Data Visualization and Visual Analytics
Homework 9: Spotify Tracks Dataset

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1 Introduction

In homework 9, we were asked to implement a visualization system using the D3.js framework and JavaScript. The system should be able to reveal insights from the Spotify tracks dataset.
For this project, I aim to visually represent the artist's style, encompassing their preferred tempo, composing genre, song styles, and popularity. Subsequently, we will delve into a detailed discussion of these insights and provide a conclusion.

2 Implementation Details

2.1 Interface

About my interface is mainly designed based on the following five parts, as shown in Figure 1. Users can enter their interested artist/band name in the search box, and the system will display charts based on the corresponding data.

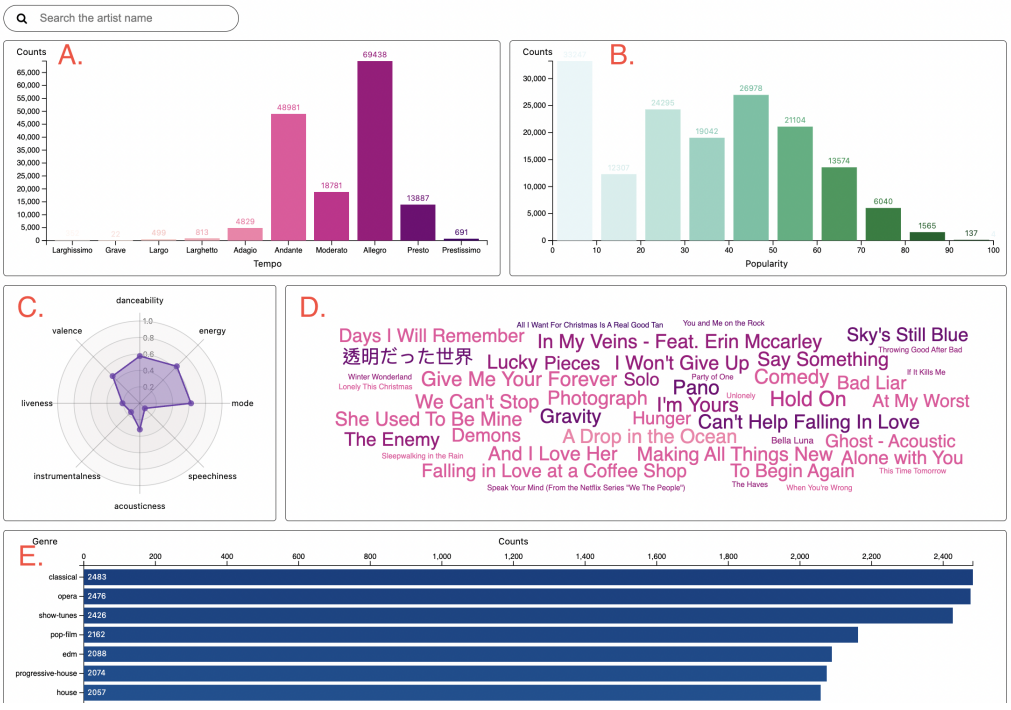

Figure 1: System Interface

A. Tempo vs. Counts
For this part, I preprocess the original tempo from bpm to common tempo markings[1] and use a bar chart to illustrate the tempo distribution of each song composed by a specific artist, and use all artists as default. The purpose is to show the tempo preferred by all artists or a specific artist.

B. Popularity vs. Counts

For this part, I use a histogram to illustrate the popularity distribution of each song composed by a specific artist, and use all artists as default. The purpose is to show the popularity of a specific artist's work.

C. Style Radar

For this part, I illustrate the song style of a specific artist using a radar chart with the following 8 metrics, and use all artists as default.

Since an artist may have multiple songs, the values shown in this chart are averages of all songs, and aim to show the song style of all artists or a specific artist.

- **Danceability:**
  Danceability describes how suitable a track is for dancing based on a combination of musical elements including tempo, rhythm stability, beat strength, and overall regularity. A value of 0.0 is least danceable and 1.0 is most danceable. Users can touch the area to see those mean value.
- **Energy:**
  Energy is a measure from 0.0 to 1.0 and represents a perceptual measure of intensity and activity. Typically, energetic tracks feel fast, loud, and noisy. For example, death metal has high energy, while a Bach prelude scores low on the scale.
- **Mode:**
  Mode indicates the modality (major or minor) of a track, the type of scale from which its melodic content is derived. Major is represented by 1 and minor is 0.
- **Speechiness:**
  Speechiness detects the presence of spoken words in a track. The more exclusively speech-like the recording (e.g. talk show, audio book, poetry), the closer to 1.0 the attribute value.
- **Acousticness:**
  A confidence measure from 0.0 to 1.0 of whether the track is acoustic. 1.0 represents high confidence the track is acoustic.
- **Instrumentalness:**
  Whether a track contains no vocals. "Ooh" and "aah" sounds are treated as instrumental in this context. The closer the value is to 1.0, the greater likelihood the track contains no vocal content.
- **Liveness:**
  Detects the presence of an audience in the recording. Higher liveness values represent an increased probability that the track was performed live.
- **Valence:**
  A measure from 0.0 to 1.0 describing the musical positiveness conveyed by a track. Tracks with high valence sound more positive (e.g. happy, cheerful, euphoric), while tracks with low valence sound more negative (e.g. sad, depressed, angry).

D. Track Name Cloud

For this part, I use a word cloud consisting of each song name with its tempo, popularity, genre, and author. It aims to let the user know what kind of songs the artist has created and which ones are the most popular or not. Users can touch text to see its details.

Please note that the number of song names may differ from the values shown in parts A, B, and E because a song may be uploaded multiple times by Spotify, in which case I will use the average.

- **Text Size:** Determined by average popularity, using the following formula, which unit of $f(x)$ is "px":

$$f(x) = \sqrt{x} * 2 + 10, \text{where } x \text{ is the mean popularity of specific song.}$$

- **Text Color:** Determined by the tempo corresponding to the color scale in part A.

E. Genre vs. Counts

For this part, I use a bar chart to illustrate the genre distribution of each song composed by a specific artist, and use all artists as default. The purpose is to show the genre preferred by all artists or a specific artist.

3 Experiments

In this section, I will illustrate the data insights from the system with overall view and a case study.

3.1 Overall View

The overall view is same as Figure 1., We can see that most of the songs are Andante (76∼108 bpm) and Allegro (120∼168 bpm). And the popularity is usually below 60, and most songs don't even get 10 points, which means it's quite difficult to write a hit song.
As shown from Figure 2., We can see that most of the songs on Spotify are major modality (mode=0.62), music and other non-speech-like tracks (speechiness=0.09), low liveness (liveness=0.21). Note that the valence is 0.47, which means that most songs sound negative (e.g., sad, depressed, angry).

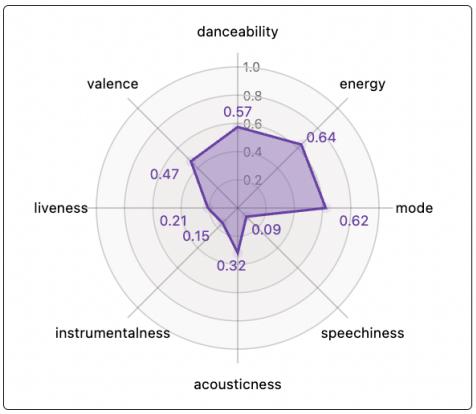

Figure 2: Style radar in overall view

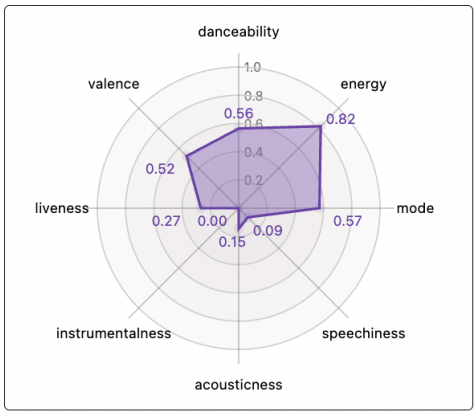

Figure 3: Style radar of Ado info.

3.2 Case Study: Ado

In this case, I will use Ado as example to show the information about her.
As illustrated in Figure 4, the mainly genre in her works is j-pop, and there is an evident that she frequently gravitates towards a faster tempo in her musical style. The majority of the songs fall within the tempo ranges of Andante (76∼108 bpm), Allegro (120∼168 bpm) and Presto (168∼200 bpm). Note that she is indeed an amazing singer, as her songs almost have a popularity rating above 60.

Figure 4: Overview of Ado info.

We notice that there is a non-popular song in her works, then we can observe which call “世界のつづき” from the word cloud, the detail shown in Figure 5.

Figure 5: Track Name Cloud of Ado info.

Finally, we compare Ado’s style (shown in Figure 3) with overall, which shows that her works fill more energy (energy=0.82) and sound more positive (e.g. happy, cheerful, euphoric) (valence=0.52).

4 Conclusion

This tool enhances the user experience by providing an interactive and informative platform. Users can explore various facets of their favorite singer or band, including but not limited to musical style, popular genres, and overall song preferences. The visual elements, such as charts and graphs, offer a dynamic and engaging way for audiences to absorb information.
Additionally, the tool allows for customization, enabling users to focus on specific aspects of an artist’s repertoire, such as tempo distribution, song popularity, or preferred genres. Through intuitive visualizations, audiences can quickly grasp patterns and trends, fostering a deeper appreciation for the musical nuances of their chosen artist.
Whether someone is a casual listener or a devoted fan, this visual analysis tool serves as a valuable resource for unraveling the artistic identity of a singer or band, making the exploration of music a more enriching and enjoyable experience.

References

[1] Ying Liu, Guangyuan Liu, Dongtao Wei, Qiang Li, Guangjie Yuan, Shifu Wu, Gaoyuan Wang, and Xingcong Zhao. Effects of musical tempo on musicians’ and non-musicians’ emotional experience when listening to music. *Frontiers in Psychology*, 9:2118, 2018.