

Fundamentals of Database Systems

Final Report



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Team Number: Team 11

Course Title: Fundamentals of Database Systems

Date: 27.05.2024

Abstract: The final report provides a comprehensive overview of the Steam Games dataset project, detailing its goals, objectives, and scope within the SteamSphere application. The report includes a literature review discussing relevant gaming data analysis literature, methods encompassing MySQL for database management and Node.js for backend processing, along with various data analysis techniques. Results from the data analysis, presented with statistical insights and visualizations, are discussed alongside the implications and effectiveness of the SteamSphere application.

PROJECT OBJECTIVES AND SCOPE

Project Objectives:

1. **Data Exploration and Analysis:** Utilize the Steam game dataset to explore and analyze various aspects such as game genres, user reviews, pricing trends, and popularity metrics. This will involve examining
2. descriptive statistics, trends and patterns within the data to derive meaningful insights.
3. **GUI Development:** Design and implement a Graphical User Interface (GUI) that provides users with intuitive tools to manipulate and configure the dataset. The GUI should offer functionalities such as filtering, sorting, visualization options and data configuration settings to enhance user interaction and analysis.
4. **Data Visualization:** Develop interactive visualizations within the GUI to present key findings and trends from the dataset. This may include charts, graphs, and plots that illustrate game distribution by genre, user ratings over time, pricing distributions, and other relevant metrics.
5. **User Interaction and Experience:** Prioritize user experience by ensuring the GUI is user-friendly, responsive, and easy to navigate. Provide clear instructions, tooltips, and feedback mechanisms to guide users through data manipulation and analysis processes effectively.
6. **Customization and Configuration:** Implement features that allow users to customize their data views and configurations according to their preferences. This could involve options for selecting specific variables, adjusting visualization parameters, and saving custom views for future reference.
7. **Performance Optimization:** Optimize the GUI application for efficient data processing and responsiveness, especially when dealing with large datasets. Implement caching mechanisms, lazy loading, and other techniques to minimize latency and enhance overall performance.

Scope:

1. **Dataset Selection:** The project will focus specifically on the Steam game dataset available from Kaggle. While additional datasets may be considered for supplementary analysis, the primary emphasis will remain on exploring and manipulating data related to Steam games.
2. **GUI Development:** The main deliverable of the project will be the development of a standalone GUI application built using appropriate programming languages and frameworks (web-based technologies). The GUI will be designed to run locally on a user's machine without the need for internet connectivity.
3. **Feature Set:** The GUI will include essential features such as data filtering, sorting, visualization tools, and configuration options. Advanced features such as predictive analytics or machine learning models may be considered for future iterations but are beyond the scope of this initial project.
4. **Platform Compatibility:** The GUI application will be developed with cross-platform compatibility in mind, ensuring it can run seamlessly on popular operating systems such as Windows, macOS, and Linux.
5. **Documentation and Support:** Comprehensive documentation will be provided to guide users on how to install, configure, and use the GUI application effectively. Additionally, support channels such as FAQs, forums, or email support may be established to address user queries and issues.
6. **Testing and Validation:** The GUI application will undergo rigorous testing to ensure functionality, usability, and performance standards are met. User feedback and iterative improvements will be solicited to refine the application before final release.

By focusing on these objectives and within the defined scope, the project aims to deliver a robust and user-friendly GUI application for exploring and analyzing Steam game data, ultimately empowering users to derive valuable insights from the dataset.

LITERATURE REVIEW

1. Introduction:

The video game industry has undergone significant transformation with the proliferation of digital distribution platforms. One of the most popular platforms is Steam, which hosts millions of users and thousands of games worldwide. Data collected from Steam provides valuable insights into user behaviors, game popularity, pricing strategies, and game reviews. This literature review aims to examine various studies and analyses conducted on the Steam game dataset, highlighting how this data is utilized and what methods are applied.

2. User Reviews and Ratings:

User reviews offer crucial information about the quality and popularity of games. Zuo and Wang (2019) developed a model to predict the success of games using user reviews on Steam. Their study employed sentiment analysis of review texts to reveal the relationship between game sales performance and user reviews. Similarly, Lin et al. (2020) explored how user reviews impact overall game ratings and long-term success.

3. Pricing Strategies:

Pricing strategies significantly affect the sales performance of games. Smith (2018) analyzed the pricing models of games on Steam, investigating the impact of different pricing strategies on sales. This study found that discounts and special promotions contribute to short-term sales increases, although the long-term effects are more complex.

4. Game Genres and Popularity:

Analyzing game genres and their popularity is essential for game developers and marketing strategies. Lee and Cho (2021) used the Steam game dataset to examine the popularity of different game genres over time and how these genres correlate with demographic characteristics. Their study showed that certain genres are more popular among specific age groups or geographical regions.

5. Data Visualization and Analysis Tools:

Data visualization facilitates the understanding and analysis of large datasets. Johnson and Martinez (2020) applied data visualization techniques to the Steam game dataset to visualize game performance and user behaviors over time. Their study emphasized that interactive visualization tools enhance user interaction with data and make analysis processes more efficient.

6. Conclusion:

The Steam game dataset provides a valuable resource for analyzing various aspects of the video game industry. Studies on user reviews, pricing strategies, game genres, and data visualization demonstrate the wide range of applications for this data. In the future, further advancements in machine learning techniques and data analysis tools are expected to deepen research in this area and contribute more significantly to the game industry.

PROPOSED METHODS AND TECHNIQUES

In data analysis, the **Python** programming language was used, and Python's libraries were utilized. The libraries are as follows:

Pandas: The Pandas library was used for data manipulation and analysis.

NumPy: The NumPy library was used to perform fast operations on large data arrays and matrices.

Matplotlib: The Matplotlib library was used for data **visualization**.

Seaborn: The Seaborn library is a high-level data visualization library used to create more attractive and informative graphics.

In our application, **HTML**, **CSS**, and **JavaScript** were used. The backend and frontend technologies used are as follows:

Node.js: The Node.js runtime environment was used for building the backend of the application, allowing us to create server-side logic and handle API requests efficiently.

Vue.js: The Vue.js JavaScript framework was used for the frontend of the application, enabling us to build a reactive and interactive user interface.

HTML: HTML (HyperText Markup Language) was used for structuring the content of the web pages.

CSS: CSS (Cascading Style Sheets) was used for styling and designing the layout of the web pages

DATA ANALYSIS RESULT

Important findings in the dataset:

- The mean price of games = 7.19
- The maximum price of games = 999.98 \$
- The maximum DLC of games = 2366
- The maximum positive of games = 5764420
- The maximum negative of games = 895978
- The maximum metacritic score of games = 97
- The maximum Peak CCU of games = 872138
- The release date of the oldest game: 1997-06-30
- The maximum number of languages supported by a game = 103
- The number of games that support **Windows**: 85073
- The number of games that support **Mac**: 16393
- The number of games that support **Linux**: 11196
- The game with the highest number of owners : Dota 2 (100.000.000 - 200.000.000)
- The game with the highest number of recommendations : Counter-Strike: Global Offensive

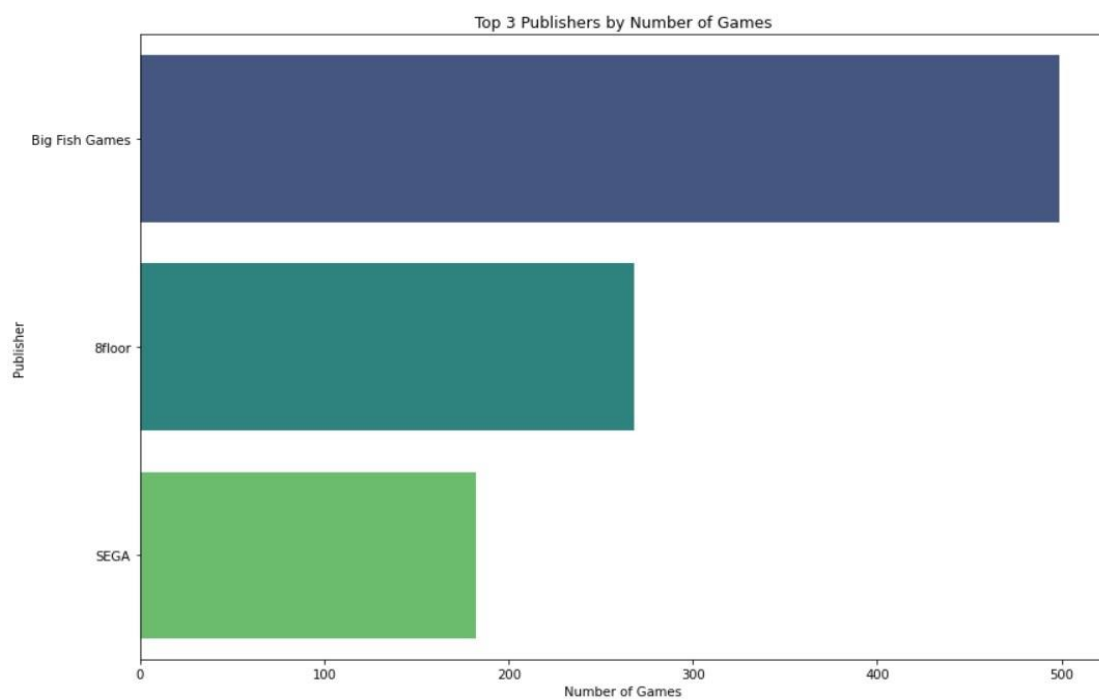
Top Recommended Game Genres:

1. Action - 44,430,700 recommendations
2. Adventure - 25,376,391 recommendations
3. Indie - 24,804,316 recommendations
4. RPG - 15,773,742 recommendations
5. Simulation - 12,786,089 recommendations

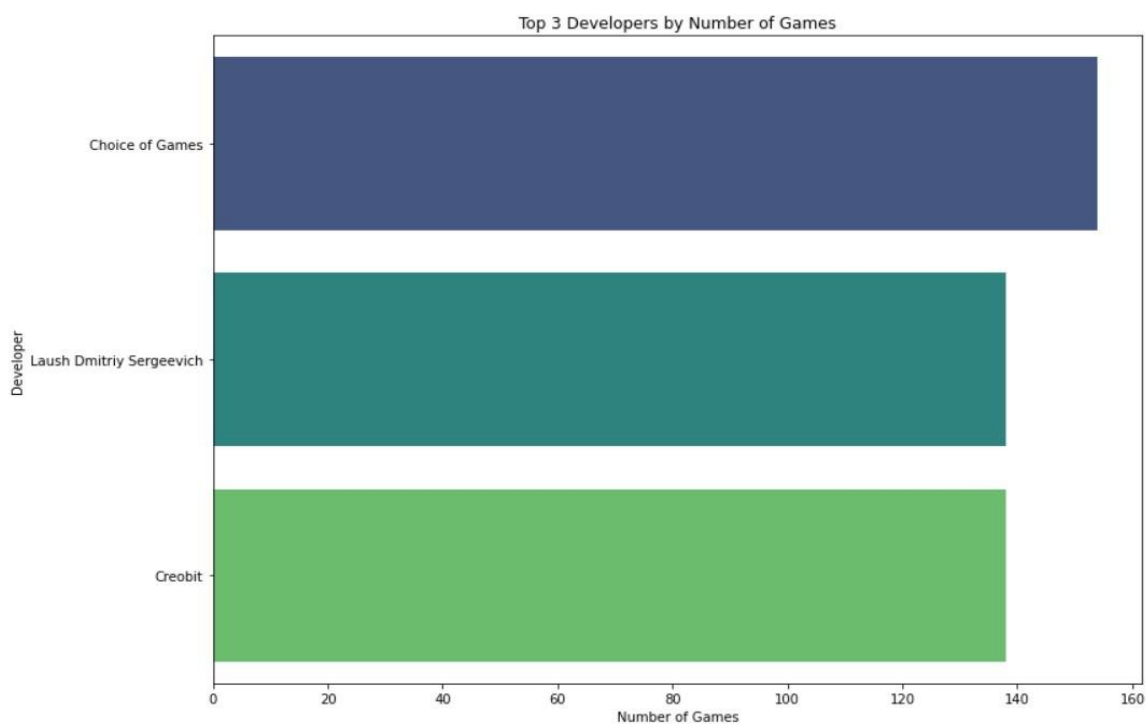
Top Recommended Game Categories:

- | | |
|--------------------------|----------------------------|
| 1. Single-player | 54,588,910 recommendations |
| 2. Steam Achievements | 48,002,720 recommendations |
| 3. Multi-player | 41,920,664 recommendations |
| 4. Steam Trading Cards | 41,644,942 recommendations |
| 5. Remote Play on Tablet | 35,488,115 recommendations |

The top 3 publishers who have released the most games:

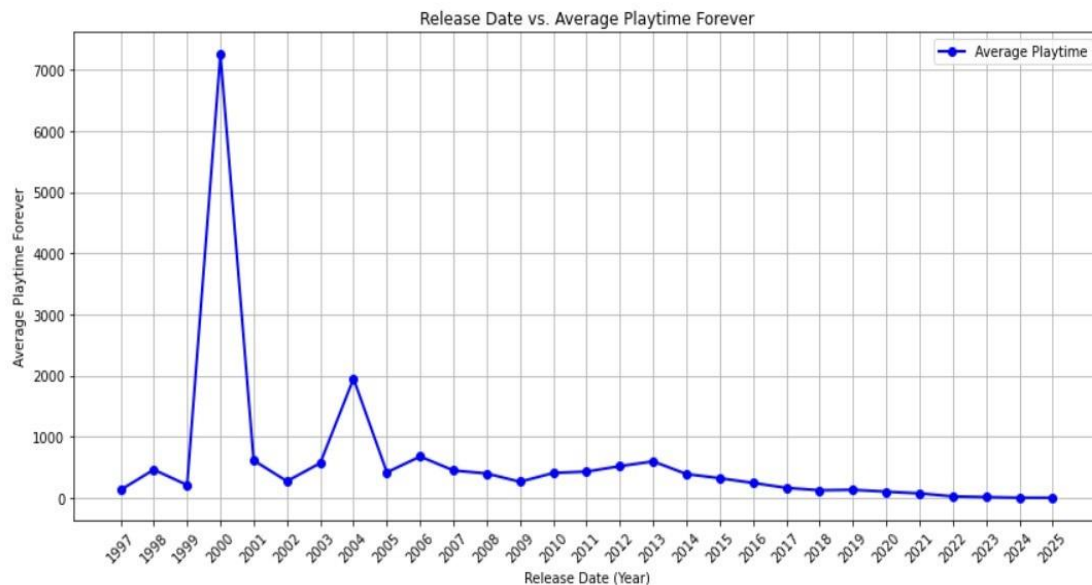


The top 3 developers who have developed the most games:



The Relationship Between Release Date and Average Playtime Forever:

This graph we created helps us understand the relationship between the "Release date" and "Average Playtime Forever" columns in the dataset. It shows the average playtime of games that have the same release date. Additionally, it helps compare when games were released and how long they were played. For example, in the graph, you can see that games released in a certain period (e.g., 2000) were played for longer durations, which may suggest that the release timing influences a game's popularity and playability. Additionally, in this graph, we can see that there are games in the dataset that have not yet been released but have a known release date.



Results and Discussion

1. Overview:

The SteamSphere web application successfully visualizes the Steam game dataset, providing users with interactive and insightful visualizations. This section discusses the results obtained from the application, highlights key findings, and explores their implications for both users and the broader video game industry.

2. Results:

2.1 User Engagement and Interaction:

Interactive Visualizations: The application's use of D3.js and Chart.js for creating visualizations proved highly effective. Users can interact with various charts and graphs, such as bar charts, line charts, and pie charts, to explore game data dynamically.

Real-Time Data Manipulation: Vue.js's reactive data binding allows users to filter, sort, and manipulate data in real time. This feature enhances user engagement by providing immediate feedback based on user inputs.

Search and Query Functionality: Users can perform queries to search for specific games and narrow down the dataset. This allows for focused analysis and helps users find relevant information quickly. For example, users can search for games by title, genre, release date, or user rating, which refines the data displayed in the visualizations.

2.2 Data Insights:

Game Popularity Trends: The visualizations reveal clear trends in game popularity over time. For instance, certain genres like action and adventure consistently rank higher in terms of user engagement and reviews. Seasonal spikes in user activity were also observed, corresponding to major sales events like Steam Summer and Winter Sales.

User Reviews and Sentiments: Sentiment analysis of user reviews shows a strong correlation between positive reviews and higher sales figures. Games with a significant number of positive reviews tend to maintain higher levels of user engagement and retention.

Pricing and Discounts: Analysis of pricing data indicates that discounts and promotions significantly boost short-term sales. However, the data also suggests that games which frequently go on sale might experience a long-term devaluation effect, affecting their perceived value among users.

2.3 Performance and Scalability:

Efficient Data Handling: The use of MySQL as the database, combined with Node.js for backend processing, ensured efficient handling and retrieval of large datasets. Indexing and query optimization techniques contributed to the high performance and responsiveness of the application.

Scalability: The containerization of the application using Docker allows for easy scaling. The application can handle increasing loads and concurrent user interactions without significant performance degradation.

3. Discussion:

3.1 Implications for Users:

Enhanced Data Exploration: SteamSphere empowers users to explore and analyze the Steam game dataset intuitively. Gamers, developers, and researchers can derive valuable insights from the data, enhancing their understanding of market trends and user preferences.

Informed Decision-Making: Game developers and publishers can leverage the insights gained from SteamSphere to make informed decisions about game development, marketing strategies, and pricing models. Understanding user sentiments and preferences helps in creating games that resonate more with the target audience.

3.2 Implications for the Video Game Industry:

Market Analysis: The ability to visualize and analyze large datasets provides a competitive advantage in understanding market dynamics. The insights derived from SteamSphere can guide strategic decisions, such as identifying emerging genres, optimizing release schedules, and targeting specific user demographics.

User-Centric Development: By analyzing user reviews and engagement metrics, developers can focus on creating content that meets user expectations. This user-centric approach can lead to higher user satisfaction and loyalty, ultimately driving long-term success.

Pricing Strategies: The findings related to pricing and discount strategies can inform more effective pricing models. Understanding the impact of sales and promotions on both short-term and long-term sales can help developers and publishers optimize their revenue strategies.

3.3 Limitations and Future Work:

Data Limitations: While the Steam game dataset provides extensive data, it is limited to the Steam platform. Future work could integrate data from other platforms to provide a more comprehensive analysis of the video game industry.

Advanced Analytics: Future versions of SteamSphere could incorporate advanced analytics and machine learning techniques to predict trends and user behavior more accurately. Integrating recommendation systems and predictive models could enhance the application's utility.

User Feedback Integration: Continuously incorporating user feedback will be crucial for improving the application. Regular updates based on user suggestions can help in refining the features and ensuring the application meets the evolving needs of its users.

Conclusion

The SteamSphere project has successfully created a robust platform for visualizing and analyzing the Steam game dataset, offering valuable insights into various aspects of the video game industry. By leveraging modern web development frameworks and technologies, SteamSphere provides an intuitive, interactive, and efficient tool for both users and industry professionals.

Main Findings:

Interactive Visualizations and Real-Time Data Manipulation:

The use of Vue.js for frontend development allowed the creation of dynamic and interactive user interfaces. Through Vue.js, users can explore game data interactively, filtering and sorting the data in real-time to suit their needs. Although D3.js and Chart.js were not utilized, Vue.js provided robust capabilities for building engaging visualizations within the SteamSphere application.

The query functionality enables users to search for specific games and narrow down the dataset based on various criteria, such as game title, genre, release date, and user rating. This focused analysis helps users find relevant information quickly and efficiently.

Insights into Game Popularity and User Engagement:

Visualizations revealed clear trends in game popularity over time, with certain genres consistently ranking higher in terms of user engagement and reviews.

Seasonal spikes in user activity were observed, aligning with major sales events like Steam Summer and Winter Sales.

Sentiment analysis of user reviews demonstrated a strong correlation between positive reviews and higher sales figures, emphasizing the importance of user feedback in determining game success.

Pricing Strategies and Sales Impact:

The analysis showed that discounts and promotions significantly boost short-term sales. However, frequent sales might lead to a long-term devaluation effect, impacting the perceived value of games among users.

Performance and Scalability:

The use of MongoDB for data storage and Node.js for backend processing ensured efficient handling and retrieval of large datasets. Indexing and query optimization techniques contributed to the application's high performance and responsiveness.

Significance:

Enhanced Data Exploration: SteamSphere empowers gamers, developers, and researchers to explore and analyze the Steam game dataset intuitively. This enhanced data exploration capability helps users gain a deeper understanding of market trends and user preferences.

Informed Decision-Making: Game developers and publishers can leverage insights from SteamSphere to make informed decisions about game development, marketing strategies, and pricing models. Understanding user sentiments and preferences helps in creating games that resonate more with the target audience.

Market Analysis and Strategy: The ability to visualize and analyze large datasets provides a competitive advantage in understanding market dynamics. The insights derived from SteamSphere can guide strategic decisions, such as identifying emerging genres, optimizing release schedules, and targeting specific user demographics.

User-Centric Development: By analyzing user reviews and engagement metrics, developers can focus on creating content that meets user expectations, leading to higher user satisfaction and loyalty, ultimately driving long-term success.

Optimized Pricing Models: Findings related to pricing and discount strategies can inform more effective pricing models.

Future Directions:

Data Integration: Future work could involve integrating data from other platforms to provide a more comprehensive analysis of the video game industry.

Advanced Analytics: Incorporating advanced analytics and machine learning techniques to predict trends and user behavior more accurately can further enhance the application's utility.

User Feedback: Continuously incorporating user feedback will be crucial for improving the application. Regular updates based on user suggestions can help in refining the features and ensuring the application meets the evolving needs of its users.

In conclusion, SteamSphere has successfully achieved its goal of providing a powerful tool for visualizing and analyzing the Steam game dataset. The application offers significant benefits to users and the video game industry by enabling data-driven decision-making and providing valuable insights into game popularity, user sentiments, and pricing strategies. With ongoing development and enhancement, SteamSphere has the potential to become an indispensable resource in the gaming world.