CSE 564 Assignment 1 Lab Report

visualizing my music taste

Motivation

For this project I decided to visualize my own music taste. Over the past 5 years my liked songs playlist on Spotify sits at 550 tracks. When I learned that Spotify has public APIs for basically everything, including audio features, I thought it would be fun and interesting to have a visual representation of something as nebulous as music taste. This project is a modest attempt at doing this.

Dataset Creation

I had to create my own dataset using Spotify APIs. Spotify does track analysis to drive recommendations. ML models are used to perform audio analysis on tracks and provide scores across multiple dimensions which I will mention below. I used Postman to make API calls and aggregated them using Excel PowerQuery. Multiple APIs needed to be called. The procedure is as follows.

1. Duplicated my liked songs playlist to create a playlist with a shareable public URL.
2. Call /playlist/tracks to get track URIs, along with album URIs and artist URIs for later use. Results are paginated at every 50th result, so for a sample size of 550 there were 11 calls to this API.
3. Call /albums to get fields like album popularity and album release date. Only 20 album details can be fetched at a time.
4. Call /artists to get fields like artist popularity. Only 50 artist details can be fetched at a time.
5. Call /audio-features to get audio analysis fields. Only 100 results can be fetched at a time.
6. Combined all partial result JSON files into one per API, using the command-line tool jq.
7. Imported all this JSON data into Excel using PowerQuery.
8. Used PowerQuery to perform data JOINS, creating the final dataset.
9. Exported as a tab-separated text file, to avoid comma-wrangling.

The GitHub repo has an Excel file with this data.

Dimensions

There are a total of 16 visualizable dimensions, not counting columns like artist_name, album_name, etc that are simply IDs.

#	Dimension	Type	Description
1	Acousticness	numerical	A confidence measure from 0.0 to 1.0 of whether the track is acoustic. 1.0 represents high confidence the track is acoustic.
2	Album Popularity	numerical	The popularity of the album. The value will be between 0 and 100, with 100 being the most popular.
3	Artist Popularity	numerical	The popularity of the artist. The value will be between 0 and 100, with 100 being the most popular. The artist\'s popularity is calculated from the popularity of all the artist\'s tracks.
4	Danceability	numerical	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.
5	Duration	numerical	The duration of the track in milliseconds.
6	Energy	numerical	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. Perceptual features contributing to this attribute include dynamic range, perceived loudness, timbre, onset rate, and general entropy.
7	Instrumentalness	numerical	Predicts whether a track contains no vocals. "Ooh" and "aah" sounds are treated as instrumental in this context. Rap or spoken word tracks are clearly "vocal". The closer the instrumentalness value is to 1.0, the greater likelihood the track contains no vocal content. Values above 0.5 are intended to represent instrumental tracks, but confidence is higher as the value approaches 1.0.
8	Key	categorical	The key the track is in. Integers map to pitches using standard Pitch Class notation. E.g. 0 = C, 1 = C♯/D♭, 2 = D, and so on. If no key was detected, the value is -1.
9	Liveness	numerical	Detects the presence of an audience in the recording. Higher liveness values represent an increased probability that the track was performed live. A value above 0.8 provides strong likelihood that the track is live.
10	Loudness	numerical	The overall loudness of a track in decibels (dB). Loudness values are averaged across the entire track and are useful for comparing relative loudness of tracks. Loudness is the quality of a sound that is the primary psychological correlate of physical strength (amplitude). Values typically range between -60 and 0 db.
11	Mode	categorical	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.
12	Release Date	numerical	The date the album was first released.
13	Speechiness	numerical	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. Values above 0.66 describe tracks that are probably made entirely of spoken words. Values between 0.33 and 0.66 describe tracks that may contain both music and speech, either in sections or layered, including such cases as rap music. Values below 0.33 most likely represent music and other non-speech-like tracks.
14	Tempo	numerical	The overall estimated tempo of a track in beats per minute (BPM). In musical terminology, tempo is the speed or pace of a given piece and derives directly from the average beat duration.
15	Time Signature	categorical	An estimated time signature. The time signature (meter) is a notational convention to specify how many beats are in each bar (or measure). The time signature ranges from 3 to 7 indicating time signatures of "3/4", to "7/4".
16	Valence	numerical	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).

Visualization Implementation

I used React and Material UI to simplify frontend development, and d3 to create SVG charts. The code is at https://github.com/countnightlock/cse564-lab1.

Some features are as follows.

UI

1. A helpful error message is shown if dimensions are incorrectly selected.
2. Drop down menus for bar chart/histogram and scatter plot.
3. A toggle button for turning the chart sideways.
4. Spotify's green/black/white color scheme.

Charts

1. Chart title, axis labels, gridlines corresponding to ticks in the frequency axis.
2. Bar graph and histograms have text labels above each bar to make visual parsing easier.
3. Scatter plots have a best-fit line when both attributes are numerical, and display Pearson's Correlation Coefficient.
4. There is a paragraph showing description for the plotted dimension(s).

Tools used for implementation are:

1. Spotify APIs - https://developer.spotify.com/documentation/web-api/
2. Postman (API calls) - https://www.postman.com/
3. Excel PowerQuery - https://learn.microsoft.com/en-us/power-query/
4. jq for JSON wrangling - https://github.com/stedolan/jq
5. d3.js - https://github.com/d3/d3/wiki
6. ReactJS - https://reactjs.org/docs/getting-started.html
7. Material UI - https://mui.com/material-ui/getting-started/overview/