

# GLOBAL ACADEMY OF TECHNOLOGY

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## Department of Artificial Intelligence and Machine Learning

DASHBOARD REPORT

On

BUSINESS INTELLIGENCE

22AML73

“Spotify Music Analysis Dashboard using Power BI”

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# Introduction

In the modern digital era, the music industry has evolved into a highly data-driven ecosystem. Streaming platforms such as **Spotify** collect massive amounts of data on songs, artists, genres, and user engagement. By leveraging this data, organizations and analysts can uncover valuable insights about musical trends, audience preferences, and performance patterns.

This project — **Spotify Music Analysis Dashboard** — focuses on transforming Spotify's open dataset into an interactive and insightful **Power BI dashboard**. The dashboard visually represents important musical metrics such as **popularity, energy, danceability, and genre distribution**, allowing users to understand what makes certain songs and artists stand out.

The analysis combines **data visualization, business intelligence, and analytical reasoning** to explore how attributes like tempo, energy, and valence influence a track's success. Through interactive visuals and KPIs, this project demonstrates how analytical tools like **Power BI** can convert raw musical data into meaningful stories and trends, offering clear insights for artists, producers, and listeners alike.

With the growing popularity of data analytics in creative industries, this project bridges the gap between **music and business intelligence**. It demonstrates how structured analysis can help discover patterns such as the most popular artists, trending genres, and the relationship between musical attributes. The **Spotify Music Analysis Dashboard** not only provides visual insights for data enthusiasts but also serves as a useful analytical reference for musicians, producers, and marketing teams seeking to understand audience preferences and optimize future releases.

## Objectives

The **Spotify Music Analysis Dashboard** aims to analyse Spotify's dataset to uncover insights about musical trends, artist performance, and track popularity. Using **Microsoft Power BI**, the project focuses on transforming raw data into meaningful visuals that reflect real-world music patterns and audience preferences. The goal is to make data-driven observations easy to understand through an interactive and visually appealing dashboard.

### **Specific Objectives:**

- To visualize Spotify's track data through interactive Power BI dashboards.
- To identify the **most popular artists** and **top-performing genres**.
- To analyze relationships between **audio features** such as energy, valence, and danceability.
- To design **Key Performance Indicators (KPIs)** that summarize overall performance.
- To apply **Business Intelligence techniques** for clear and effective decision-making.

# Dataset Description

The dataset used for this project is the **Spotify Tracks Dataset**, obtained from **Kaggle**, a popular platform for open-source data. This dataset contains comprehensive information about songs available on Spotify, including various **musical attributes, artist details, and track-level metrics** such as popularity, energy, and danceability. It provides a rich foundation for exploring how these features influence a song's success and how different genres perform over time.

The dataset consists of more than **75,000 records** and multiple attributes describing each track in detail. Each record represents a single track with features that help analyze both its **musical composition** and **audience engagement**. The combination of numerical and categorical variables makes it ideal for data visualization and BI analysis using **Power BI**.

## Key Features of the Dataset:

Column Name	Description
<b>track_id</b>	Unique identifier assigned to each song on Spotify.
<b>track_name</b>	The name or title of the track.
<b>artists</b>	The name(s) of the performing artist(s). Multiple artists are separated by semicolons.
<b>album_name</b>	Name of the album in which the song was released.
<b>track_genre</b>	The primary genre classification of the song.
<b>popularity</b>	A numerical value (0–100) indicating how popular a song is on Spotify.
<b>danceability</b>	Describes how suitable a track is for dancing based on tempo, rhythm, and beat stability.
<b>energy</b>	Measures the intensity and activity level of a song. Higher values indicate energetic tracks.
<b>valence</b>	Represents the musical “positiveness” or emotional tone of a track.
<b>tempo</b>	The speed or beats per minute (BPM) of the song.
<b>duration_ms</b>	Duration of the track measured in milliseconds.
<b>instrumentalness</b>	Predicts whether a track contains vocals or is purely instrumental.

## Purpose of the Dataset:

The Spotify dataset is used to analyze music trends and understand how different audio features affect a song's popularity. It helps identify top-performing artists, popular genres, and relationships between musical attributes such as energy and danceability. The data provides a strong foundation for creating insightful visualizations in **Power BI**.

# Data Preparation

Data preparation is one of the most important phases of this project, as it ensures the dataset is accurate, consistent, and ready for visualization. The process was performed in **Power Query Editor** within **Microsoft Power BI**, where the Spotify dataset was cleaned, transformed, and enhanced to make it suitable for analytical reporting.

## 1. Data Loading

The dataset, downloaded from **Kaggle** in CSV format, was imported into **Power BI Desktop** using the **Get Data** → **Text/CSV** option. Once loaded, the data preview was checked to verify column names, data types, and overall structure.

## 2. Data Cleaning

Data cleaning was carried out to remove inconsistencies and ensure high data quality:

- Removed **duplicate records** using the `track_id` column as a unique identifier.
- Deleted rows with **null or missing values** in key columns such as popularity, `track_name`, or artists.
- Verified data types — ensuring numeric fields (like popularity, energy, and danceability) were correctly formatted as decimal numbers and categorical fields (like `track_genre` and artists) were set as text.

## 3. Data Transformation

Data transformation involved deriving new columns and preparing additional metrics to enhance analysis:

- Converted song duration from milliseconds to minutes using the calculated column:
- $\text{Duration (min)} = [\text{duration\_ms}] / 60000$
- Created an **Energy Category** column to classify songs as High, Medium, or Low based on energy values:
  - High →  $\text{energy} > 0.7$
  - Medium →  $\text{energy between } 0.4 \text{ and } 0.7$
  - Low →  $\text{energy} < 0.4$
- Split the **artists** column by delimiter “;” to enable analysis of collaborations and multiple artists per track.

## 4. Data Validation

After transformations, the dataset was validated by checking total row counts, confirming column consistency, and reviewing value distributions using summary statistics in Power BI.

## 5. Final Preparation

Once all steps were completed, the data was **loaded into Power BI’s model** using “Close & Apply.” The dataset was now fully cleaned, formatted, and optimized for creating visualizations and DAX-based calculations in the dashboard.

# Tools and Techniques

The **Spotify Music Analysis Dashboard** was designed and developed using **Microsoft Power BI**, a leading Business Intelligence (BI) tool known for its strong data visualization, modeling, and reporting capabilities. This section outlines the tools used throughout the project and the analytical techniques implemented to transform the raw dataset into an interactive and insightful dashboard.

## 1. Tools Used:

Tool / Platform	Purpose / Functionality
Microsoft Power BI Desktop	Core BI tool used for data visualization, dashboard design, and report creation.
Power Query Editor	Used for cleaning, transforming, and shaping the dataset before loading into the model.
DAX (Data Analysis Expressions)	Used to create calculated columns, measures, and KPIs like Average Popularity and Energy.
Kaggle (Spotify Dataset)	Source of the dataset containing detailed information on tracks, artists, and genres.
Power BI Custom Visual Marketplace	Provided additional visuals such as Word Cloud, Radar Chart, Violin Plot, and Chord Diagram for better insights.
GitHub	Used to store and share the project documentation and Power BI file (.pbix).

## 2. Techniques Implemented:

The following techniques and BI concepts were applied during the project:

- **Data Cleaning & Transformation:** Used **Power Query** to remove duplicates, fix data types, and create new calculated fields such as Duration (min) and Energy Category.
- **Data Modeling:** Built relationships among dataset attributes (artists, genres, track IDs) for efficient filtering and aggregation.
- **Measure Creation (DAX):** Developed key measures for KPIs such as *Total Songs*, *Average Popularity*, *Average Energy*, and *Danceability*.
- **Dashboard Design:** Applied the **Spotify dark theme** (#121212) with **Spotify green accents** (#1DB954) for a modern look. Organized visuals into sections for KPIs, charts, and comparisons.
- **Custom Visuals:** Integrated visuals from Power BI Marketplace — Word Cloud for genre frequency, Violin Plot for danceability distribution, Chord Diagram for artist–genre relations, and Radar Chart for multi-attribute analysis.
- **Interactivity and Filters:** Added slicers for artist and genre to allow dynamic exploration and user interaction.

# Dashboard Overview

The **Spotify Music Analysis Dashboard** was designed to visually represent the musical and popularity trends derived from Spotify's dataset. Built in **Microsoft Power BI**, the dashboard delivers an interactive and user-friendly experience, allowing users to explore relationships between audio features, genres, and artists. It follows a clean, modern layout inspired by Spotify's branding — with a **dark background (#121212)** and **green accent color (#1DB954)** — ensuring visual consistency and readability.

The dashboard is organized into multiple sections, each serving a unique analytical purpose. At the top, key **KPI cards** provide a quick snapshot of overall statistics such as **Total Songs, Average Popularity, Top Artist, and Top Genre**. These indicators summarize the dataset and give an immediate overview of the most important insights.

The central section of the dashboard includes visualizations that focus on **comparative and trend analysis**. A **Line Chart** illustrates popularity variation over time, while a **Bar Chart** highlights the top music genres or artists based on popularity. These visuals allow users to identify which musical categories perform best and how song engagement has evolved.

To explore relationships between song features, the dashboard includes a **Scatter Plot** showing the correlation between **Energy** and **Danceability**, and a **Radar Chart** that compares average values of multiple audio attributes such as energy, valence, and instrumentality. These visuals help explain what makes certain genres or tracks more appealing to listeners.

Additional visualizations like a **Word Cloud** and **Chord Diagram** further enrich the analysis. The Word Cloud displays the most frequent music genres, while the Chord Diagram illustrates artist-genre collaborations, emphasizing how some artists contribute across multiple music categories. A **Gauge Chart** provides a simple, visual representation of average energy levels in the dataset.

Interactive **slicers and filters** for **Artist, Genre, and Popularity Range** enable users to customize their view, making the dashboard not only informative but also highly interactive.

Overall, the dashboard provides a **comprehensive view of Spotify's music landscape**, combining key metrics, patterns, and trends into a single, aesthetically cohesive Power BI report. It effectively demonstrates how Business Intelligence tools can transform raw musical data into actionable insights.

Finally, the dashboard reflects a perfect balance between **analytics and design** — using Power BI's advanced visualization capabilities to turn raw numbers into meaningful stories. It allows anyone, from data enthusiasts to music lovers, to explore how sound, rhythm, and energy translate into audience engagement and popularity on Spotify.

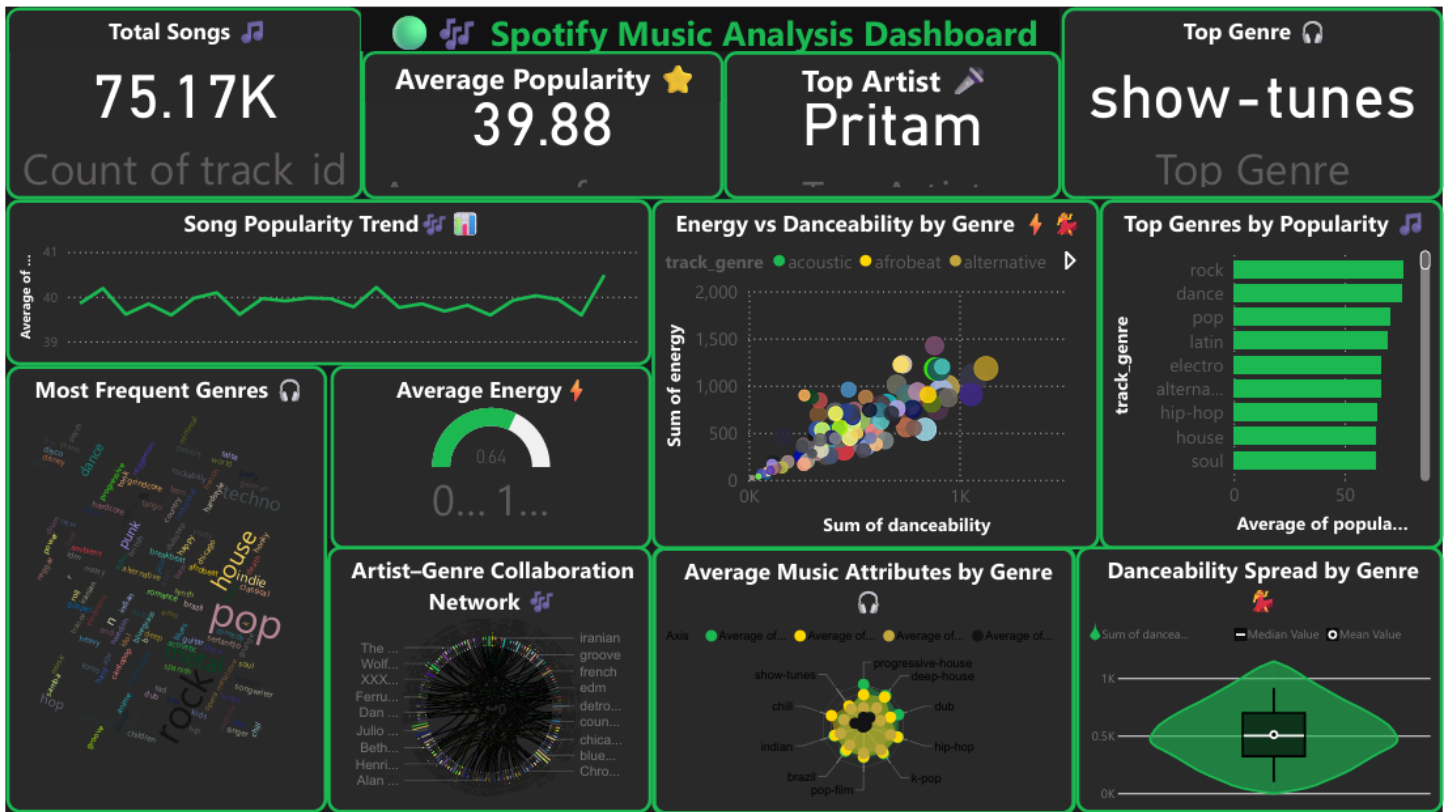


Figure 1: Spotify Music Analysis Dashboard (Power BI Output)

### Dashboard Highlights

- Displays key KPIs like Total Songs, Average Popularity, Top Artist, and Top Genre for quick insights.
- Allows interactive exploration of Energy, Danceability, and Popularity Trends.
- Uses advanced visuals such as Word Cloud, Radar Chart, and Chord Diagram to enhance storytelling.
- Built using Microsoft Power BI with a Spotify-inspired color palette and dynamic slicers.

# DAX Measures Used

DAX (Data Analysis Expressions) is a powerful formula language in **Microsoft Power BI** used to perform calculations and data analysis on model data. It enhances the analytical capability of Power BI by allowing the creation of custom measures, calculated columns, and tables that dynamically respond to filters and user interactions. In this project, DAX was extensively used to calculate key performance indicators (KPIs) and derive insights from the Spotify dataset.

The **Spotify Music Analysis Dashboard** uses multiple DAX measures to compute aggregated statistics like **average popularity**, **total songs**, **average energy**, and **average danceability**. These measures help provide dynamic and accurate data representations that automatically update when filters or slicers are applied.

Some of the important DAX measures used in this project are listed below:

**1. Total Songs:** Total Songs = COUNT(dataset[track\_id])

This measure counts the total number of tracks in the dataset and is displayed on the KPI card to give an overview of dataset size.

**2. Average Popularity:** Average Popularity = AVERAGE(dataset[popularity])

This measure calculates the average popularity score of all songs, allowing comparison across artists and genres.

**3. Average Energy:** Average Energy = AVERAGE(dataset[energy])

This measure is used in the gauge chart to represent the overall energy level of tracks on Spotify.

**4. Average Danceability:** Average Danceability = AVERAGE(dataset[danceability])

This helps in understanding how danceable the songs are on average across the dataset.

**5. Top Artist:** Top Artist =

VAR topArtist =

TOPN(1, SUMMARIZE(dataset, dataset[artists], "Count", COUNT(dataset[track\_id])), [Count], DESC)

RETURN

MAXX(topArtist, dataset[artists])

This DAX expression dynamically identifies the artist with the highest number of songs in the dataset.

**6. Top Genre:** Top Genre =

VAR topGenre =

TOPN(1, SUMMARIZE(dataset, dataset[track\_genre], "Count", COUNT(dataset[track\_id])), [Count], DESC)

RETURN

MAXX(topGenre, dataset[track\_genre])

# Key Insights

The Spotify Music Analysis Dashboard provides several valuable insights into the musical landscape, artist performance, and listener preferences. Through visual exploration and DAX-based metrics, the following observations were made:

- The dataset contains over 75,000 songs, representing a wide range of musical styles and artists.
- The average popularity score across tracks is approximately 40, indicating that most songs in the dataset fall within a moderate popularity range rather than extreme hits.
- Pritam emerged as the top artist with the highest number of songs in the dataset, while “Show-tunes” appeared as the most frequent genre, highlighting its dominance.
- The line chart reveals that overall song popularity has remained fairly stable over time, with slight fluctuations influenced by new releases and seasonal trends.
- The scatter plot comparing Energy vs. Danceability suggests a positive correlation — songs that are high in energy tend to be more danceable and appealing to listeners.
- The radar chart and gauge visuals indicate that tracks generally maintain moderate energy and danceability levels, reflecting the balance found in mainstream music.
- The word cloud and chord diagram emphasize the diversity of genres and artist collaborations, showing that cross-genre music has become more common in recent years.

Overall, the dashboard effectively highlights how audio characteristics, artist activity, and genre trends shape the popularity of music on Spotify. These insights can be useful for understanding listener preferences and guiding content recommendations or playlist creation.

# Conclusion

The **Spotify Music Analysis Dashboard** successfully converts raw Spotify data into clear and meaningful insights using Power BI. By leveraging DAX measures and visual analytics, the dashboard highlights key trends in song popularity, audio characteristics, and genre distribution. It provides a structured and interactive view of how features like energy and danceability influence a track’s appeal. This makes the dashboard a valuable tool for understanding the modern music landscape.

The project demonstrates the strength of **data storytelling** through well-designed visuals such as bar charts, radar graphs, gauge charts, and chord diagrams. These visuals simplify complex data and make insights easy to interpret for both technical and non-technical users. It also showcases how Business Intelligence tools can be used creatively outside of traditional business contexts. The dashboard blends analytical accuracy with aesthetic presentation inspired by Spotify’s theme.

Overall, the project bridges the gap between **music and analytics** by presenting insights in an interactive and visually engaging manner. It proves how Power BI can transform large datasets into actionable knowledge and meaningful storytelling. The dashboard stands as a complete, user-friendly, and insightful representation of Spotify’s musical trends.