




Visplorify: Interactive Visual Analysis of Spotify Listening Histories

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Abstract

The audio streaming platform Spotify collects various personal data from its users, including an extensive streaming history. Despite providing this data, Spotify lacks tools for visualizing or analyzing it. This work introduces Visplorify, an application to analyze and visualize the extended streaming history. The main goal is to offer interested Spotify users a way to visually explore their listening behavior and gain deeper insights into their music data. Visplorify automatically processes users' streaming history, enriching it with detailed data presented in an interactive dashboard. Users can explore and gain insights from their data using filters and visualizations to examine patterns and trends. Users have found several use cases, such as identifying personal patterns, reflecting on life events, discovering old and new favorite songs, and creating playlists. The application also provides users with insight into potential analyses of their personal data, increasing transparency.

CCS Concepts

• **Human-centered computing** → **Information visualization; Visualization systems and tools;**

1. Introduction

Spotify is the world's most popular audio-streaming platform. On this platform, over 551 million users have access to more than 100 million songs [Spo]. This incredible variety makes it difficult to keep track of all the songs that have been heard over the years. Nevertheless, Spotify collects that data, and users have the opportunity to request their so-called *Extended Streaming History* under the privacy settings. This data, once received, is in JSON format and almost cryptic for the casual user. Spotify does not provide any tools to analyze or visualize this listening history. Visplorify addresses this issue by converting this raw data into insightful, interactive visualizations that facilitate the exploration and analysis of users' personal Spotify streaming history. Users can choose which timeframe they want to examine further, discover relationships between their top songs in this timeframe, and get information about their audio features. Since music taste changes over time, there is an option to compare different timeframes in a combined view. Finally, Visplorify aims to enhance Spotify's recommendation system by closely matching new songs with personalized filters that users can apply in advance. These derived recommendations can be seamlessly integrated into the user's personal library or playlists without the need for manual intervention.

2. Related Work

Previous works on personal streaming history focus on last.fm. Despite certain differences between the two music platforms and the data they provide, these works share a common objective: employing visualizations to represent and analyze the data of the personal

listening history. For this, Byron and Wattenberg [BW08] introduce the Streamgraph to visualize trends in music listening. Baur et al. [BSSB10, BB09] present two works, showcasing visualizations for analyzing personal streaming histories. The first employs network visualizations on different linked abstraction levels, including an entangled global view and chronological session representations that only work up to a thousand songs. The second integrates personal photos and calendar entries into a tool called "LastHistory", which provides a personal experience and extends the visual analysis capabilities of the first one. Further, Khulusi et al. [KKM*20] give an overview of visualizations and tasks for musical data. Visplorify also draws inspiration from Explorify, a student project that visually analyzes Spotify listening history, emphasizing features such as Artist Genre Network and Daily Listening Patterns [IE22]. While these tools offer initial insights and inspiration, Visplorify addresses limitations and expands upon features and ideas. For example, while the Heatmap in Explorify is effective for visualizing days in a year, Visplorify offers users the ability to explore any time period in detail and allows for the analysis of the whole account span, features absent in Explorify. Furthermore, none of the introduced tools focus on deriving new songs, an aspect that Visplorify leverages. Similarly, most visual interfaces for music recommendations tailored for casual users typically do not include the listening history aspect [McD18, Vav17, Spo18, Gib11].

3. Methodology

Visplorify is designed for all Spotify users, ensuring ease of use without requiring expert knowledge. Visplorify offers a diverse set

of visualizations, grounded in the utilization of Plotly Dash [Inc], a Python framework for creating interactive web-based dashboards. While more advanced visualizations are for experienced users, exploring the streaming history and the application is an experience developed to serve every user. Six tasks were defined at the beginning of the project and have since been implemented throughout the development process. Users can begin by pre-filtering their data in the dashboard. Subsequently, the distribution of listening time for this filtered data is presented in a heatmap and a barchart for an initial overview. This can be seen in the Supplemental Material (Figure S1a). In the next step, users can select timeframes, years, or single days on the heatmap, serving as anchor points for additional visualizations, including a daypicker with a scrollable list for viewing heard songs for each day, a node-link diagram, and a separate tab with diagrams. In the list (Figure S1b), songs are presented with album covers and their respective listening durations, resembling the display format in Spotify (**T1 Explore Previously Heard Songs and Artists**). Clicking on a song reveals additional information, including details about the artists as depicted in Figure S1d (**T2 Overview of Individual Songs and Artists**). Users also have the option to play a 30-second sample of the selected song and the top songs of the artists (**T3 Enjoy Music and Visualizations**). Additionally, they can add them to their personal Spotify library with a single click. In the node-link diagram (Figure S1c), the nodes represent the Top Songs of the selected data. Users can choose between different options for the color and position of the nodes, allowing them to switch between versions of the network (**T4 Discover Relationships between Songs**). These options include *Time*, which encodes the first listening instance of the song; *Layers*, which orders the songs based on their overall listening time divided by duration; *Artist Genres*, which clusters the songs based on the genres of their artists; and *Audio Features*, which clusters the songs based on their audio characteristics. Users can select songs in the network to receive personalized, filtered recommendations and even create playlists featuring the songs in the network (**T5 Create Song Recommendations and Playlists**). Further, six visualizations are included to provide an overview of listening habits within the selected timeframe (Figure S2). A pie chart of the Top Songs, barcharts to depict Top Artists and Genres, and histogram, line and radar charts to offer details about the audio features of the heard songs. Overall statistics, such as the number of songs played, are also given. Users can further compare different timeframes or filter options by adding additional traces (Figure S3) (**T6 Summarize and Compare Different Timeframes**).

4. Use Cases and Results

The visualizations implemented in Visplorify provide users with a broad range of analysis and exploration possibilities through interaction and the linkage of various perspectives. Users discovered personal patterns, gained insights into their listening habits and reminisced about their music journey.

The heatmap and barchart provide a general overview of the data. Using filter options, they can be employed to identify timeframes with increased offline music listening or overall listening trends. One user noticed a significant gap in listening time when he started a new job, while another observed a prolonged absence during illness. Moreover, the heatmap and the slider beneath the barchart

serve as selection tools for timeframes, years, and specific days.

Once days are chosen, users can delve into a more detailed view within the scrollable list. This enables easy retrieval of songs associated with events like Christmas or other occasions. Furthermore, the search function allows users to search for songs, artists, or albums and marks the search results on the heatmap. This feature can be utilized to identify where artists were first heard or to find recurring songs over several days.

In the network, the different options allow for a variety of use cases. For instance, if *Time* is chosen as position, users can find songs that were discovered at the same time. Combined with the color *Artist Genres*, sessions of certain genres, such as in Figure S5a, can be found on the timeline. With the option *Layers* users were surprised about their top songs in certain timeframes. Clustering on audio characteristics and genres allowed them to identify underlying connections and patterns in their heard music. Users can add song suggestions to the network that match their current tastes, drawing from top songs, other recommendations, and genres, making it easier to discover new songs. Filtering by popularity and audio features allows users to tailor their preferences (Figure S4a). By selecting specific nodes in the network, users can add them to a new playlist created in their personal Spotify account. Examples could include the top rock songs from their listening history, the top 1000 songs of 2023 (Figure S4b), or playlists solely filled with recommended tracks.

The interactive diagrams allow users to compare various time periods and filters, such as the distinction between offline and online listened songs, different years, or winter and summer months (Figure S5d). While the charts about the top songs, artists, and artist genres provide a general sense of users' music preferences and are easy to understand, the more complex diagrams about the audio features provide detailed insights into personal patterns and trends related to danceability, energy, valence, and other characteristics of the listened songs. Showcasing patterns such as lower danceability and energy during nighttime (Figure S5c) and higher acousticness during Christmas (Figure S5e), users could reminisce about life events (Figure S5b) and analyze behavioral changes.

All the presented visualizations, and interactive features not only provide value for this specific application but could also be adapted for use in other domains. For instance, personal reading histories and movie-watching habits could be analyzed using comparable methods, generating recommendations for both books and movies.

5. Conclusion

Visplorify enables Spotify users to engage more meaningfully with their listening history. The tool enhances the music streaming experience, by offering interactive visualizations and analytical features, providing users with deeper insights into their music preferences, facilitating the discovery of new songs along with artists, and allowing for personalized curation. Additionally, it showcases the analysis possibilities available with the data gathered by Spotify, thereby increasing transparency. The implementation faced challenges, leading to the exploration of different creative approaches and the adoption of compromises. Despite limitations and unrealized ideas, the application offers various functionalities and representations for users to explore their listening behavior and enjoy musical experiences.

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