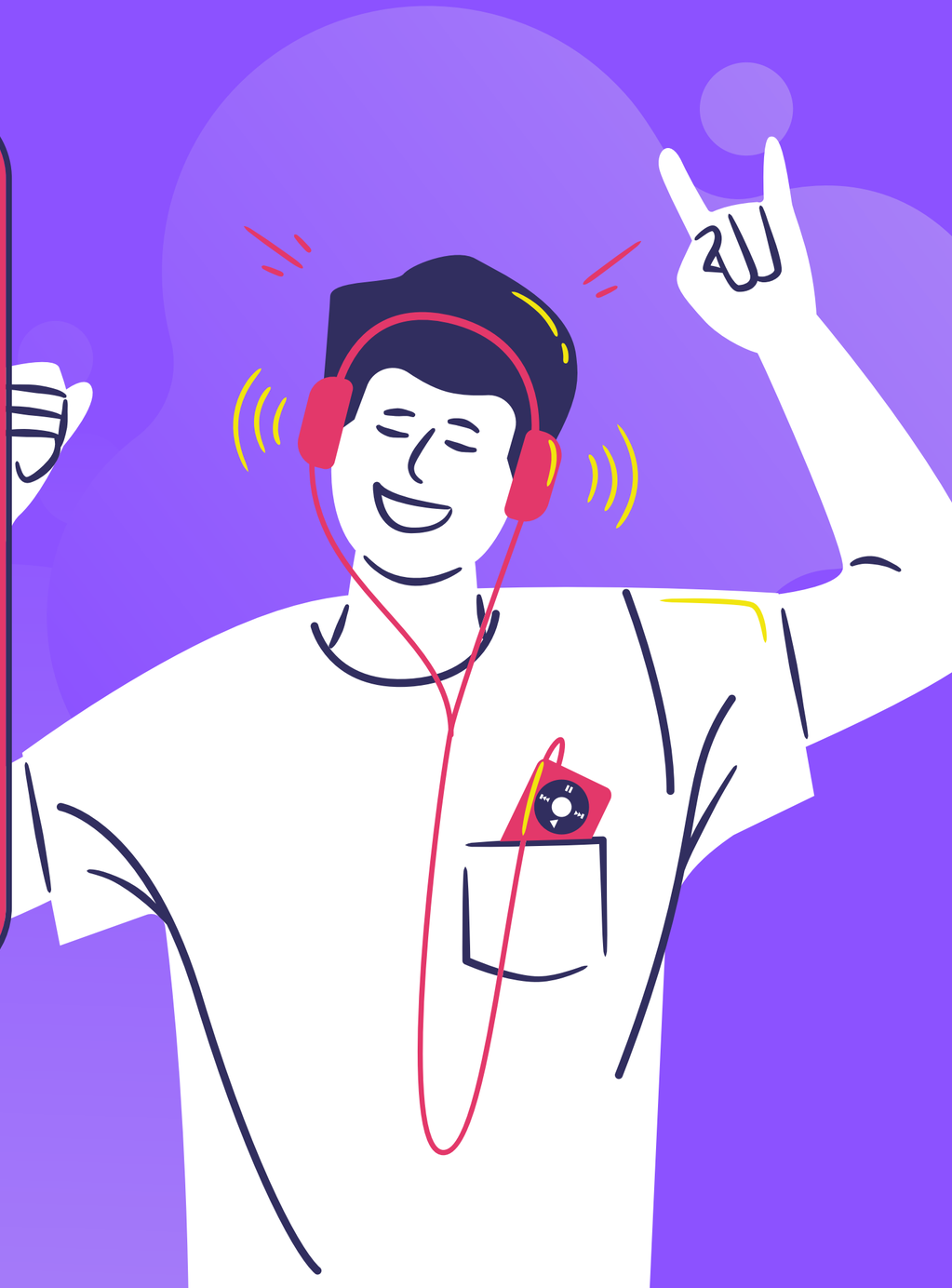
Music Recommendation System

Presented by:
Parul (044)



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OBJECTIVE

The purpose of this project is to develop a music recommendation system based on user preferences and song features. The system aims to provide personalized song recommendations to users based on their favourite genres and artists.

DATASET

The music dataset used in this project is obtained from the "musicdataset.csv" file. It contains information about various songs, including their titles, artists, genres, and popularity ratings. The dataset was loaded into R using the read.csv function.

Filter

Index	Title	Artist	Top.Genre	Year	Beats.Per.Minute..BPM.	Energy	Danceability	Loudness..dB.	Liveness	Length..Duration.	Popularity
1	Sunrise	Norah Jones	adult standards	2004	157	30	53	-14	11	201	71
2	Black Night	Deep Purple	album rock	2000	135	79	50	-11	17	207	39
3	Clint Eastwood	Gorillaz	alternative hip hop	2001	168	69	66	-9	7	341	69
4	The Pretender	Foo Fighters	alternative metal	2007	173	96	43	-4	3	269	76
5	Waitin' On A Sunny Day	Bruce Springsteen	classic rock	2002	106	82	58	-5	10	256	59
6	The Road Ahead (Miles Of The Unknown)	City To City	alternative pop rock	2004	99	46	54	-9	14	247	45
7	She Will Be Loved	Maroon 5	pop	2002	102	71	71	-6	13	257	74
8	Knights of Cydonia	Muse	modern rock	2006	137	96	37	-5	12	366	69
9	Mr. Brightside	The Killers	modern rock	2004	148	92	36	-4	10	223	77
10	Without Me	Eminem	detroit hip hop	2002	112	67	91	-3	24	290	82
11	Love Me Tender	Elvis Presley	adult standards	2002	109	5	44	-16	11	162	49
12	Seven Nation Army	The White Stripes	alternative rock	2003	124	46	74	-8	26	232	74
13	Als Het Golft	De Dijk	dutch indie	2000	102	88	54	-6	53	214	34
14	I'm going home	Ten Years After	album rock	2005	117	93	38	-2	81	639	26
15	Fluorescent Adolescent	Arctic Monkeys	garage rock	2007	112	81	65	-5	14	173	66
16	Zonder Jou	Paul de Leeuw	dutch cabaret	2006	133	42	42	-10	16	236	48
17	Speed of Sound	Coldplay	permanent wave	2005	123	90	52	-7	7	288	69
18	Uninvited	Alanis Morissette	alternative rock	2005	127	54	38	-5	9	276	57

Showing 1 to 18 of 799 entries, 12 total columns

CONTENTS OF DATASET

- **Index**: ID
- **Title**: Name of the Track
- **Artist**: Name of the Artist
- **Top Genre**: Genre of the track
- **Year**: Release Year of the track
- **Beats per Minute (BPM)**: The tempo of the song
- **Energy**: The energy of a song - the higher the value, the more energetic. song
- **Danceability**: The higher the value, the easier it is to dance to this song.
- **Loudness**: The higher the value, the louder the song.
- **Length**: The duration of the song.
- **Liveness**: The higher the value the more spoken words the song contains
- **Popularity**: The higher the value the more popular the song is.

METHODOLOGY

Data Acquisition and Preprocessing

The music dataset used in this project was sourced from the "musicdataset.csv" file . The data was loaded into r using read.csv function.To ensure data quality, missing values in the dataset were examined using the sum(is.na(music_data))command. The preprocessing phase involved several steps, including data cleaning and feature engineering, to prepare the dataset for the recommendation system.

Feature Extraction and Representation

Three main features were considered for song representation: keywords extracted from song titles, genre and artist information. The song titles were processed to extract keywords, which were then combined to form a consolidated keyword representation for each song.

User Profile Creation

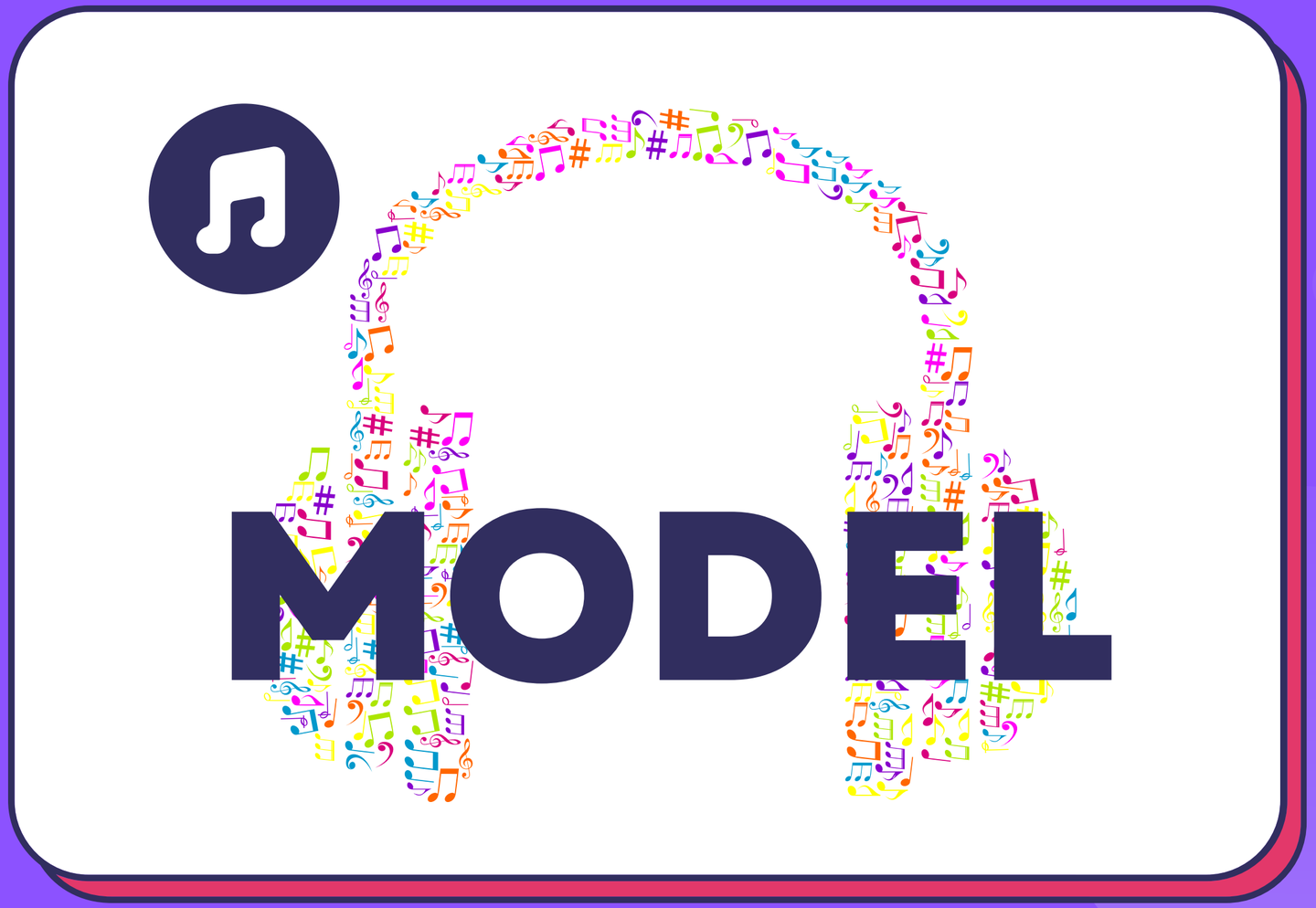
The user profile was created based on the user's favourite genres. In this project, the user's favouritegenres were set as "dutch pop" and "pop". A user profile matrix was created to match the dimensions of the feature matrix, and similarity scores were computed using the cosine similarity measure.

Similarity Calculation

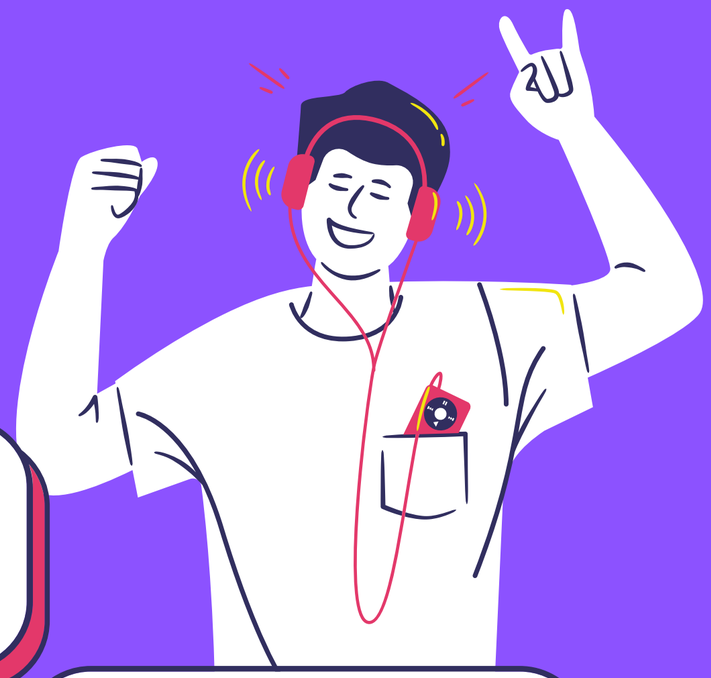
To determine the similarity between the user profile and the song features, cosine similarity was employed. The cosine similarity measure computes the cosine of the angle between two vectors and provides a similarity score ranging from 0 to 1. The similarity scores were calculated using the simil function from the proxy package.

Recommendation Generation

Based on the similarity scores, song recommendations were generated for the user. The similarity scores were merged with the original dataset, and the recommendations were sorted in descending order of similarity. The top N recommendations were selected to provide a personalized list of songs for the user.


MODEL

Recommendation on the basis of GENRES



- Rock
- Pop
- EDM
- Country
- Hiphop
- Jazz
- K-Pop
- Blues
- Reggae

GENRE MATRIX

	adult standards	album rock	alternative hip hop	alternative metal	classic rock	alternative pop rock	pop	modern rock	detroit hip hop	alternative rock	dutch indie	ga ro
1	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
2	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
3	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
4	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
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8	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FA
9	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FA
10	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FA
11	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
12	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FALSE	FA
13	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TRUE	FA
14	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
15	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	TI
16	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA
17	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FA

Showing 1 to 17 of 799 entries, 116 total columns

FEATURE MATRIX

ngs × | song_profiles1 × | Untitled1 × | .Rhistory × | Untitled2* × | user_profile_matrix × | feature_matrix × | genre_m

Filter | Cols: « < 1 – 50 > »

	adult standards	album rock	alternative hip hop	alternative metal	classic rock	alternative pop rock	pop	modern rock	detroit hip hop	alternative rock	dutch indie	ga ro
1	1	0	0	0	0	0	0	0	0	0	0	
2	0	1	0	0	0	0	0	0	0	0	0	
3	0	0	1	0	0	0	0	0	0	0	0	
4	0	0	0	1	0	0	0	0	0	0	0	
5	0	0	0	0	1	0	0	0	0	0	0	
6	0	0	0	0	0	1	1	0	0	0	0	
7	0	0	0	0	0	0	1	0	0	0	0	
8	0	0	0	0	0	0	0	1	0	0	0	
9	0	0	0	0	0	0	0	1	0	0	0	
10	0	0	0	0	0	0	0	0	1	0	0	
11	1	0	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	1	0	
13	0	0	0	0	0	0	0	0	0	0	1	
14	0	1	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	0	0	

Showing 1 to 17 of 799 entries, 116 total columns

USER PROFILE

ic_data | user_profile | sorted_

Filter

	genre_matrix
1	0
2	0
3	0
4	0
5	0
6	0
7	1
8	0
9	0
10	0
11	0
12	0
13	0
14	0
15	0
16	0
17	0
18	1

Showing 1 to 19 of 116 entries, 1 total colum

USER PROFILE MATRIX

dations | top_songs | song_profiles1 | Untitled1 | .Rhistory | Untitled2* | user_profile_matrix | feature_

Filter | Cols: « < 1 – 50 > »

	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12	V13	V14	V15	V16	V17
1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

SIMILARITY DATAFRAME CONTAINING SIMILARITY SCORES OF FEATURE MATRIX AND USER PROFILE MATRIX

_songs | song_profiles1 | Untitled1 | .Rhistory | Untitled2* | user_profile_matrix | similarity_df | feature_

Filter

	Index	similarity_scores
1	1	0.0000000
2	2	0.0000000
3	3	0.0000000
4	4	0.0000000
5	5	0.0000000
6	6	0.4082483
7	7	0.7071068
8	8	0.0000000
9	9	0.0000000
10	10	0.0000000
11	11	0.0000000
12	12	0.0000000
13	13	0.0000000
14	14	0.0000000
15	15	0.0000000
16	16	0.0000000
17	17	0.0000000
18	18	0.0000000

Showing 1 to 19 of 799 entries, 2 total columns

SORTED RECOMMENDATIONS

r_profile | sorted_recommendations | top_songs | song_profiles1 | Untitled1 | .Rhistory | Untitled2* | use

Filter

	Index	Title	Artist	Top.Genre	Year	Beats.Per.Minute..
23	23	Als De Morgen Is Gekomen	Jan Smit	dutch pop	2006	
25	25	Dichterbij Dan Ooit	BLØF	dutch pop	2002	
40	40	De Weg	Guus Meeuwis	dutch pop	2005	
52	52	Dansen Aan Zee	BLØF	dutch pop	2000	
82	82	Wêr Bisto	Twarres	dutch pop	2001	
86	86	Aanzoek Zonder Ringen	BLØF	dutch pop	2006	
94	94	Blauwe Ruis	BLØF	dutch pop	2002	
114	114	Bloed, Zweet En Tranen	Andre Hazes	dutch pop	2002	
123	123	Voltooid Verleden Tijd	IOS	dutch pop	2009	
148	148	Zij Maakt Het Verschil	De Poema's	dutch pop	2003	
177	177	Hier	BLØF	dutch pop	2000	
181	181	Father & Friend	Alain Clark	dutch pop	2007	
205	205	Pak Maar M'n Hand	Nick & Simon	dutch pop	2007	
228	228	Mijn Houten Hart	De Poema's	dutch pop	2003	
256	256	Rain Down on Me	Kane	dutch pop	2003	
267	267	Omarm	BLØF	dutch pop	2003	
282	282	Laat Me / Vivre - Lange Versie	Alderliefste met Ramses Shaffy en Liesbeth List	dutch pop	2005	
298	298	Une Belle Histoire (Een Mooi Verhaal)	Alderliefste	dutch pop	2008	

Showing 1 to 18 of 799 entries, 13 total columns

TOP SONGS

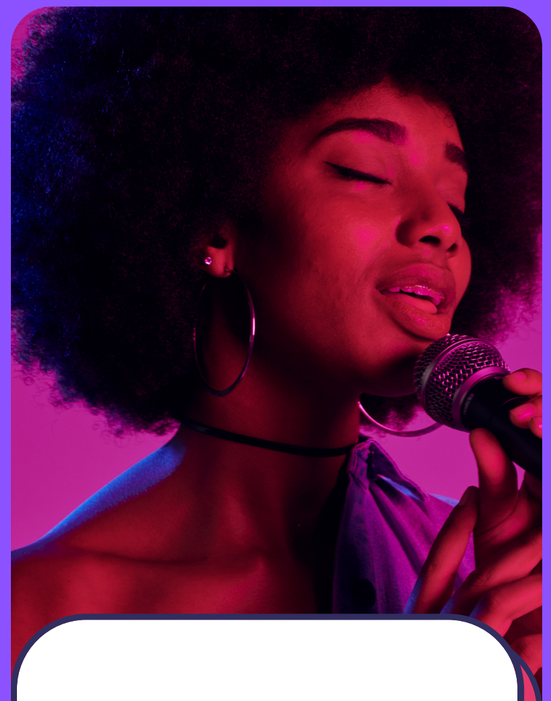
ndations × | top_songs × | song_profiles1 × | Untitled1 × | .Rhistory × | Untitled2* × | user_profile_matrix ×

Filter

	Index	Title	Artist	Top.Genre	Popularity
23	23	Als De Morgen Is Gekomen	Jan Smit	dutch pop	55
25	25	Dichterbij Dan Ooit	BLØF	dutch pop	16
40	40	De Weg	Guus Meeuwis	dutch pop	42
52	52	Dansen Aan Zee	BLØF	dutch pop	52
82	82	Wêr Bisto	Twarres	dutch pop	48
86	86	Aanzoek Zonder Ringen	BLØF	dutch pop	42
94	94	Blauwe Ruis	BLØF	dutch pop	41
114	114	Bloed, Zweet En Tranen	Andre Hazes	dutch pop	59
123	123	Voltooid Verleden Tijd	IOS	dutch pop	39
148	148	Zij Maakt Het Verschil	De Poema's	dutch pop	54
177	177	Hier	BLØF	dutch pop	40
181	181	Father & Friend	Alain Clark	dutch pop	35
205	205	Pak Maar M'n Hand	Nick & Simon	dutch pop	59
228	228	Mijn Houten Hart	De Poema's	dutch pop	45
256	256	Rain Down on Me	Kane	dutch pop	47

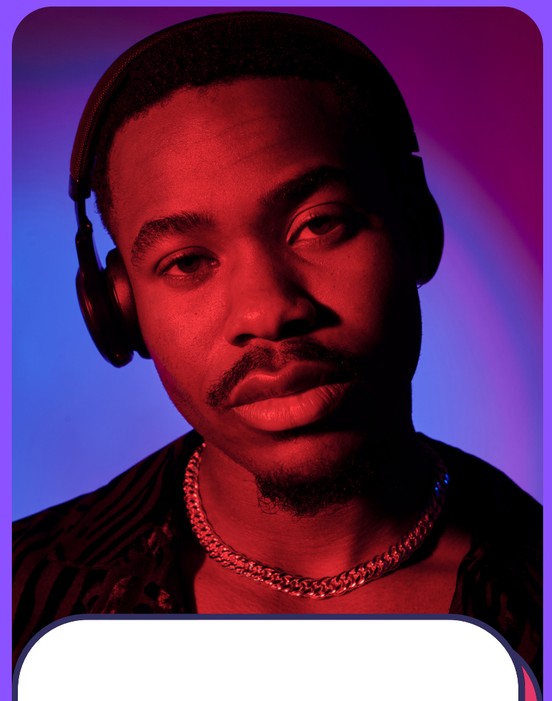
Showing 1 to 15 of 15 entries, 5 total columns

Recommendation on the basis of ARTIST



Reese Miller
Jazz Artist

Lars Peeters
Pop Artist



Benjamin Shah
Hiphop Artist

Avery Davis
EDM Artist

ARTIST MATRIX

Untitled2* | artist_matrix | top_songs | feature_matrix

Filter | Cols: « < 1 – 50 > »

	Norah Jones	Deep Purple	Gorillaz	Foo Fighters	Bruce Springsteen	City To City	Maroon 5	Muse	The Killers	Eminem	Elvis Presley	The White Stripes
1	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
2	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
3	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
4	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
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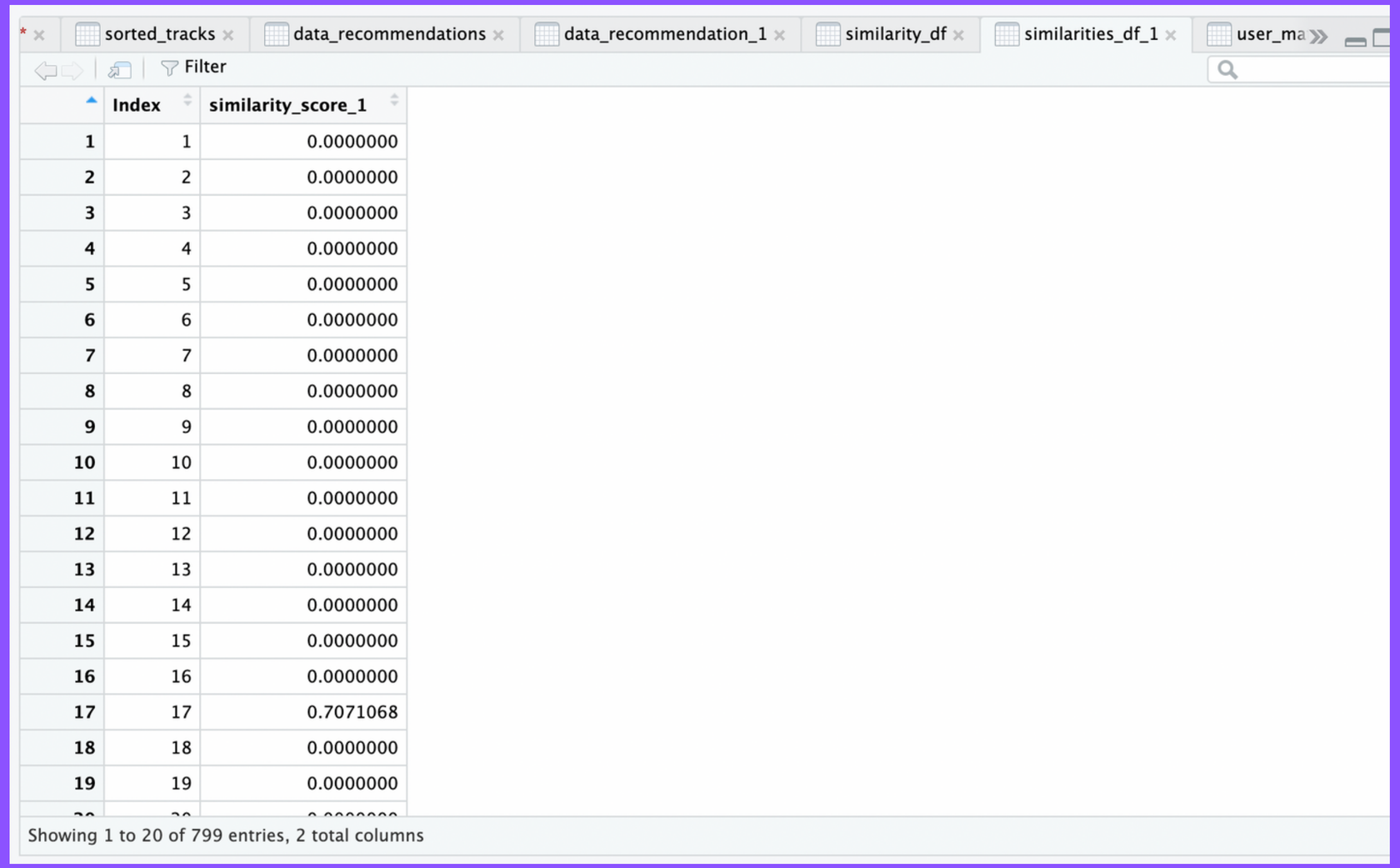
13	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
14	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
15	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
16	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
17	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

Showing 1 to 17 of 799 entries, 396 total columns

REAL MATRIX

	Norah Jones	Deep Purple	Gorillaz	Foo Fighters	Bruce Springsteen	City To City	Maroon 5	Muse	The Killers	Eminem	Elvis Presley	The White Stripes	De Dijk	Ten Years After	Arctic Monkeys
1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
5	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	0	1	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
14	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
24	0	0	0	0	0	0	0	0	1	0	0	0	0	0	

SIMILARITY DATAFRAME CONTAINING SIMILARITY SCORES OF REAL MATRIX AND USER MATRIX



	Index	similarity_score_1
1	1	0.0000000
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3	3	0.0000000
4	4	0.0000000
5	5	0.0000000
6	6	0.0000000
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8	8	0.0000000
9	9	0.0000000
10	10	0.0000000
11	11	0.0000000
12	12	0.0000000
13	13	0.0000000
14	14	0.0000000
15	15	0.0000000
16	16	0.0000000
17	17	0.7071068
18	18	0.0000000
19	19	0.0000000

Showing 1 to 20 of 799 entries, 2 total columns

SORTED TRACKS

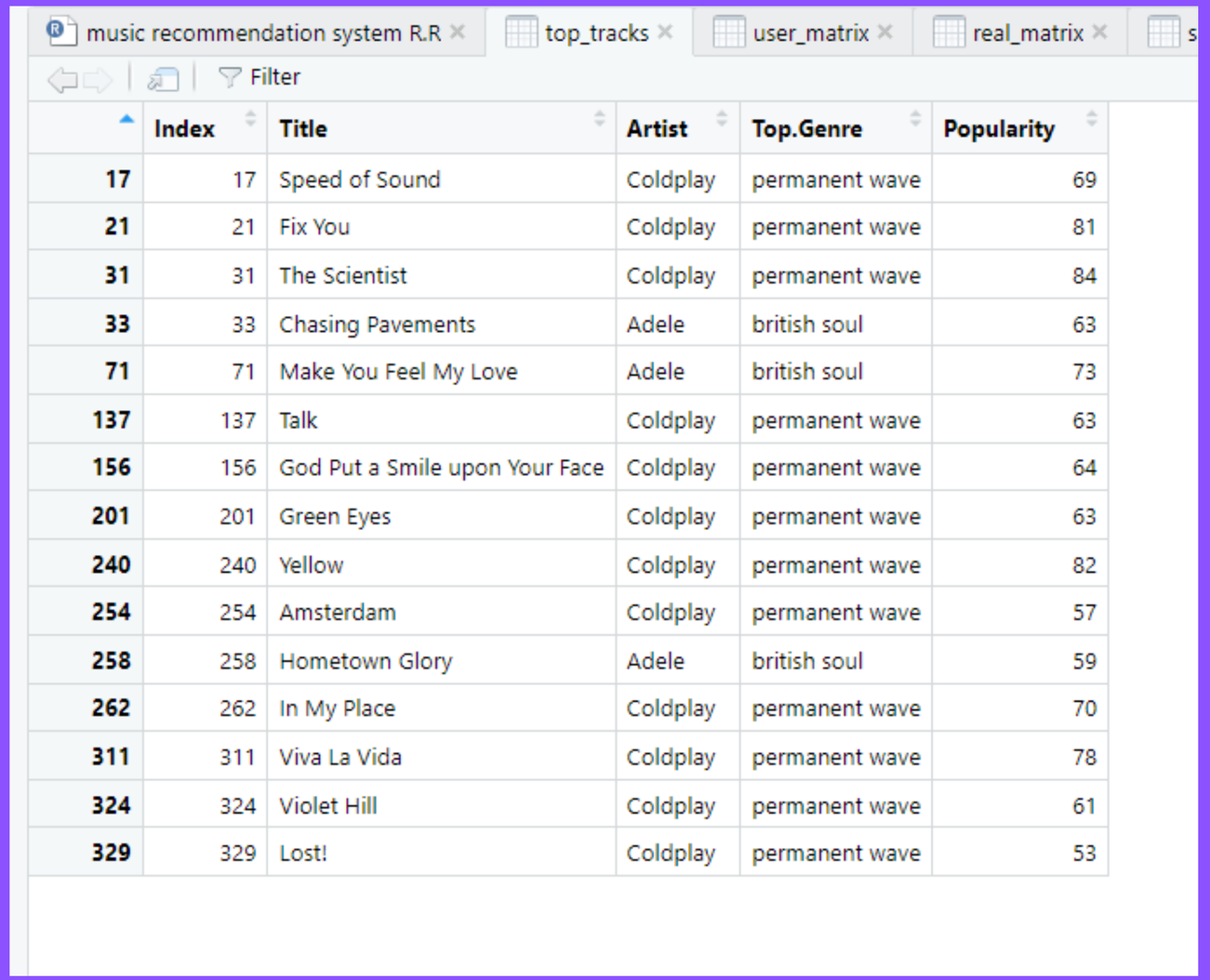
Untitled2* | sorted_tracks | data_recommendations | data_recommendation_1 | similarity_df | similarities_df_1

Filter

	Index	Title	Artist	Top.Genre	Year	Beats.Per.Minute..BPM.	En
17	17	Speed of Sound	Coldplay	permanent wave	2005	123	
21	21	Fix You	Coldplay	permanent wave	2005	138	
31	31	The Scientist	Coldplay	permanent wave	2002	146	
33	33	Chasing Pavements	Adele	british soul	2008	80	
71	71	Make You Feel My Love	Adele	british soul	2008	77	
137	137	Talk	Coldplay	permanent wave	2005	120	
156	156	God Put a Smile upon Your Face	Coldplay	permanent wave	2002	127	
201	201	Green Eyes	Coldplay	permanent wave	2002	130	
240	240	Yellow	Coldplay	permanent wave	2000	173	
254	254	Amsterdam	Coldplay	permanent wave	2002	73	
258	258	Hometown Glory	Adele	british soul	2008	123	
262	262	In My Place	Coldplay	permanent wave	2002	145	
311	311	Viva La Vida	Coldplay	permanent wave	2008	138	
324	324	Violet Hill	Coldplay	permanent wave	2008	76	
329	329	Lost!	Coldplay	permanent wave	2008	87	
351	351	Politik	Coldplay	permanent wave	2002	171	
371	371	Life in Technicolor ii	Coldplay	permanent wave	2008	131	
377	377	Trouble	Coldplay	permanent wave	2000	140	
392	392	Clocks	Coldplay	permanent wave	2002	131	

Showing 1 to 20 of 799 entries, 13 total columns

TOP TRACKS


music recommendation system R.R | top_tracks | user_matrix | real_matrix | s

Filter

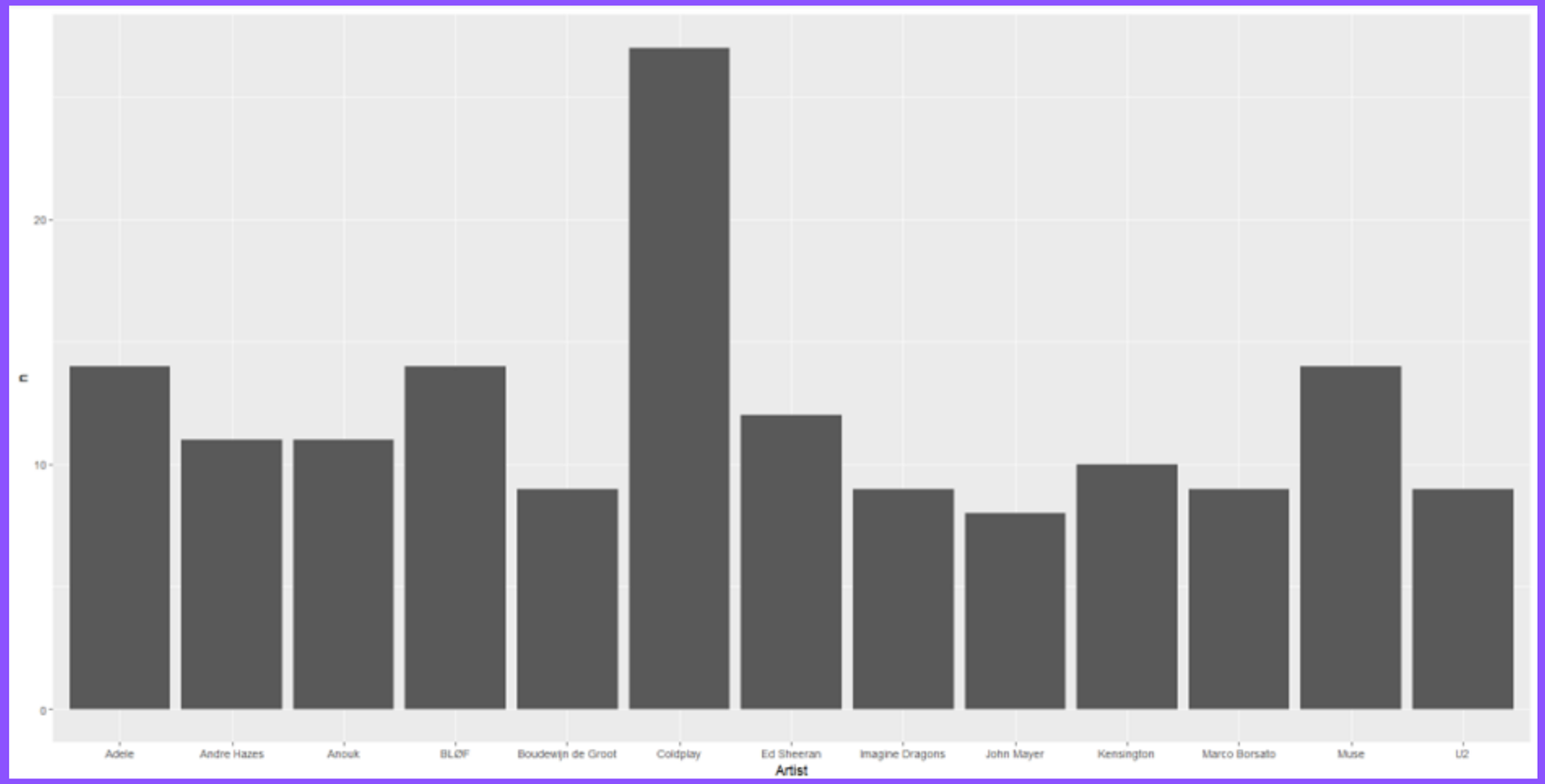
	Index	Title	Artist	Top.Genre	Popularity
17	17	Speed of Sound	Coldplay	permanent wave	69
21	21	Fix You	Coldplay	permanent wave	81
31	31	The Scientist	Coldplay	permanent wave	84
33	33	Chasing Pavements	Adele	british soul	63
71	71	Make You Feel My Love	Adele	british soul	73
137	137	Talk	Coldplay	permanent wave	63
156	156	God Put a Smile upon Your Face	Coldplay	permanent wave	64
201	201	Green Eyes	Coldplay	permanent wave	63
240	240	Yellow	Coldplay	permanent wave	82
254	254	Amsterdam	Coldplay	permanent wave	57
258	258	Hometown Glory	Adele	british soul	59
262	262	In My Place	Coldplay	permanent wave	70
311	311	Viva La Vida	Coldplay	permanent wave	78
324	324	Violet Hill	Coldplay	permanent wave	61
329	329	Lost!	Coldplay	permanent wave	53

VISUALISATION

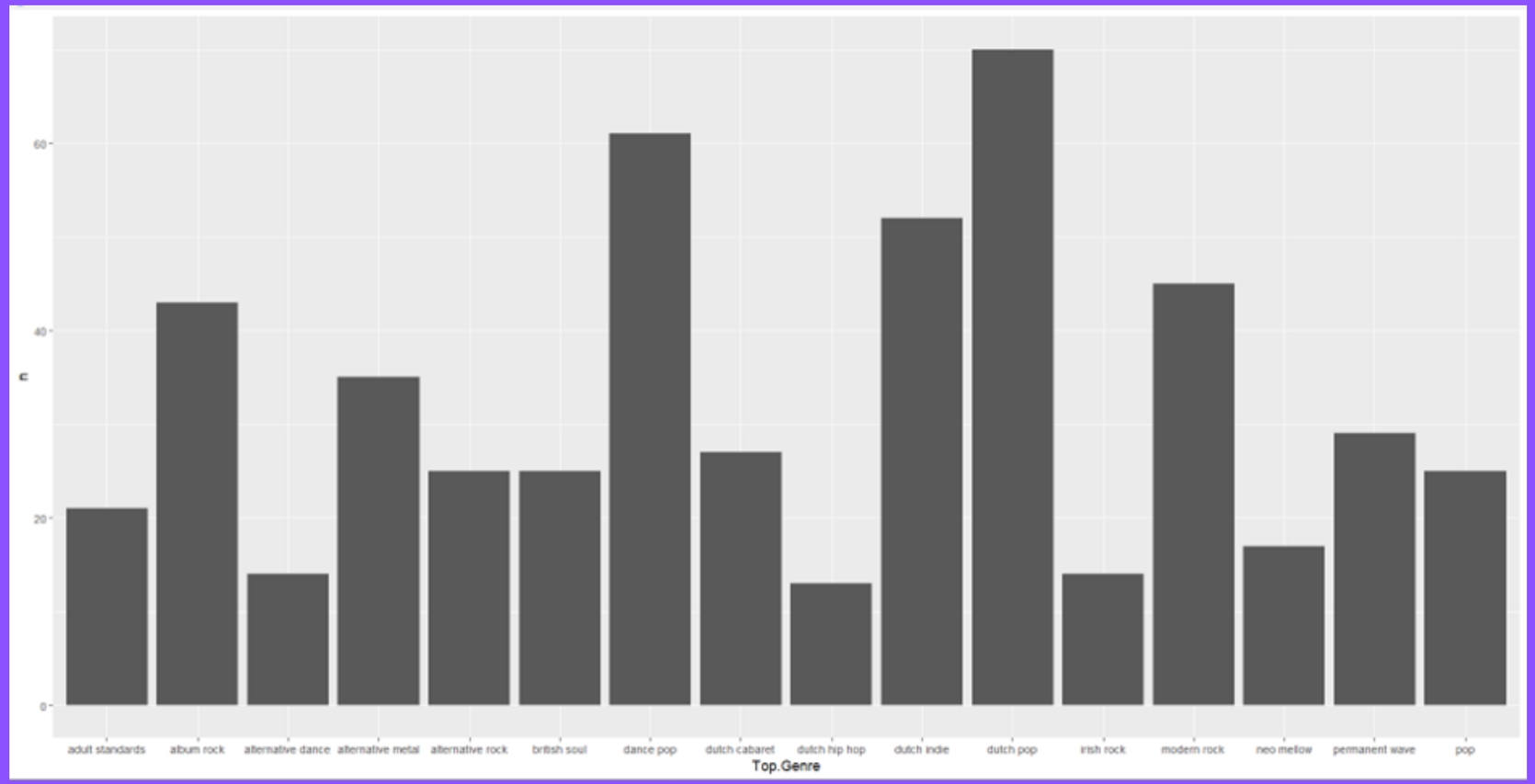
Data visualization was performed to gain a visual understanding of the music dataset.

- The count of songs by genre was visualized using a bar plot. The **count** function from the **dplyr** package was used to calculate the frequency of each genre, and the **ggplot2** package was used to create the bar plot.
- The count of songs by year was visualized using a bar plot. Again, the **count** function and **ggplot2** package were used for this analysis.
- The density plot of artist counts was created to show the distribution of song counts per artist. The **ggplot2** package was used to generate the plot.
- The relationship between the length of songs and their popularity was visualized using a scatter plot. The **ggplot2** package was used to create the scatter plot.

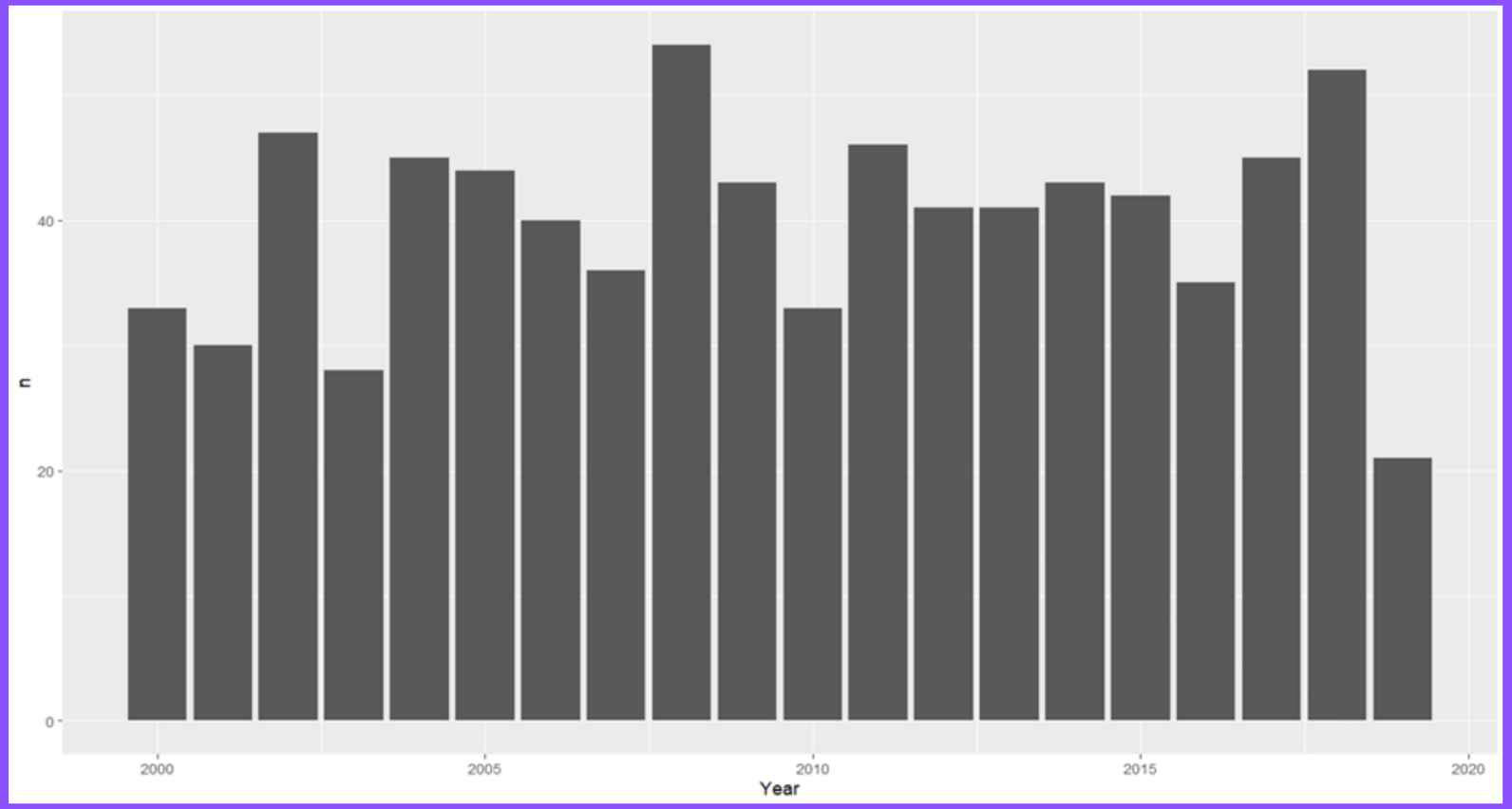
Artist Count Plot: The plot represents the count of songs for each artist. Artists with more than 6 songs are included. It gives an insight into the number of songs contributed by different artists.



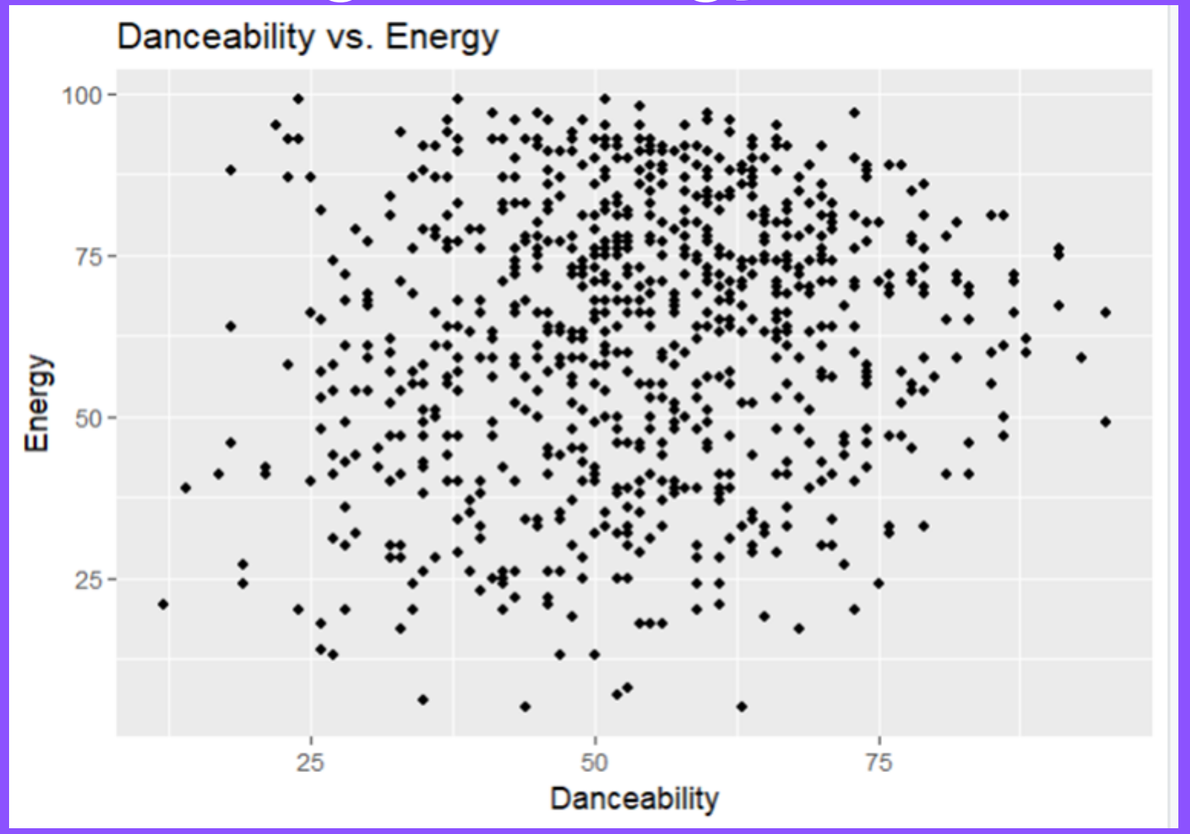
Genre Count Plot: The plot shows the count of songs for each top genre. Genres with more than 10 songs are included. It provides an overview of the distribution of songs across different genres.



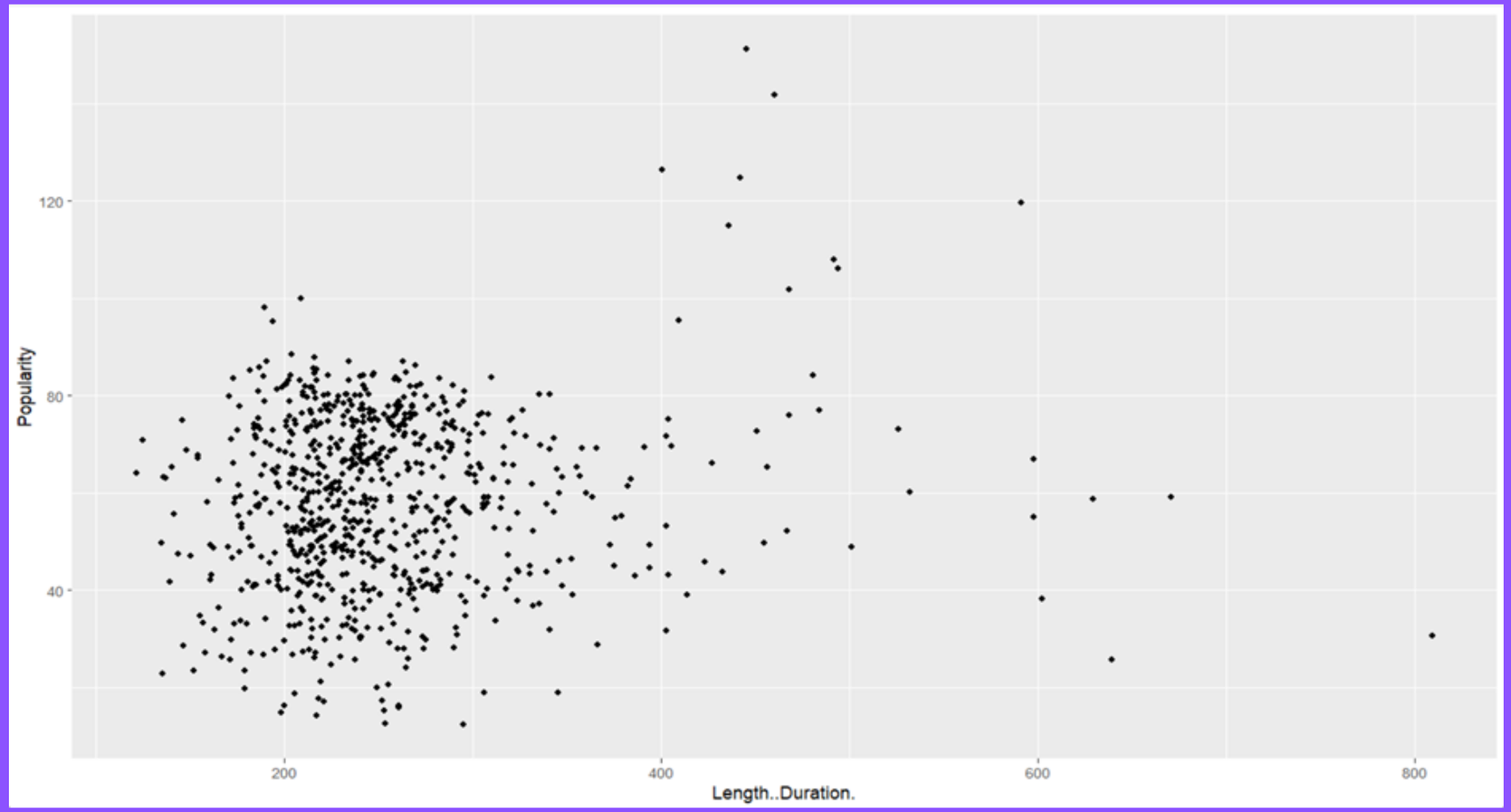
Year Count Plot: This plot displays the count of songs for each year. It helps visualize the distribution of songs over time, indicating which years have a higher or lower number of releases.



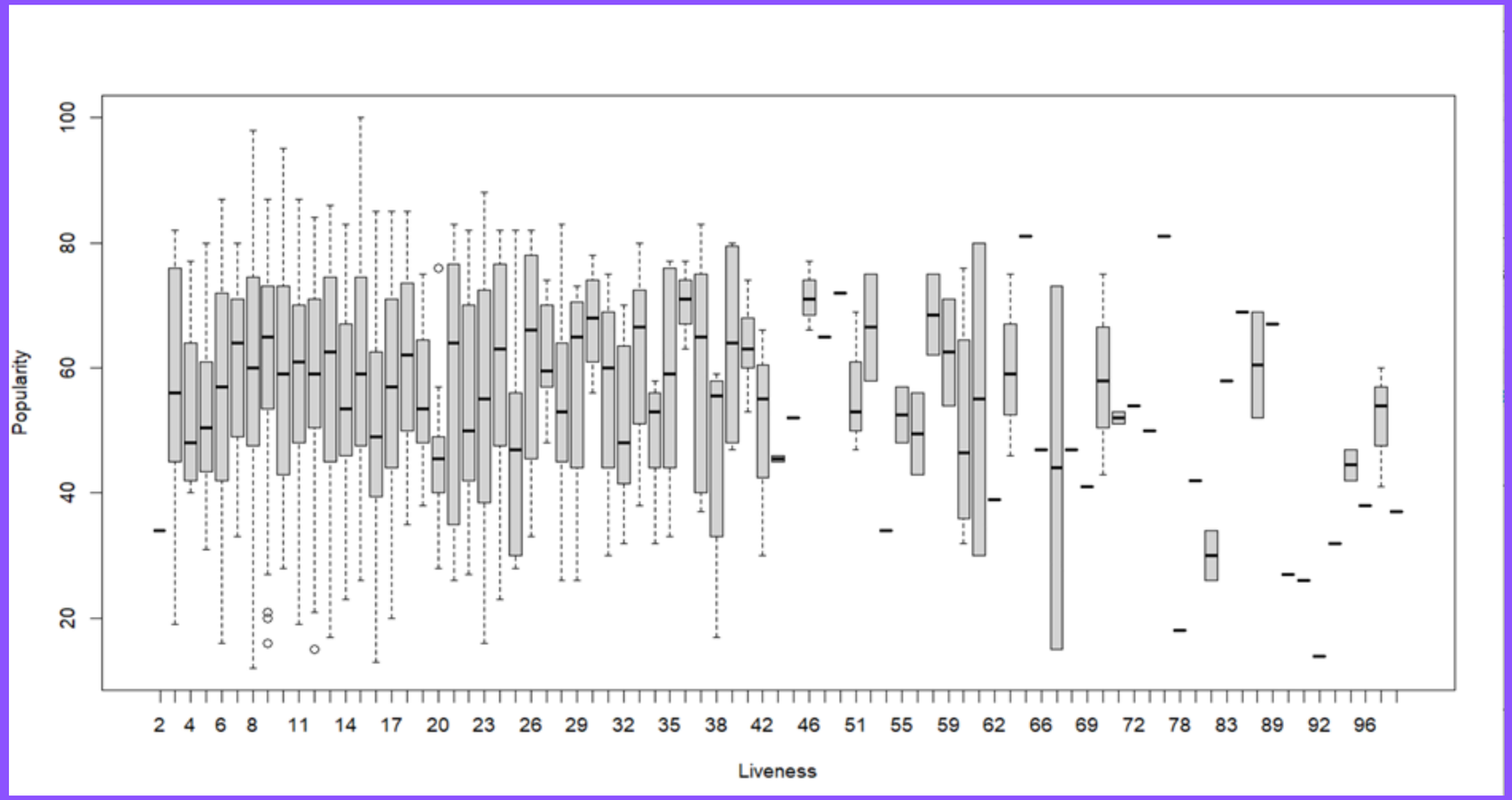
Danceability vs. Energy: This scatter plot displays the relationship between danceability and energy. It helps visualize if there is any correlation between these attributes and whether songs with higher danceability tend to have higher energy levels.



Length vs. Popularity: The jitter plot shows the relationship between song length and popularity. It gives a scattered representation of how the duration of a song relates to its popularity.



Popularity vs. Liveness (Boxplot): The boxplot shows the distribution of popularity across different levels of liveness. It helps compare the median, quartiles, and potential outliers in popularity for different liveness categories.

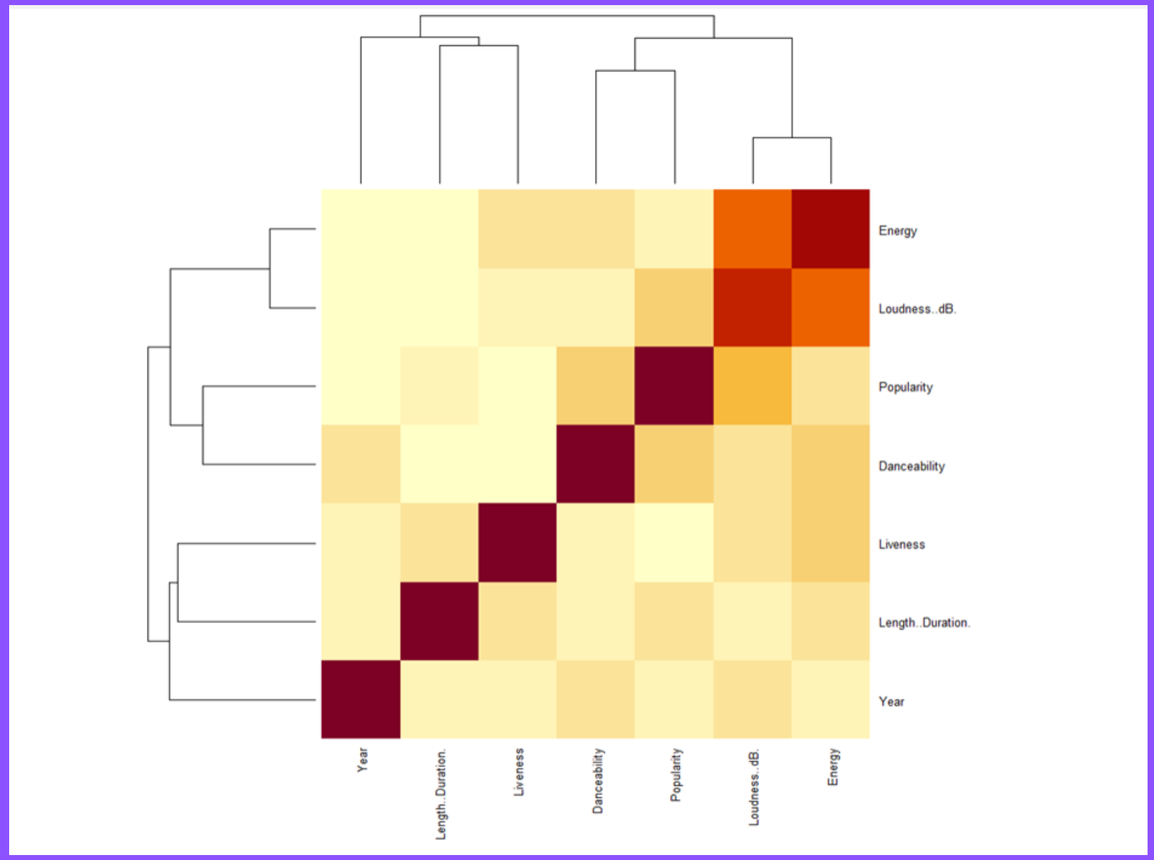


CORRELATION ANALYSIS

Correlation analysis was performed to explore the relationships between different numerical attributes of the songs.

- The **cor** function was used to calculate the correlation matrix between the attributes "Year," "Energy," "Danceability," "Loudness..dB.," "Liveness," "Length..Duration.," and "Popularity."
- The correlation matrix was printed to examine the strength and direction of the correlations between attributes.

Heatmap of Correlation Matrix: The heatmap visually represents the correlation matrix using colors. It allows for a quick assessment of the strength and patterns of correlations between variables.



```
> correlation_matrix<-cor(music_data[,c("Year","Energy","Danceability","Loudness..dB.","Liveness","Length..Duration.",
> print(correlation_matrix)
                      Year       Energy Danceability Loudness..dB.    Liveness Length..Duration.   Popularity
Year           1.00000000 -0.065945349    0.05240345   -0.02153571 -0.02926872     -0.043848059 -0.039250432
Energy        -0.06594535  1.000000000    0.14734541    0.72238675  0.16652483      0.005369493  0.119782470
Danceability   0.05240345  0.147345415    1.00000000    0.04883080 -0.09015558     -0.098747655  0.216114542
Loudness..dB. -0.02153571  0.722386750    0.04883080    1.00000000  0.05688718     -0.045013724  0.299709702
Liveness      -0.02926872  0.166524826   -0.09015558    0.05688718  1.00000000      0.026290429 -0.113455882
Length..Duration. -0.04384806  0.005369493   -0.09874766   -0.04501372  0.02629043      1.000000000 -0.002756057
Popularity    -0.03925043  0.119782470    0.21611454    0.29970970 -0.11345588     -0.002756057  1.000000000
>
```

VARIABLE NAME	DEPENDENT / INDEPENDENT	DEPENDENT VARIABLES
Year	INDEPENDENT	NIL
Energy	DEPENDENT	Loudness(0.72), Popularity(0.12)
Danceability	DEPENDENT	Popularity(0.22)
Loudness..dB.	DEPENDENT	Energy(0.72)
Liveness	INDEPENDENT	NIL
Length..Duration.	INDEPENDENT	NIL
Popularity	DEPENDENT	Energy(0.12), Danceability(0.22), Loudness(0.30)

Conclusion

This project successfully analyzed a music dataset and provided personalized music recommendations based on user preferences. By utilizing various data manipulation and visualization techniques, the project uncovered insights about the dataset, such as genre distribution, popularity of artists, and correlations between variables. The user-based and artist-based recommendation models enhanced the music listening experience by suggesting songs that aligned with the user's preferences. This project demonstrates the application of data analysis and recommendation systems in the music industry, providing valuable insights for music enthusiasts and industry professionals alike.