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Our Music Playlists

Smart Music Recommendation System for Emerging Artists

A fairer recommendation system based on user behavior and music similarity

Business Case Scenario

Popular streaming platforms **prioritize mainstream artists** , making it hard for emerging musicians to get discovered.

This project creates **a fair recommendation system** based on user behavior and music similarity by using graph databases to identify relationships in music preferences to **prioritize emerging artist recommendations.**

Dataset Features

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User ID

1h4min ▶

a hash of the user's Spotify username

Artist

45min ▶

the name of the artist

Playlist

30min ▶

name of the playlist containing the song

Song

1h15min ▶

the title of the track

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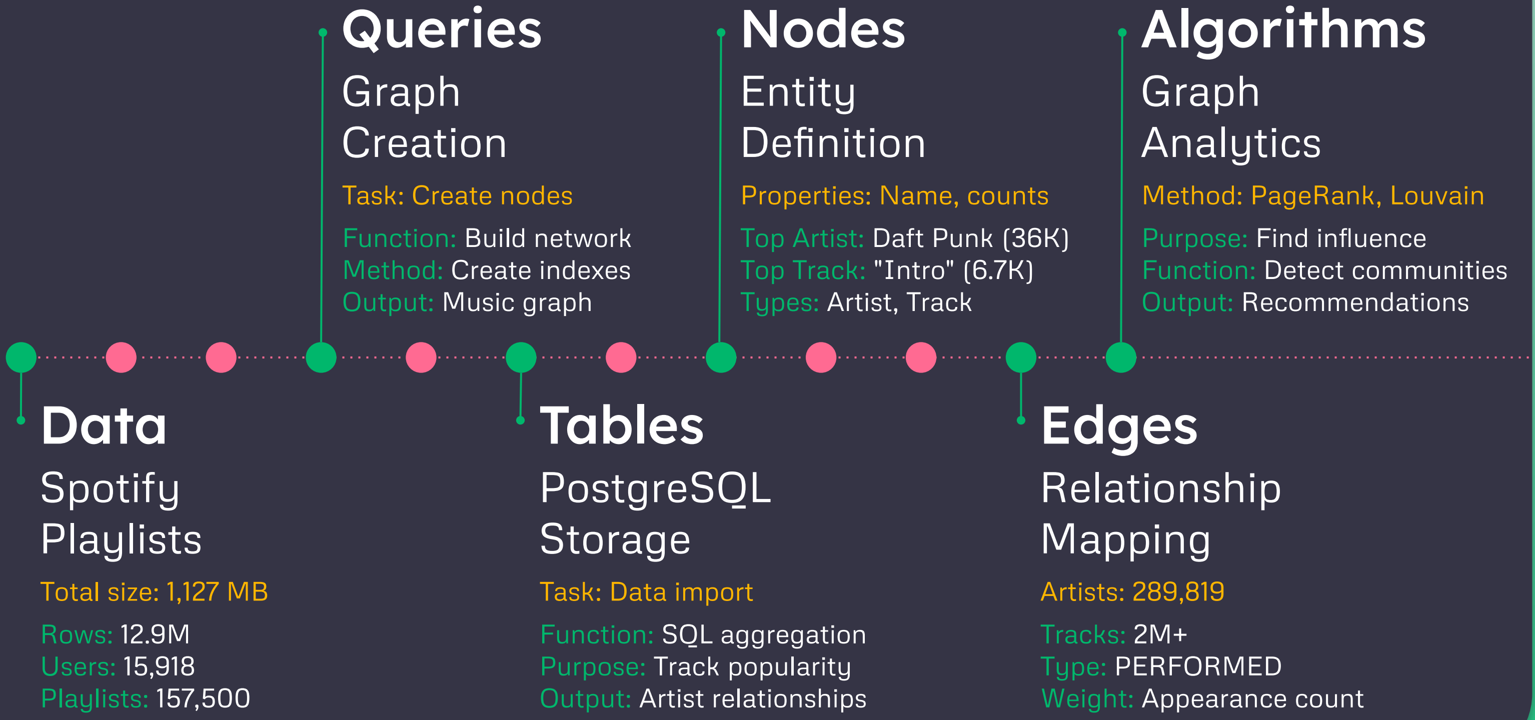
Neo4j
use case

Follow

Our recommendation system uses Neo4j to model music as a network of connected users, artists, and tracks. It uncovers hidden patterns to identify emerging artists and create recommendation paths.

- A relational database would be slower and less efficient.

Our Approach



Data

Spotify Playlists

Total size: 1,127 MB

Rows: 12.9M
Users: 15,918
Playlists: 157,500

Queries

Graph Creation

Task: Create nodes

Function: Build network
Method: Create indexes
Output: Music graph

Tables

PostgreSQL Storage

Task: Data import

Function: SQL aggregation
Purpose: Track popularity
Output: Artist relationships

Nodes

Entity Definition

Properties: Name, counts

Top Artist: Daft Punk (36K)
Top Track: "Intro" (6.7K)
Types: Artist, Track

Edges

Relationship Mapping

Artists: 289,819

Tracks: 2M+
Type: PERFORMED
Weight: Appearance count

Algorithms

Graph Analytics

Method: PageRank, Louvain

Purpose: Find influence
Function: Detect communities
Output: Recommendations

Nodes

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● Artist

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Total of 289,819

Connected through co-listening patterns

● Track

Follow

2M+

Average track appears in 6-7 playlists

Each track connects to exactly one artist

● User

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Average of 206 unique artists per user

Average of 705 unique tracks per user

14-15 playlists per user on average

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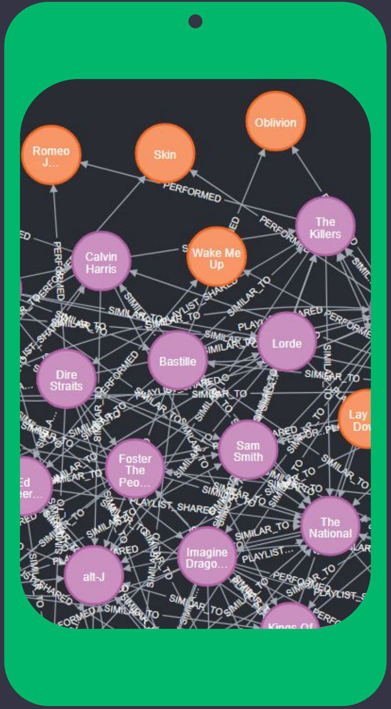

Edges:

number of playlists

PERFORMED (Artist →Track)

- Links 289K artists to 2M+ tracks

SIMILAR_TO (Artist ↔Artist)

- Created from co-listening patterns

APPEARS_IN (Track →Playlist)

- Average playlist: 56 tracks
- Maximum playlist size: 47,362 tracks

Neo4j Graph Algorithms

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PageRank

3:15

Identifies influential artists in the music network

Louvain Community Detection

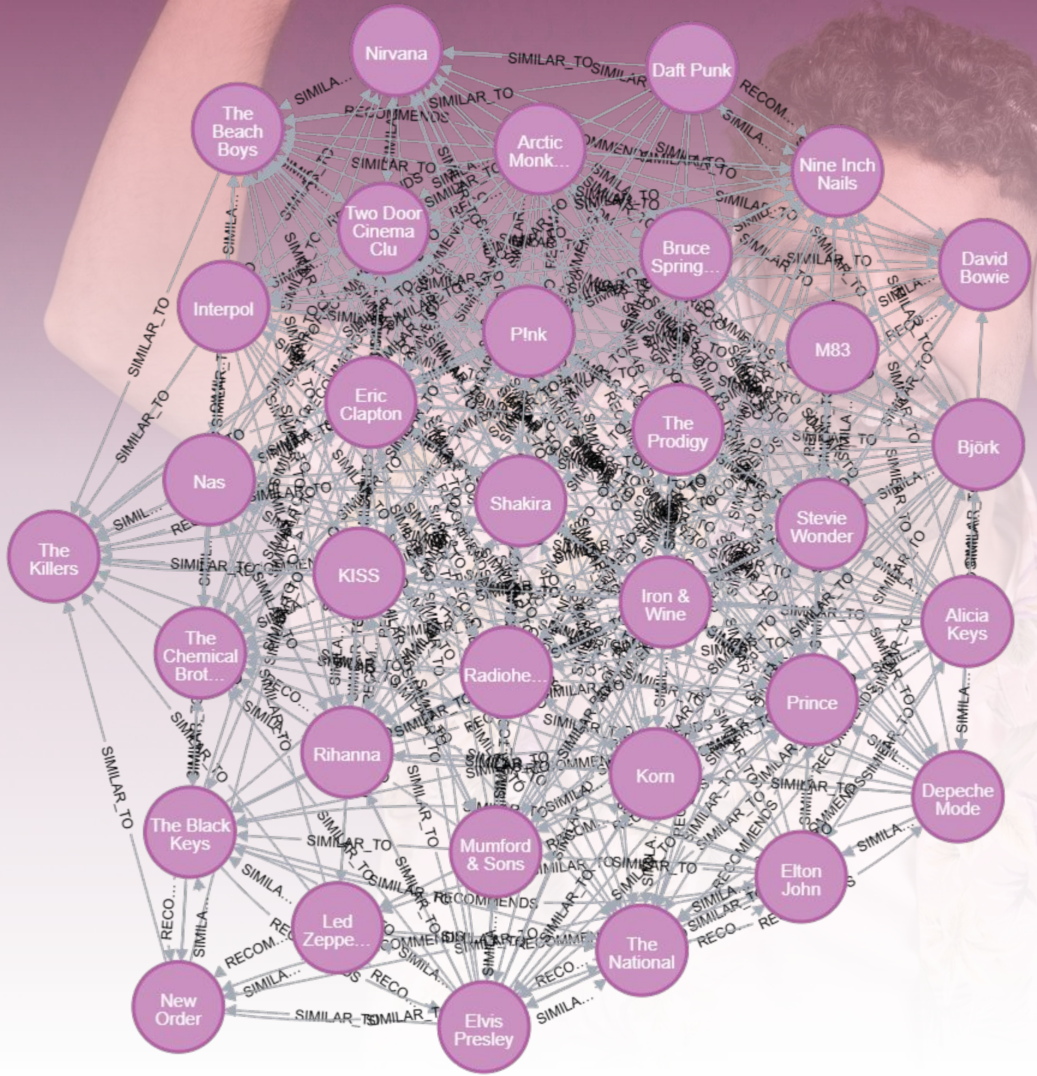
3:20

Discovers natural music communities/genres

Multiple similarity calculations

3:10

Combines shared tracks (cosine similarity) and genre overlap (Jaccard)



Neo4j graph Similarity Relationships

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MongoDB

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use case

Storing artist metadata with varying attributes to support flexible searches and identifying emerging artists

MongoDB vs. Relational DB

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MongoDB

Strengths

- Nested data (track features and collaboration lists)
- Schema flexibility supports evolving artist data without migration
- Real-time analytics and filtering

Relational DB

Limitations

- Joins between artists, tracks, and genres ➪ complex
- Schema rigidity

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Redis use case

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Storing and retrieving recently played artists, session data, and trending emerging artists in real time

Redis vs. Relational DB

Redis

Strengths

- Real-time access + in-memory storage
- Frequent updates
- Ideal for fast-changing data
- Optimized key-value format for speed and scalability

Relational DB

Limitations

- Slow write/read speeds
- Live activity tracking or session caching is difficult
- Complex schemas

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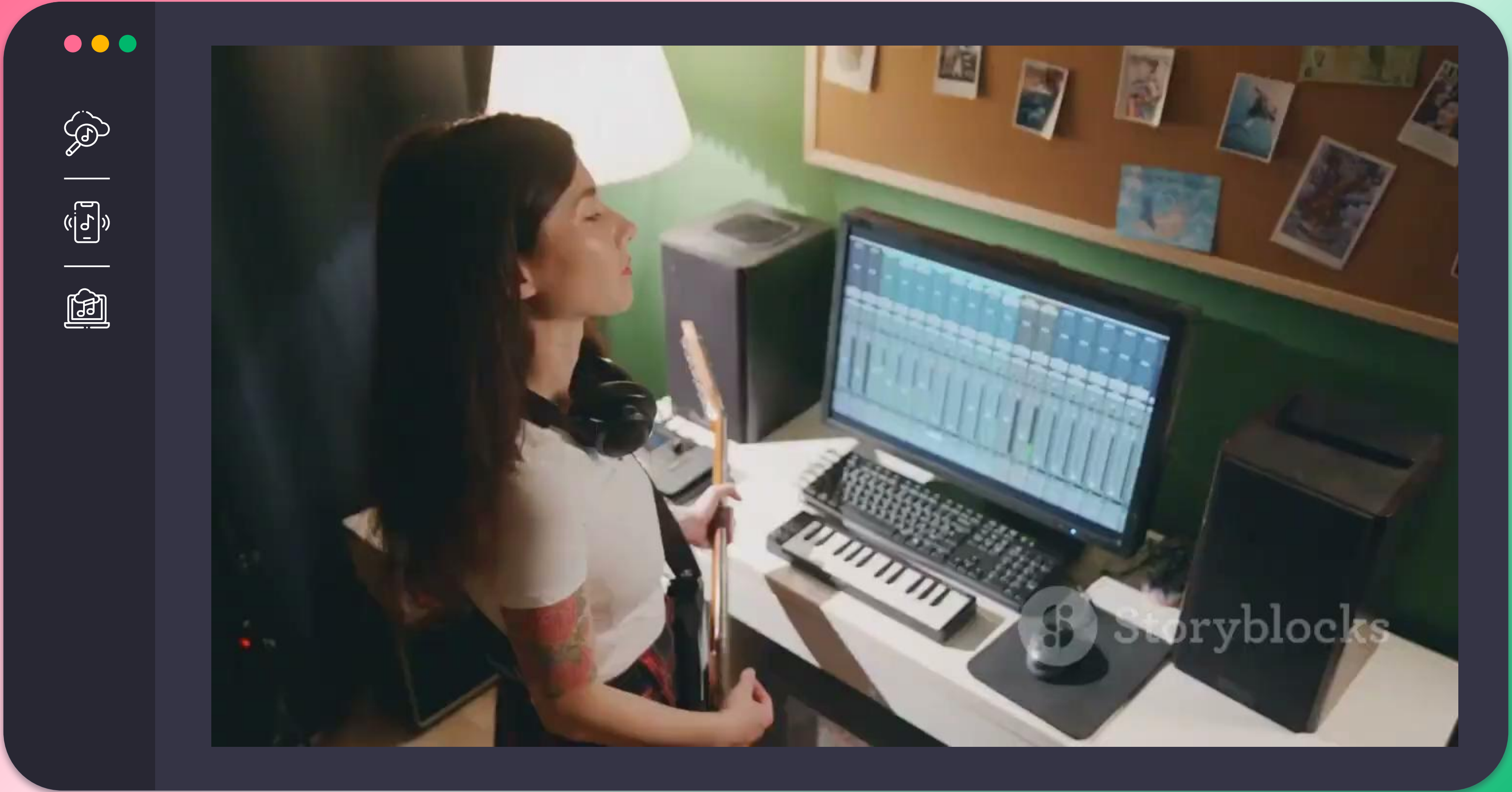

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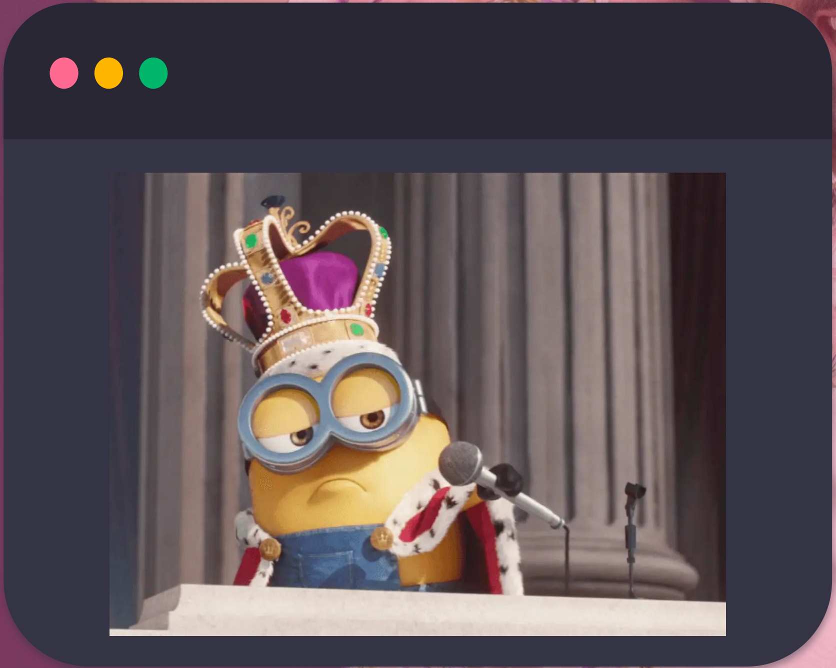

Thank you!

Citations

Redis Image:
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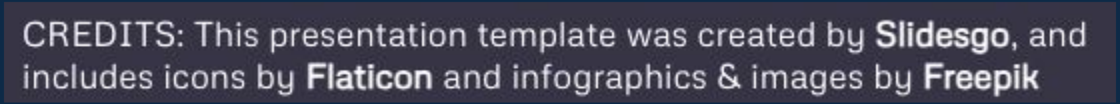
Kevin video:
https://bcourses.berkeley.edu/courses/1540223/pages/2-dot-3-1-concepts-relational-databases?module_item_id=17262685



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