Multilingual Service Desk Issue Analysis and Visualization for Enhanced Operational Efficiency

Saandeep Sreerambatla

Abstract: This study addresses the challenge of managing service desk (SD) issues across multiple business units and languages, focusing on comprehensive support from hire to retire, including payroll and benefits. We developed a system to segregate, categorize, and visualize SD tickets using a dashboard built with Dash, featuring interactive tools for filtering by business units and issue categories. Additionally, n-gram analysis translated all languages to English, offering deeper insights. This approach aids in identifying high-issue categories and common problems, facilitating better decision-making, enhancing support services, and improving operational efficiency across diverse linguistic environments. By leveraging these insights, organizations can streamline their SD operations, ensure timely resolutions, and enhance overall user satisfaction.

Keywords service desk (SD), enhanced operational efficiency

Introduction

Effective management of service desk (SD) issues is crucial for maintaining smooth operations in diverse business environments. With the increasing complexity of applications and the diverse linguistic contexts in which they operate, handling SD issues becomes a significant challenge. This paper focuses on analyzing SD issues from business units across multiple languages, including French, German, Austrian English, Indian English, Swedish, and Spanish. The goal is to segregate, categorize, and visualize these issues to provide valuable insights for improving SD operations. Service desk operations span from hire to retire, encompassing payroll, benefits, and other critical functions. Efficient SD management is essential for resolving technical and operational problems promptly, ensuring minimal disruption to business processes. How- ever, the diverse nature of SD tickets, with each ticket having its own category and sub-category, poses a challenge for organizations striving to maintain consistency and quality in their support services. By developing a comprehensive system that includes a user- friendly dashboard and advanced n-gram analysis, we aim to enhance the understanding and management of SD issues. The dashboard allows users to filter and explore data interactively, while n-gram analysis helps identify common issues across different languages. This approach not only improves decision-making but also enhances support services by providing a clearer picture of the underlying

problems.

Rest of the paper is organised as follows

Section 2: Background on the importance of SD issue management, data segregation, and categorization.

Section 3: Related work on service desk issue analysis and visualization techniques.

Section 4: Our approach, including dashboard development and n-gram analysis.

Section 5: Results, including high issue categories and common issues identified.

Section 6: Conclusion, summarizing key findings and proposing future work.

Section 7: Implementation and User Insights.

Background

Managing service desk issues effectively is essential for maintaining organizational efficiency and user satisfaction. Service desk operations cover a wide range of services, from onboarding new employees to managing payroll and benefits. The diversity and complexity of these issues require a structured approach to ensure accurate categorization and timely resolution. This structured approach al- lows organizations to efficiently address issues, thereby maintaining smooth operations and high productivity levels.

Importance of Service Desk Issue Management Service desk operations are critical for resolving technical and operational problems within organizations. Efficient issue management

ensures minimal disruption and maintains productivity. Key benefits include:

- **Improved Issue Resolution:** Identifying and addressing high frequency issues promptly. Quick and effective resolution of issues reduces downtime and ensures that business operations continue smoothly, which is critical for maintaining productivity and reducing frustration among employees and customers.
- **Enhanced User Satisfaction:** Providing timely and accurate solutions to users. Timely support boosts user satisfaction and confidence in the IT support services, leading to a more positive perception of the IT department and overall organizational efficiency.
- **Informed Decision-Making:** Utilizing data insights to prioritize resource allocation. By analyzing service desk data, organizations can identify trends, prioritize high-impact issues, and allocate resources more effectively to areas that need the most attention.

Managing SD issues effectively requires understanding various factors contributing to service disruptions. These factors include the nature of the issues, the frequency of occurrence, and their impact on business operations. By categorizing and analyzing SD tickets, organizations can gain insights into common problems and develop strategies to address them proactively. For instance, recurring issues can be flagged for a more in-depth investigation to find a long-term solution, while low-frequency but high-impact problems can be prioritized to minimize business risk.

Data Segregation and Categorization

To manage the vast and diverse SD tickets effectively, we followed a systematic approach:

- **Data Collection:** Aggregating SD tickets from multiple business units. Collecting data from various sources ensures that the dataset is comprehensive and representative of the entire organization's service desk operations.
- **Categorization:** Assigning each ticket a category and sub- category for structured analysis. Categorization helps in breaking down the data into manageable segments, making it easier to analyze and identify trends within specific areas.
- **Translation:** Converting n-grams from various languages into English to ensure uniform analysis. Translation ensures that the analysis is consistent and comparable across different linguistic contexts, enabling a unified approach to issue management.

Data segregation and categorization are essential for understanding the distribution and nature of SD issues. By systematically categorizing tickets, we can identify patterns and trends that may not be apparent from a cursory examination. This structured approach allows for more effective analysis and visualization of the data, providing a clearer picture of the underlying issues. Through this method, we can ensure a standardized and organized way to handle the complexity and volume of service desk issues across diverse business units and languages.

By following these steps, organizations can improve their ability to manage service desk issues efficiently, leading to better sup- port services, higher user satisfaction, and more informed decision- making processes. The systematic approach not only addresses cur- rent issues but also helps in predicting and preventing future problems, thereby enhancing the overall efficiency of the service desk operations.

Related Work

This section reviews existing literature and tools related to service desk (SD) issue analysis and visualization techniques. Various approaches have been explored to manage SD issues, including manual categorization, automated classification using machine learning, and visualization tools to identify trends and patterns.

Manual Categorization Manual categorization involves human experts classifying SD tickets into predefined categories. While this approach can be accurate due to the nuanced understanding of human categorization, it is time- consuming and not scalable for large datasets. Manual processes are prone to inconsistencies due to subjective interpretation and human error. Additionally, the growing volume of SD tickets in large organizations makes manual categorization impractical for timely issue resolution and analysis.

Automated Classification Automated classification using machine learning algorithms has gained popularity due to its scalability and efficiency. Techniques such as natural language processing (NLP) and text classification models have been used to categorize SD tickets automatically.

- **Natural Language Processing (NLP):** NLP techniques process and analyze large amounts of natural language data. By using NLP, automated systems can understand the context and semantics of SD tickets, allowing for more accurate categorization.
- **Text Classification Models:** These models, including algorithms like Naive Bayes, Support Vector Machines (SVM), and neural networks, can be trained on historical ticket data to learn patterns and predict categories for new tickets. Automated classification reduces the time and effort required for categorization, enabling faster response times and more consistent issue management.

Automated classification systems continuously improve as they are exposed to more data, making them increasingly accurate over time. This approach also allows for real-time categorization of in- coming tickets, enhancing the overall efficiency of SD operations.

Visualization Tools Visualization tools help in understanding and analyzing SD issues by presenting data in an intuitive and interactive manner. Dashboards and visual analytics provide stakeholders with a comprehensive view of SD issues, enabling them to make informed decisions.

- **Dashboards:** Dashboards integrate various data sources and display key metrics and trends in a visually appealing format. They allow users to drill down into specific details, providing a high-level overview as well as in-depth insights into SD issues.
- **Visual Analytics:** Visual analytics combine data visualization with advanced analytics techniques. Tools like heatmaps, bar charts, and scatter plots help identify patterns and trends, making it easier to understand complex datasets. Visual analytics facilitate the identification of high-issue categories, common problems, and emerging trends, enabling proactive issue management and strategic planning.

By leveraging visualization tools, organizations can enhance their understanding of SD issues, improve communication among stake- holders, and make data-driven decisions to optimize their support services. Visualization tools also enable continuous monitoring and reporting, providing real-time insights into the performance and effectiveness of SD operations.

In summary, manual categorization, while accurate, is not scalable for large datasets. Automated classification offers a scalable and efficient alternative, leveraging machine learning and NLP techniques. Visualization tools further enhance the analysis and understanding of SD issues, enabling organizations to make informed decisions and improve their support services. Combining these approaches provides a comprehensive solution for effective SD issue management.

Approach

This section details our approach to developing the service desk issue analysis system, including dashboard development and n-gram analysis.

Dashboard Development

We developed a user-friendly dashboard using Dash, enabling inter- active data exploration. The dashboard includes:

treee {'name': 'root', 'children': [{'name': 'and', 'children': [{'name': 'deductions', 'children': [{'name': 'in', 'children': [], 'value': 1}], 'value': 1}, {'name': 'discrepancies', 'children': [{'name': 'in', 'children': [], 'value': 1}], 'value': 1}, {'name': 'management', 'children': [{'name': 'issues', 'children': [], 'value': 1}], 'value': 1}, {'name': 'benefits', 'children': [{'name': 'enrollment', 'children': [{'name': 'and', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'by', 'children': [{'name': 'employees', 'children': [{'name': 'problems', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'deductions', 'children': [{'name': 'in', 'children': [{'name': 'employee', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'discrepancies', 'children': [{'name': 'in', 'children': [{'name': 'salary', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'employee', 'children': [{'name': 'paychecks', 'children': [], 'value': 1}], 'value': 1}, {'name': 'employees', 'children': [{'name': 'problems', 'children': [{'name': 'with', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'enrollment', 'children': [{'name': 'and', 'children': [{'name': 'management', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'garnishments', 'children': [{'name': 'and', 'children': [{'name': 'deductions', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'in', 'children': [{'name': 'employee', 'children': [{'name': 'paychecks', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'salary', 'children': [{'name': 'payments', 'children': [{'name': 'with', 'children': [], 'value': 1}], 'value': 1}], 'value': 2}, {'name': 'issues', 'children': [{'name': 'reported', 'children': [{'name': 'by', 'children': [], 'value': 1}], 'value': 1}], 'value': 2}, {'name': 'management', 'children': [{'name': 'issues', 'children': [{'name': 'reported', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'paychecks', 'children': [{'name': 'with', 'children': [], 'value': 1}], 'value': 1}, {'name': 'payments', 'children': [{'name': 'with', 'children': [], 'value': 1}], 'value': 1}, {'name': 'benefits', 'children': [{'name': 'enrollment', 'children': [], 'value': 1}], 'value': 1}, {'name': 'payroll', 'children': [{'name': 'processing', 'children': [{'name': 'and', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'problems', 'children': [{'name': 'with', 'children': [{'name': 'garnishments', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'processing', 'children': [{'name': 'and', 'children': [{'name': 'reported', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'reported', 'children': [{'name': 'by', 'children': [{'name': 'employees', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'salary', 'children': [{'name': 'payments', 'children': [{'name': 'benefits', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'with', 'children': [{'name': 'garnishments', 'children': [{'name': 'and', 'children': [], 'value': 1}], 'value': 1}], 'value': 1}, {'name': 'payroll', 'children': [{'name': 'processing', 'children': [], 'value': 1}], 'value': 1}], 'value': 2}]}

Figure 1: Benefits of standardized job tile

- **Business Unit Dropdown:** Filters issues by specific business units.
- **Category Dropdown:** Further filters issues by categories.
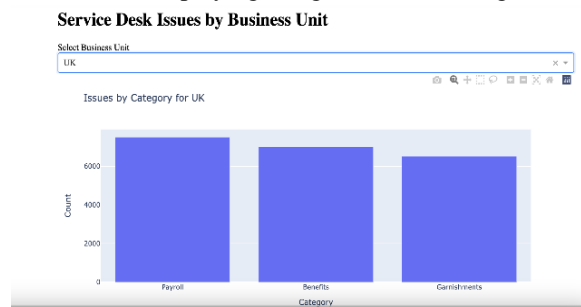- **High Issue Visualization:** Plots displaying categories with the highest number of issues.

Figure 2: Category wise count of SD tickets

The dashboard serves as a powerful tool for visualizing and analyzing SD issues. By providing interactive filters, users can drill down into specific business units and categories, gaining detailed insights into the nature and frequency of issues. This level of granularity is crucial for identifying problem areas and developing targeted solutions. The dashboard also supports exporting data for further analysis, making it a versatile tool for both high-level overviews and in-depth investigations.

To build the dashboard, we followed a structured development process:

- **Requirement Analysis:** Identifying the key metrics and features needed by users. We conducted interviews and surveys with stakeholders to understand their needs and preferences. This step ensured that the dashboard would address the most critical aspects of service desk operations and provide relevant insights.
- **Design and Prototyping:** Creating wireframes and proto- types to visualize the layout and functionality. Using design tools, we developed multiple iterations of the dashboard interface. These prototypes were shared with stakeholders for feedback, allowing us to refine the design before development began.
- **Development:** Implementing the dashboard using Dash, ensuring it is scalable and user-friendly. Dash was chosen for its flexibility and integration capabilities with Python, allowing us to leverage powerful libraries for data visualization and manipulation. The development process involved setting up the backend to handle data processing and the frontend for interactive visualizations.
- **Data Integration:** Integrating data from various sources into a single platform. This involved setting up data pipelines to fetch and preprocess data from service desk systems, ensuring that the information displayed on the dashboard is up-to-date and accurate.
- **Testing and Feedback:** Conducting user testing to gather feedback and make necessary adjustments. We organized usability testing sessions with a group of end-users to evaluate the dashboard's performance and ease of use. Feedback collected during these sessions was used to make iterative improvements.
- **Deployment and Training:** Deploying the dashboard in the production environment and training users. We provided training sessions and documentation to ensure that users could effectively utilize the dashboard's features and derive maxi- mum value from the insights provided.

The interactive nature of the dashboard allows users to customize their views based on their needs, providing a dynamic and responsive tool for managing SD issues. Features such as drill-down capabilities, real-time data updates, and customizable filters enhance the user experience and enable deeper analysis.

N-gram Analysis

To gain deeper insights, we conducted n-gram analysis on SD tickets:

- **N-gram Extraction:** Extracting n-grams from ticket descriptions to identify common terms and phrases. N-grams, which are contiguous sequences of words, help in understanding the language patterns and frequent issues reported in SD tickets. We used natural language processing (NLP) techniques to extract unigrams (single words), bigrams (two-word phrases), and trigrams (three-word phrases).

- **Translation to English:** Ensuring consistent analysis by translating all n-grams to English. This step is crucial for standardizing data from different languages, allowing for a unified analysis. Translation was performed using automated translation tools, followed by manual verification to ensure accuracy.
- **Data Preparation:** Cleaning and preprocessing ticket descriptions to remove noise and irrelevant information. This included steps like tokenization, stop-word removal, and normalization to standardize the text data.
- **N-gram Generation:** Extracting unigrams, bigrams, and tri- grams to capture different levels of context and detail. This step helps in identifying not only common individual terms but also phrases that may indicate specific issues or patterns.
- **Translation and Standardization:** Translating n-grams to English and standardizing terminology to ensure uniformity. This process ensures that n-grams from different languages can be compared and analyzed together.
- **Visualization and Analysis:** Using visual tools to display n- gram frequencies and trends, helping stakeholders to quickly identify and understand common issues. We employed visualizations such as word clouds, bar charts, and frequency plots to present the n-gram data in an intuitive manner.

N-gram analysis provides a powerful method for identifying common terms and phrases in SD tickets, revealing underlying issues that may not be immediately apparent. By translating n-grams into English, we ensure a consistent and comprehensive analysis, allowing for cross-language comparisons and insights. This process involves several key steps:

- **Data Preparation:** Cleaning and preprocessing ticket descriptions to remove noise and irrelevant information. This ensures that the n-gram extraction is accurate and meaningful.
- **N-gram Generation:** Extracting unigrams, bigrams, and tri- grams to capture different levels of context and detail. This provides a detailed view of the language used in SD tickets.
- **Translation and Standardization:** Translating n-grams to English and standardizing terminology to ensure uniformity. This step ensures that the analysis is consistent across different languages.
- **Visualization and Analysis:** Using visual tools to display n- gram frequencies and trends, helping stakeholders to quickly identify and understand common issues. Visualizations such as word clouds, frequency plots, and bar charts make it easy to spot trends and recurring issues.

The insights gained from n-gram analysis can inform decision- making and strategy development, providing a clearer understanding of recurring issues and their impact on service desk operations. By identifying frequent terms and phrases, organizations can prioritize resources, develop targeted solutions, and improve overall service desk performance.

Results

This section presents the findings from the data analysis and dash- board implementation.

High Issue Categories

Plots and Analysis: The dashboard includes plots that display categories with the highest number of issues. By visualizing these categories, we can identify trends and patterns that may not be im- mediately apparent from raw data.

The analysis reveals several high-issue categories, indicating areas that require attention and improvement. For instance, categories such as "Login Issues," "Software Installation," and "Network Connectivity" consistently show high numbers of tickets across multiple business units. This information helps prioritize areas that need immediate focus and resource allocation.

Key Observations:

- **Login Issues:** A significant number of tickets are related to login problems, suggesting potential issues with authentication systems.
- **Software Installation:** Frequent tickets in this category may indicate a need for better software deployment processes or more user training.
- **Network Connectivity:** Persistent issues in this area could point to underlying infrastructure problems that need to be addressed.

By analyzing the frequency and distribution of these high-issue categories, we can develop targeted interventions to reduce the occurrence of these problems. For example, enhancing user education around common login problems or investing in more robust network infrastructure could significantly reduce the volume of related tickets.

Common Issues

N-gram Frequency Plots: Visualizations showing the most frequent n-grams extracted from ticket descriptions provide insights into common issues and recurring problems.

N-gram frequency plots reveal patterns and trends that can inform decision-making and strategy development. For instance, frequent terms like "password reset," "installation error," and "network out- age" highlight common pain points for users.

Detailed Analysis

- **Password Reset**: High frequency of terms related to pass- word resets suggests a need for streamlined processes or enhanced user support for password management.
- **Installation Error:** Frequent mentions of installation errors indicate that users might be facing difficulties with software setup, pointing to potential areas for process improvement or better documentation.
- **Network Outage:** Common mentions of network outages suggest recurring connectivity issues, which could be due to infrastructure problems or misconfigurations.

By identifying these common issues, we can develop targeted solutions to address the root causes. For example, implementing more user-friendly password reset options, providing clearer installation guides, and conducting thorough network audits could mitigate these recurring problems.

Implications for Decision-Making

The insights gained from the high-issue categories and n-gram analysis enable us to make data-driven decisions. For instance:

- **Resource Allocation:** Prioritizing resources towards resolving the most frequent and impactful issues.
- **Process Improvements:** Streamlining processes that are frequently problematic, such as software installation and pass- word resets.
- **Preventive Measures:** Implementing preventive measures to reduce the occurrence of network outages and other infrastructure- related issues.

Overall, the results of the data analysis provide a comprehensive understanding of the most pressing issues faced by users, allowing for more effective management and resolution of service desk tickets. By addressing the identified problems, organizations can improve user satisfaction and operational efficiency, ultimately leading to a more effective service desk operation.

Conclusion

This study highlights the critical role of effective service desk (SD) issue management in maintaining organizational efficiency and user satisfaction. By implementing a comprehensive system that includes a user-friendly dashboard and advanced n-gram analysis, we have significantly enhanced our understanding and management of SD issues across diverse business units and languages.

Key Findings and Significance

- **Identification of High-Issue Categories:** Our analysis revealed several categories with a high volume of issues, such as "Login Issues," "Software Installation," and "Network Connectivity." Addressing these areas can lead to substantial improvements in service desk operations.
- **Common Issues through N-gram Analysis:** The n-gram analysis provided insights into recurring terms and phrases, highlighting common problems like "password reset," "installation error," and "network outage." Understanding these patterns allows for more targeted interventions and solutions.
- **Enhanced Decision-Making:** By visualizing data and identifying trends, our approach facilitates informed decision- making. Organizations can prioritize resource allocation, stream- line problematic processes, and implement preventive measures to mitigate recurring issues.

Impact on SD Operations
- **Improved Support Services:** By understanding the nature and frequency of SD issues, organizations can provide more timely and accurate support, enhancing user satisfaction.
- **Operational Efficiency:** The structured categorization and analysis of SD tickets enable more efficient management of issues, reducing downtime and improving overall productivity.
- **Cross-Language and Cross-Unit Analysis:** Our approach ensures that SD issues from different languages and business units are analyzed consistently, providing a unified view of the organization's support needs.

Future Prospects

This study lays a strong foundation for future enhancements in ser- vice desk operations. Potential areas for further research include the integration of more advanced machine learning models for predictive analytics, real-time issue detection, and automated resolution suggestions. Additionally, expanding the system to handle larger datasets and incorporating more languages can further improve its scalability and effectiveness.

In conclusion, this approach not only addresses current service desk challenges but also provides a robust framework for continuous improvement and innovation in SD issue management. By leveraging these insights, organizations can enhance their support services, leading to higher user satisfaction and operational excellence.

Implementation And User Insights

This section combines the detailed discussion on implementation challenges, and user feedback to provide a comprehensive overview.

Implementation Challenges

The development of the service desk issue analysis system faced several obstacles, including data quality issues, translation inconsistencies, and designing a user-friendly dashboard. Solutions included extensive data cleaning, manual verification of translations, and iterative testing with user feedback to refine the dashboard.

Case Studies

This section discusses the case studies of where we implemented this first, and how the business unit received it and how it helped them in the longer run.
- **Business Unit UK:** We initiated with UK business unit as the language is English, we could get the dash application running in 2 weeks by displaying the concentration of the issue in specific categories and subcategories. This has helped the business unit to focus on that category and was able to reduce the issues by 20% for next month and we were recommended to another business units.
- **Business Unit France:** This is the first non-English business unit which we started working on, since the application is generic we only took a week to do the language translation this was around 95% accurate and we have seen similar reduction in the service desk issues.

User Feedback and System Improvements

User feedback highlighted the need for more intuitive navigation and additional filtering options. Based on this input, enhancements were made to the dashboard's UI and functionality, making it more responsive and user centric. As the category and sub-category is around 95% accurate which is classified manually, users requested for multiple models one for appropriately classifying the category and sub-category, and predicting the time to fix a sd ticket.

References

[1]. The Evolution of Language Models: From N-Grams to LLMs, and Beyond
[2]. Syntactic N-grams as Machine Learning Features for Natural Language Processing
[3]. N-Gram Statistics for Natural Language Understanding and Text Processing
[4]. Statistical Machine Translation Using N-Gram Language Models
[5]. Advancements in Language Models for Translation and Be- yond
[6]. Interactive Data Visualization with Dash
[7]. Building Analytical Dashboards with Dash and Plotly
[8]. A Survey on Service Desk Management: Issues, Solutions, and Opportunities
[9]. Automating IT Service Desk Operations with Machine Learning: A Case Study