engagement on the platform. Using this data, we can build a recommender system to identify the top three employees with whom a new employee (in this case, with ID **emp_030**) is most similar and would likely get along the best.

Step-by-Step Approach-

Data Preparation: Read the dataset and create a 'soup' of features that combines the department, published topics, liked articles, and engagement levels for each employee.

TF-IDF Vectorization: Use the TF-IDF vectorizer to convert the text data into numerical vectors. This helps in quantifying the textual information and capturing the importance of each word relative to the entire dataset.

Cosine Similarity Calculation: Compute the cosine similarity between the TF-IDF vectors of employees to determine how similar each employee is to others based on their 'soup' of features.

Employee Recommendations: For the new employee emp_030, find the three most similar existing employees based on the cosine similarity scores.

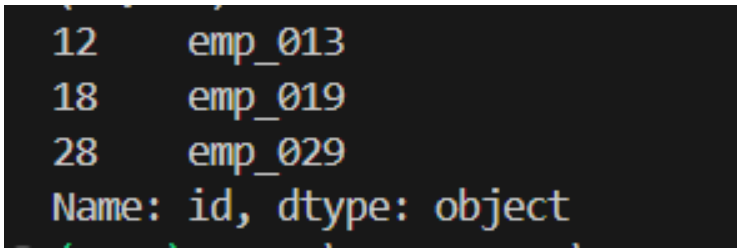

Figure 03: Output for the recommender system

According to the output of the recommender system, **emp_013**, **emp_019** and **emp_029** will be the recommended employee for the new employee with the employee ID **emp_30**.

By using the internal social media data, FAU Bank can enhance the onboarding experience of new employees through personalized social integration. The recommender system identifies existing employees who share similar interests and engagement levels, facilitating meaningful connections. This approach not only helps new employees feel welcomed but also fosters a supportive network that can boost their confidence, productivity, and overall job satisfaction.
Effective onboarding is crucial for the long-term success of both new employees and the organization. By leveraging data from the internal social media platform, FAU Bank can create a more personalized and socially engaging onboarding process. This recommender system serves as a powerful tool to identify potential mentors or peers who can help new employees integrate seamlessly into the company culture, thereby enhancing job satisfaction and organizational commitment.

2.3 Factors that affect employee performance *(5 Points)*

There are a lot of factors that influence the employee performance. It can be employee capabilities or the organizational environment. If any organization identifies and understands the factors then it will hugely help the company to grow and reach the goal faster. Here, we discuss the main factors affecting employee performance based on scientific theories and provide recommendations for FAU Bank to increase employee performance.

Work Environment: A supportive work environment that includes adequate resources, a healthy work-life balance, and a positive organizational culture can enhance performance (Kohun, 1992). On the other hand, a stressful and unsupportive environment can lead to burnout and reduced productivity.

Motivation: Motivation is a critical determinant of employee performance. According to Herzberg's Two-Factor Theory, job satisfaction and dissatisfaction are influenced by motivational factors (e.g., recognition, responsibility) and hygiene factors (e.g., salary, working conditions) (Herzberg, 1966).

Leadership: Leadership has a profound impact on employee performance. Transformational leadership, which involves inspiring and motivating employees through a shared vision and by being a role model, has been shown to positively affect employee performance (Bass, 1985).

Job Structure: The design of a job significantly impacts employee performance. The Job Characteristics Model by Hackman and Oldham (1976) suggests that jobs that are high in skill variety, task identity, task significance, autonomy, and feedback lead to higher job satisfaction and performance.

Long-Term Strategies to Increase Employee Performance at FAU Bank-

Implement a Comprehensive Employee Development Program: Provide ongoing training, mentorship, and career development opportunities. Tailor programs to individual employee needs and career goals.
Enhance Employee Engagement: Foster a culture of engagement by involving employees in decision-making processes, encouraging innovation, and providing opportunities for meaningful work.
Promote a Positive Organizational Culture: Cultivate a culture of trust, respect, and collaboration. Recognize and celebrate diversity and inclusion within the workplace.
Regular Performance Reviews: Conduct regular performance appraisals to provide constructive feedback, set realistic goals, and discuss career progression. Ensure that the review process is transparent and fair.
Adopt Flexible Work Practices: Offer flexible working arrangements to accommodate employees' personal needs and preferences, which can enhance job satisfaction and productivity.
Encourage Work-Life Balance: Provide resources and programs to help employees manage stress and maintain a healthy balance between work and personal life. This could include wellness programs, mental health support, and family-friendly policies.

By focusing on these strategies, FAU Bank can create an environment that not only enhances employee performance but also fosters loyalty, job satisfaction, and long-term success for both the employees and the organization.

2.4 Employee performance analysis *(10 Points)*

FAU Bank is undertaking a data science project to analyze employee performance and identify the underlying factors affecting it. Understanding these factors is crucial for improving overall performance and making informed decisions regarding employee management and development. This analysis aims to provide insights into department-wise performance, identify key factors influencing performance, and develop a predictive model to forecast future employee performance. By leveraging data from the **FAU_Bank_Employee_Performance.xls** dataset, this project seeks to highlight actionable strategies for enhancing employee performance, thereby benefiting both the organization and its workforce.

Exploratory Data Analysis (EDA)

Step 1: Loading and Inspecting the Dataset The dataset FAU_Bank_Employee_Performance.xls was loaded and initially inspected. This involved displaying the first few rows to understand the structure and content of the data. This initial inspection helps in identifying the types of data present and any immediate issues that may need addressing.

Step 2: Checking for Missing Values A check was performed to ensure data completeness. The dataset was found to have no missing values, which is crucial for reliable analysis and model training.

Step 3: Dropping Unnecessary Columns The EmpNumber column, which serves as an identifier and does not contribute to the analysis, was dropped. This helps in focusing on the attributes that are meaningful for the performance analysis.

Step 4: Department-wise Performance Rating Analysis The average performance ratings were calculated for each department. A bar plot was created to visualize these ratings, revealing departments with lower average ratings that may require targeted interventions to improve performance.

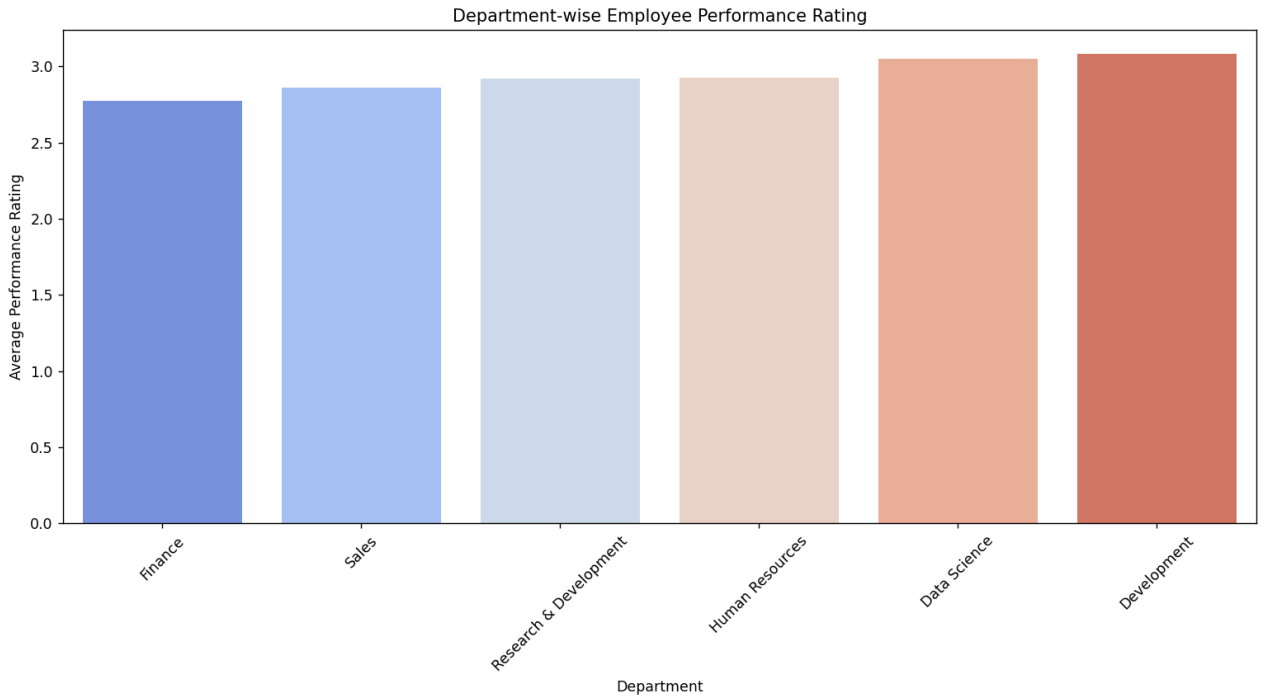

Figure 04: Department-wise employee performance rating.

Step 5: Encoding Categorical Variables Categorical attributes such as Gender, Education Background, Marital Status, Department, Job Role, Business Travel Frequency, OverTime, and Attrition were converted to numerical data types using Label Encoding. This conversion is essential for machine learning algorithms to process the data effectively.

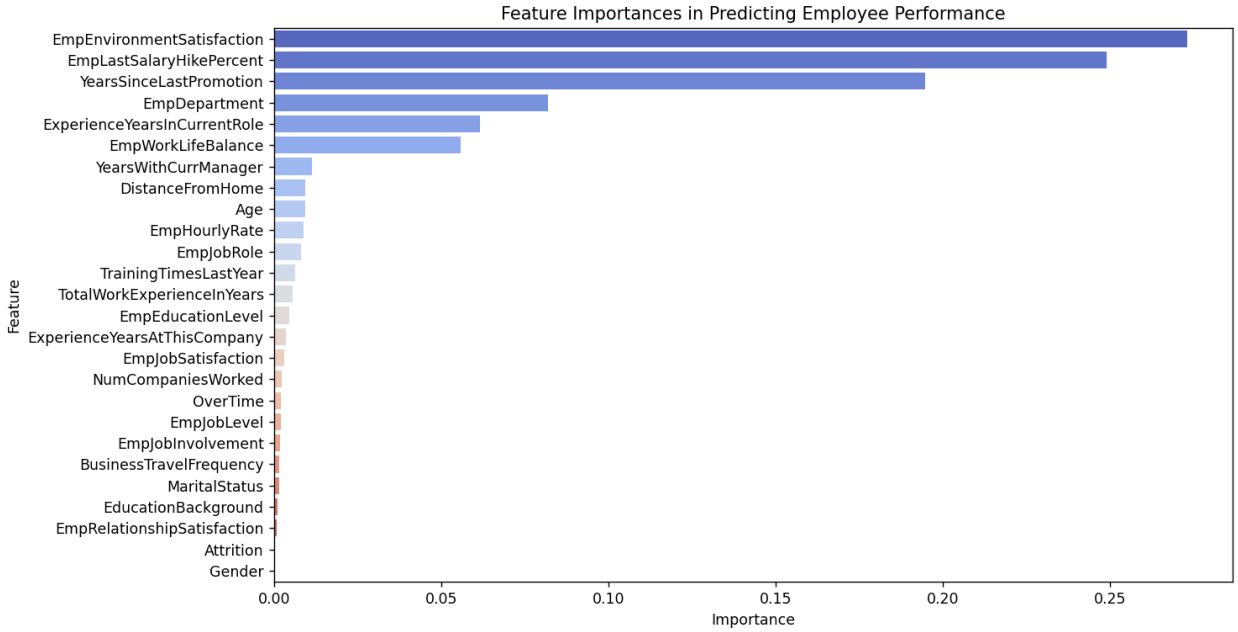

Figure 05: Factors that affect employee performance

Step 6: Correlation Matrix: A correlation matrix was calculated and plotted to observe the relationships between all variables. The matrix showed significant correlations between certain variables and performance ratings. For instance, OverTime had a high positive correlation with Performance Rating, suggesting that employees who work overtime tend to have higher performance ratings. Other notable correlations included Job Level and Total Working Years with Performance Rating.

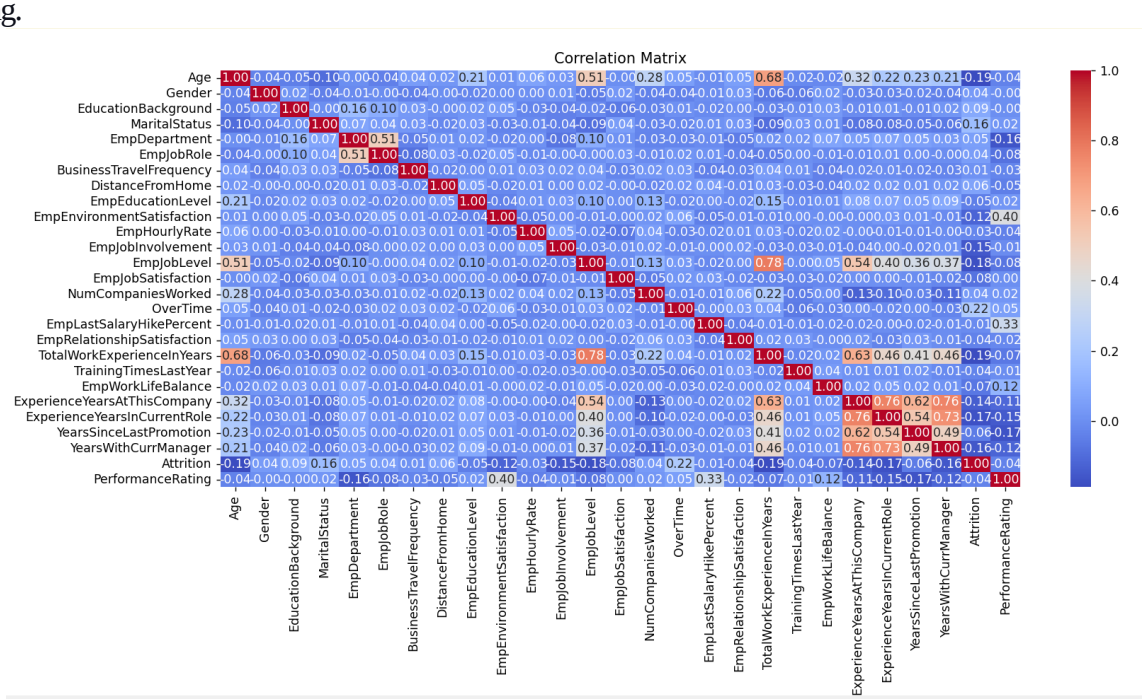

Figure 06: Correlation matrix

Machine Learning Model

Model Selection: Gradient Boosting Classifier

The Gradient Boosting Classifier was chosen for its ability to handle both classification and regression tasks, robustness to overfitting, and effectiveness with complex datasets. This model is particularly suited for predicting employee performance due to its ability to capture non-linear relationships and interactions between variables.

Training and Evaluation The data was split into training and testing sets to validate the model's performance. The model was trained on the training set and then evaluated using the testing set. The evaluation metrics, including accuracy, precision, recall, and the overall classification report, indicated that the model performed well in predicting employee performance.

Feature Importance Analysis The importance of each feature in predicting employee performance was analyzed. Key factors identified included OverTime, Total Working Years, Years at Company, and Job Level. These insights help in understanding which attributes have the most significant impact on performance, guiding the bank's strategies to enhance employee performance.

By conducting a thorough Exploratory Data Analysis (EDA), encoding categorical variables, analyzing correlations, and employing Gradient Boosting for prediction, we were able to identify the core factors affecting employee performance at FAU Bank. The model's evaluation metrics demonstrated its reliability, making it a valuable tool for predicting and enhancing employee performance.

Recommendations

Departmental Focus: Address performance issues in departments with lower average ratings by identifying specific challenges and providing targeted support.
OverTime Management: Optimize overtime work to ensure it contributes positively to performance without leading to burnout.
Employee Development: Invest in training and career development programs to enhance skills and career progression, particularly in roles and levels highly correlated with performance.
Predictive Insights: Use the predictive model to proactively identify employees at risk of underperformance and implement early interventions.

By following these recommendations, FAU Bank can improve overall employee performance, leading to increased productivity and job satisfaction.

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