

## ORIGINAL ARTICLE



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## Interactive Dashboard for Music Streaming Analytics Using Power BI

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### Abstract

The digital music streaming space has seen great growth which in turn has produced large scale data sets which we are now able to use for in depth analysis of user taste and music trends. We report in this study which is a full analysis of the Spotify Top Songs data set using Power BI to present what we found which was valuable information related to what makes a song popular, how artists do over time, and the what the content of the music is. Our main goal was to dig out what may be considered hidden in the data and present it in an interactive and very visual way. The data we looked at included song title, artist name, popularity score, what is and what is not explicit content, and also what year the data was from. We also did what we had to in terms of data prep which included cleaning up the data, transforming it into a workable format, and bringing it all to a consistent structure. We used many visual tools which included bar graphs, KPI's, etc. We put together a dashboard which includes key metrics like total number of songs, total artists, songs per artist and their popularity distribution. Also, we highlight which artists are dominant and do a compare of explicit and non-explicit songs. Also, we looked at the trends in average popularity which in turn help to see how audience preferences time.

**Keywords:** Spotify, Tableau, Data Visualization, Music Analytics, Listener Behavior

### Introduction

The rise of digital music streaming has greatly changed the way the world listens to music. Outlets like Spotify which present large scale music libraries, personal play lists, and easy access have become very popular. As we see millions of users engaging with these services every day a large set of data is produced that in turn gives us insight into what is being listened to, what is popular, and which are the new trends. With the growth of this data, we see an increased importance of data analysis in the entertainment field. Analysis of music data helps us to determine what the audiences' preferences are, which artists are trending, and how to better run recommendation systems. Also, it supports the decision making process for music producers, marketers, and the platforms themselves by bringing to light trends and user interaction info.

The Spotify data set is a great resource for analysis which includes song names, artist info, popularity ratings and what type of content is explicit. These elements enable in depth analysis of music trends and artist performance across many different variables. By looking at this data we are able to present to you which are the most popular songs, which artists are doing the best, and what the trends are in terms of what the public is into. For this project we will do an exploratory data analysis of the Spotify Top Songs data set and report out via Power BI.

We aim to create an interactive dashboard which reports out on total number of songs, artist by artist breakdown, trends in popularity, and a compare between which types of songs do better with or without explicit content. Beyond commercial benefits, analyzing streaming data also contributes to academic and industrial understanding of music information retrieval (MIR) and listener behavior analytics. MIR based studies highlight how streaming data can identify collective

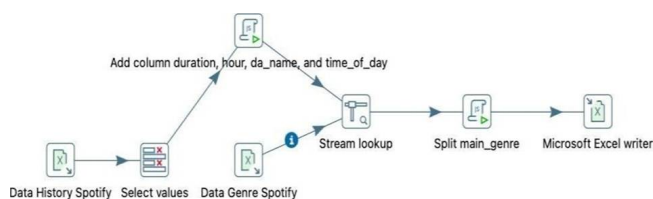
trends, emotional associations, and social contexts of listening.

For instance, Ferwerda and Schedl demonstrated that temporal listening habits— such as listening more frequently at night— are correlated with users' personality traits and emotional states. Likewise, recent surveys show that listening context (time, activity, mood) influences user preferences and engagement behaviors.

From a technical perspective, the task of deriving useful information from such large data sets demands proper data management techniques along with visualization approaches. Applications like Tableau have an important part to play in this regard by helping in designing interactive dashboards that help detect behavioral trends in users. Hence, the current research seeks to analyze the data of Spotify users through Tableau in order to discern their listening habits, preferences in music genre, and use of the platform. While many previous studies focus on algorithmic recommendation models, this study emphasizes the visual analytical perspective, showing how descriptive dashboards can complement predictive approaches by translating data into decision-ready insights.

## Method

The approach used for this research involved a descriptive analysis approach which utilized data visualization and business intelligence tools in studying the listening habits of users of Spotify. This involved the use of the Extract, Transform and Load techniques through Pentaho Data Integration, along with visualization techniques in Power BI.



**Fig. 1: ETL workflow in Pentaho Data Integration for Spotify streaming dataset**

### Data Source and Collection:

The dataset used in this study was obtained from a publicly available Spotify Top Songs dataset in CSV format. It contains multiple records with key attributes such as track name, artist name, popularity score, explicit content classification, and temporal indexing.

These attributes provide essential information related to song characteristics, artist performance, and popularity trends across different time periods.

The dataset was imported into Power BI for further analysis and processing. Initial data preparation steps included data cleaning, handling missing values, and formatting of variables to ensure consistency and accuracy.

The structured dataset enabled efficient analysis of music trends and user preferences. The workflow integrates data preprocessing and transformation within Power BI, followed by the creation of interactive dashboards for visualization. This approach ensures a systematic, scalable, and interpretable analysis process, allowing meaningful insights to be derived from the dataset.

The ETL process executed by using Pentaho Data Integration (PDI) is depicted in (Fig. 1) below. The process starts with extracting the play history data (Data History Spotify) and genre data (Data Genre Spotify) from the Spotify dataset. The next step involves selecting the appropriate values, followed by creating new computed columns such as play duration in minutes, listening hours, day of the week, and time of day.

Then Comes a Stream Lookup to combine the genre column data with the overall playback data stream. For more clarity on the genre, a Split step called main\_genre determines the primary genre for each artist. In case there were several genres assigned to an artist, this resolves the ambiguity. After the data enrichment process, the final data stream is exported using the Microsoft Excel Writer step. Visualization and Analysis Using Power BI.

Once the data was cleaned and prepared, it was uploaded into the Power BI Desktop application. With the help of Power BI, various interactive visualizations could be created to examine the trends of songs, artists, and the content. The following are the important dashboards that were created:

**Artist and Song Analysis:** Displaying best artists and songs on the basis of popularity ratings and number of songs.

**Popularity Variations:** Demonstrating the changes in average popularity of songs against different time indices through line graphs.

**Explicitness Analysis:** Comparing the explicit and non-explicit songs to analyze their content.

**Songs by Each Artist:** Demonstrating the significance of every artist contributing to the dataset through bar graphs.

**KPIs:** Offering comprehensive key performance indicators such as total number of songs, total number of artists, and average popularity by means of KPI indicators. The dashboards allowed for the determination of not only trends at a macro-level but also deeper analysis of music and artist dynamics. The interactivity offered by Power BI made analyzing the data much easier.

### Analytical Framework and Validation:

Descriptive statistics were used to quantify frequency, duration, and distribution patterns. Validation was conducted through visual inspection and data sampling to ensure the integrity of aggregated results. The combined use of Pentaho

for ETL and Tableau for visualization provided a robust analytical workflow that enhanced the accuracy, transparency, and interpretability of findings.

## Results and Discussion

### Artist and Song Analysis

Artist and Song Analysis Dashboard (Fig. 2) proves that Taylor Swift is the most influential artist in our data set because she has the largest number of songs and popularity in our sample.

Also, the analysis proves that songs belonging to famous artists are more popular in view of the preferences for familiar artists among audiences. Songs per Artist demonstrates that a few numbers of artists make substantial contributions to the data set.

(Fig. 2) shows the Song and Artist panel that has songs with their respective artists and album images listed. Each row shows a small sized picture, song name, and selection checkbox where users can interact with the data.

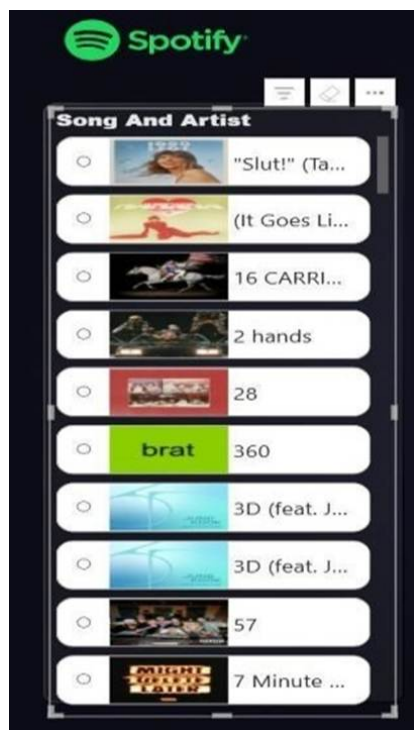


Fig. 2: Top 10 Artists and Tracks Dashboard

This segment shows a more detailed overview of tracks like showing how diverse the songs featured in the dataset are. By using both text and graphics to describe songs and their artists, this visualization adds to the user experience.

### Dashboard Explanation

The dashboard (Fig. 1) presents a thorough overview of the Spotify dataset using several visual elements. According to the first page of the dashboard, some KPIs, including total number of songs and total number of artists, indicate the size of the dataset.

From the Artist Popularity graph, it is clear that Taylor Swift has the highest accumulated popularity, showing great audience participation. From the Songs by Artist graph, the distribution of songs is evident, with one particular artist contributing significantly to the data set.

From the Explicit vs Non-Explicit comparison, it is clear that the songs within the database are purely explicit, hence no diversity in terms of types of songs. Secondly, from the Average Popularity by Month graph, there seems to be a rise in the data showing increasing song popularity.

Overall, the dashboard effectively combines multiple visualizations to provide both summary-level insights and detailed analysis of music trends.



Fig. 3: Dashboard of Spotify

### Artist Dominance

- There are few artists who make up most of the data set.
- Taylor Swift makes up the most songs and highest popularity.
- Therefore, people’s interest is focused on very few artists.

### Popularity Trends

- Popularity of songs differs for each song and time index.
- Average popularity trend is fairly stable with small changes.
- Shows that there is consistent audience interest over time.

- Songs from popular artists achieve higher visibility and popularity scores.

#### Explicit vs Non-Explicit Analysis

- Both explicit and non-explicit songs are present in the dataset.
- Non-explicit songs have a slightly higher proportion.
- Reflects diverse listener preferences and content variation.

#### Songs per Artist Distribution

- Most artists contribute only a few songs.
- A small number of artists dominate the dataset.
- Highlights imbalance in song distribution across artists.

## Conclusion

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In conclusion, the use of Power BI was successful in analyzing the Spotify Top Songs dataset and obtaining valuable insights regarding musical trends and other factors. The created dashboard allowed visualizing some of the most important information about the data, including the number of songs, artist contributions, popularity dynamics, and the presence of explicit content.

First of all, it is possible to identify that a few popular artists are prevalent in the dataset, including Taylor Swift, who contributes significantly both to song quantity and to popularity. In addition, one can observe that song popularity does not change much and varies around a constant point with small changes only. The comparison of the two types of content shows that they are relatively even in number, which indicates diverse audience preferences.

Finally, the work demonstrates the efficiency of Power BI as a data visualization platform. The presented results give a good starting point for further research, where one can consider additional variables to explore in the future.