



Simple, open music recommendations

Sam Thursfield, GUADEC 2021

Recommenders are everywhere



[@AliceAvizandum](#), Twitter

**Can I make a
recommendation
algorithm?**

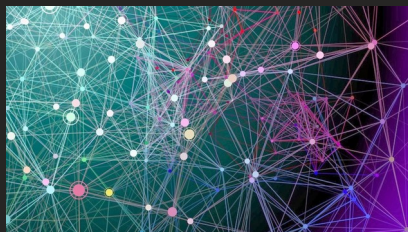
Recommendation basics:

data → process → more data

Recommendation basics:

Music collection

Social data



process



List of songs

| | | | | | |
|----|-------------------------|---------------------------|----------------------------|------|---|
| :: | Waiting At The Gate | Love Grocer | Fresh Produce | 4:47 | ☆ |
| :: | Sleeve | The Rubber Duck Orchestra | Jack Tombs's Album | 4:30 | ☆ |
| :: | Shrimp | Mr. Scruff | Trouser Jazz | 7:01 | ☆ |
| :: | Monkey Boogie | Millencolin | For Monkeys | 2:26 | ☆ |
| :: | She Likes to Smile | RokkaTone | In This Life | 5:10 | ☆ |
| :: | Random I Am | Millencolin | For Monkeys | 2:40 | ☆ |
| :: | Acid Tape Track | Squarepusher | Selection Sixteen | 3:53 | ☆ |
| :: | Bing Bong | Super Furry Animals | PZYK Vol. 2 | 5:18 | ☆ |
| :: | Balkanik Glaze | The Rubber Duck Orchestra | Jack Tombs's Album | 4:54 | ☆ |
| :: | Politicians In My Eyes | Death | For The Whole World To See | 5:52 | ☆ |
| :: | Trans-Universal Express | Tom Furse | PZYK Vol. 2 | 2:52 | ☆ |

Listen history

Audio analysis

...

Music recommendation basics:

playlist → process → playlist

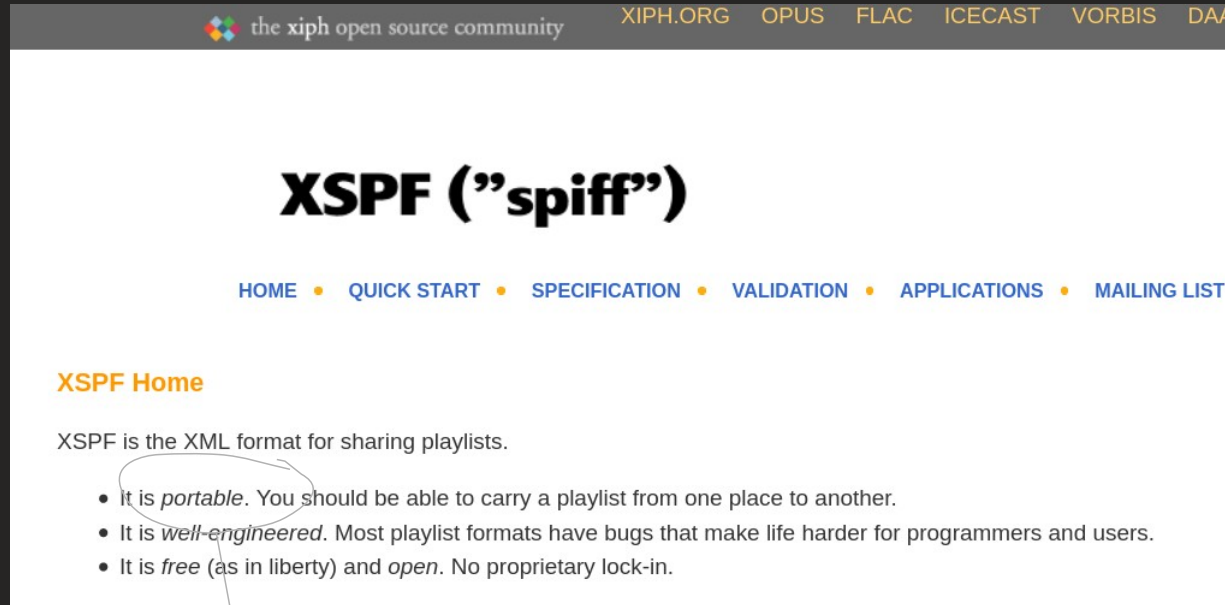
Music recommendation basics:

playlist → process → playlist

```
> cpe tracker tracks | cpe shuffle --count 5 - | jq '{ title: .title, creator: .creator }' -c
{"title":"Find the River","creator":"R.E.M."}
{"title":"Good Good Things","creator":"Descendents"}
{"title":"Yuko and Hiro","creator":"Blur"}
{"title":"The Basset Hound's Lament","creator":"Thomas Truax"}
{"title":"Widowmaker","creator":"The Possibles"}
```

cpe = Calliope – set of commandline tools that work with playlists
playlist = list of JSON objects

Playlist format



The screenshot shows the top portion of the XSPF website. At the top, there is a navigation bar with the Xiph logo and the text "the xiph open source community" on the left, and links for "XIPH.ORG", "OPUS", "FLAC", "ICECAST", "VORBIS", and "DAV" on the right. Below this is a large heading "XSPF ('spiff')". Underneath the heading is a horizontal menu with links: "HOME", "QUICK START", "SPECIFICATION", "VALIDATION", "APPLICATIONS", and "MAILING LIST". The main content area starts with the sub-heading "XSPF Home" in orange. Below that is a paragraph: "XSPF is the XML format for sharing playlists." followed by a bulleted list of three points. The first point, "It is *portable*. You should be able to carry a playlist from one place to another.", has the word "portable" circled in blue. An arrow points from this circle down to the text "Resolve the playlist in order to listen." located below the screenshot.

the xiph open source community XIPH.ORG OPUS FLAC ICECAST VORBIS DAV

XSPF ("spiff")

[HOME](#) • [QUICK START](#) • [SPECIFICATION](#) • [VALIDATION](#) • [APPLICATIONS](#) • [MAILING LIST](#)

XSPF Home

XSPF is the XML format for sharing playlists.

- It is *portable*. You should be able to carry a playlist from one place to another.
- It is *well-engineered*. Most playlist formats have bugs that make life harder for programmers and users.
- It is *free* (as in liberty) and *open*. No proprietary lock-in.

Resolve the playlist in order to listen.

Demo: resolve a playlist

```
cpe tracker resolve-content five-songs.cpe | jq
```

You can now **export** the playlist as .m3u, .xspf, etc.

```
cpe spotify resolve five-songs.cpe | jq
```

Requires a free Spotify API key.

You can now **upload** the playlist to Spotify.

Spotify facts

9000+ data pipelines

1600+ engineers



50 million tracks (25% of which have zero listens)

> half a trillion events captured per day

Data sources

MusicBrainz samthursfield2 • My Data • Search

About Us • Products • Search • Editing • Documentation •

Rough Trade

(post-2000)
Label

Overview Relationships Aliases Tags Details Edit

Annotation

This is the relaunched Rough Trade.
Don't file any pre-2000 releases here.
Click here for "old" Rough Trade (1978 - 1999/2000, LC-05661).
Show more...

Annotation last modified by [F1 HumHumXX](#) on 2010-01-18 11:25 UTC. [View annotation history](#) | [Edit annotation](#)

Wikipedia

Rough Trade Records is an independent record label based in London, England. It was formed in 1978 by Geoff Travis who had opened a record store off Ladbroke Grove. Having successfully promoted and sold records by punk rock and early post-punk and indie pop bands such as the Normal and Desperate Bicycles, Travis began to manage acts and distribute bands such as Scritti Politti and began the label, which was informed by left-wing politics and the ethos of the [London independent scene](#). [Rough Trade](#) also sold its [distribution services](#) to independent record labels.

Show more...

Continue reading at [Wikipedia](#)... Wikipedia content provided under the terms of the [Creative Commons BY-SA license](#)

Releases

Previous **1** 2 3 4 5 ... 12 Next

| Release | Artist | Format | Tracks | Country/Date | Catalog# | Barcode |
|--------------------------|--------------------|--------------|----------|--------------|----------|---------|
| <input type="checkbox"/> | Arauco / Calmanera | Robert Wyatt | 7" Vinyl | 2 FR 1980 | 100 112 | |

External links: Official website, @RoughTrade, Discogs, roughtrade, roughtra

ListenBrainz Recent Data Reports About • Sign in

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Listen Reports Charts Playlists Recommendations Collaborations Report User

See profile on MusicBrainz

Recent listens (126096 total)

- Inside Out (Roy's Rad Nomad Mix) Phuture *Playing now*
- Inside Out (Roy's Rad Nomad Mix) Phuture 4 minutes ago
- Figure This Shit Out (Shit and Shine) 07 Jul, 6:18 pm
- Time (Beats & Pieces Big Band) 07 Jul, 6:10 pm

MusicBrainz:
metadata

ListenBrainz:
listen history

Last.fm:
tags
listen history

Jeffrey Lewis

Overview Tracks Albums Photos Similar Artists Events Biography Tags More...

Tags

anti-folk singer-songwriter lo-fi indie

Including Regina Spektor, Kimya Dawson and The Mosby Peaches

Including Bob Dylan, Tom Waits and Elliott Smith

Including Neutral Milk Hotel, Pavement and Bon Iver

Including Arctic Monkeys, Radiohead and The Killers

Similar Artists

- Kimya Dawson 146,722 listeners
- Paul Barbeau 104,850 listeners
- AJJ 138,833 listeners

Show more

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Get Audio Features for a Track

Get audio feature information for a single track identified by its unique Spotify ID.

Request

| HEADER | TYPE | REQUIRED |
|---------------|--------|----------|
| Authorization | String | Required |

A valid access token from the Spotify Accounts service: see the [Web API Authorization Guide](#) for details.

| PATH PARAMETER | TYPE | REQUIRED |
|----------------|--------|----------|
| {id} | String | Required |

The Spotify ID for the track.

Response

```
GET https://api.spotify.com/v1/audio-features/{id}

1 // json response
2
3 {
4   "danceability": 0.735,
5   "energy": 0.578,
6   "key": 5,
7   "loudness": -11.84,
8   "mode": 0,
9   "speechiness": 0.0461,
10  "acousticness": 0.514,
11  "instrumentalness": 0.0902,
12  "liveness": 0.159,
13  "valence": 0.624,
14  "tempo": 98.002,
15  "type": "audio_features",
16  "id": "06AKEBrKucKw0KREUrnVt",
17  "uri": "spotify:track:06AKEBrKucKw0KREUrnVt",
18  "track_href": "https://api.spotify.com/v1/tracks/06AKEBrKucKw0KREUrnVt"
19 }
```

Spotify:
acoustic analysis,
playlists,
listen history

...and many more...

Demo: listening history

```
cpe -v 3 lastfm-history --user ssam scrobbles | head -n 5
```

Last 5 tracks I listened to.

```
cpe lastfm-history artists --first-play-since='6 months ago' \  
--min-listens 10
```

Artists I discovered in the last 6 months.

See more examples at: <https://calliope-music.readthedocs.io/en/latest/examples/>

Demo: 'forgotten songs' playlist

```
cpe lastfm-history tracks --last-play-before='1 year ago' \  
    --min-listens=5 | \  
    cpe shuffle - --count 20
```

Now select 30 minutes worth of music:

```
cpe tracker resolve-content - | cpe select \  
    --constraint=type:playlist-duration,vmin:30m,vmax:30m - | \  
    cpe export --format=m3u -
```

See more examples at: <https://calliope-music.readthedocs.io/en/latest/examples/>

Constraint-based local search

Music playlist generation by adapted simulated annealing

Steffen Pauws, Wim Verhaegh, Mark Vossen¹

Philips Research, Prof. Holstlaan 4, 5656 AA Eindhoven, The Netherlands

Abstract

We present the design of an algorithm for use in an interactive music system that automatically generates music playlists that fit the music preferences of a user. To this end, we introduce a formal model, define the problem of automatic playlist gen-

February 2008 Information Sciences 178(3):647-662

https://www.researchgate.net/publication/223327847_Music_playlist_generation_by_adapted_simulated_annealing

Constraint-based local search

Table 4. Constraint set ‘typical’.

| <i>description</i> | <i>constraint</i> |
|---------------------------|---|
| All different songs | pairs-global($1, n_{\max}, 1, d(v) = \{x \mid x \neq v\}$) |
| Release in 1980-2001 | each-global($1, n_{\max}, 7, [1980, 2001]$) |
| $\geq 20\%$ Stevie Wonder | fraction-global($1, n_{\max}, 3, \{\text{Stevie Wonder}\}, .2, 1$) |
| $\geq 10\%$ Seal | fraction-global($1, n_{\max}, 3, \{\text{Seal}\}, .1, 1$) |
| $\geq 10\%$ Peter Gabriel | fraction-global($1, n_{\max}, 3, \{\text{Peter Gabriel}\}, .1, 1$) |
| $\geq 10\%$ Janet Jackson | fraction-global($1, n_{\max}, 3, \{\text{Janet Jackson}\}, .1, 1$) |
| $\geq 10\%$ Mariah Carey | fraction-global($1, n_{\max}, 3, \{\text{Mariah Carey}\}, .1, 1$) |
| $\geq 20\%$ Phil Collins | fraction-global($1, n_{\max}, 3, \{\text{Phil Collins}\}, .2, 1$) |
| $\geq 40\%$ R&B | fraction-global($1, n_{\max}, 5, \{\text{R\&B}\}, .4, 1$) |
| $\geq 40\%$ Popular | fraction-global($1, n_{\max}, 5, \{\text{Popular}\}, .4, 1$) |
| 2-3 different genres | cardinality-global($1, n_{\max}, 5, 2, 3$) |
| Different succ. genres | chain-global($1, n_{\max}, 5, d(v) = \{x \mid x \neq v\}$) |
| Similar succ. tempi | chain-global($1, n_{\max}, 8, d(v) = \{x \mid \text{sim}(x, v) \in [0, 0.1]\}$) |

```
cat tracks.cpe | cpe shuffle - | cpe select \  
  --constraint=type:playlist-duration,vmin:60m,vmax:120m \  
  --constraint=type:item-duration,vmin:0s,vmax:6m - > playlist.cpe
```

simpleai: <https://pypi.org/project/simpleai/>

GNOME Music Ideas



Listenbrainz integration

Link to music download sites

Automatic Musicbrainz tagging

Show artist info and links

Suggest 'artists you might like'

Generate recommendation playlists

The screenshot shows the GNOME Music application interface. The top navigation bar includes 'Albums', 'Artists', 'Songs', and 'Playlists'. The left sidebar lists various playlist categories: 'Favorite Songs', 'Most Played', 'Never Played', 'Recently Added', 'Recently Played', and 'Test' (which is highlighted in blue). The main content area displays a playlist titled 'Test' containing 15 songs. Each song entry includes a three-dot menu icon, the song title, the artist name, the album name, and the duration, with a star icon for favoriting.

| Menu | Song Title | Artist | Album | Duration | Favorites |
|------|--------------------------------|---------------------------|-----------------------|----------|-----------|
| ⋮ | Waiting At The Gate | Love Grocer | Fresh Produce | 4:47 | ☆ |
| ⋮ | Politicians In My Eyes | Death | For The Whole WorL... | 5:52 | ☆ |
| ⋮ | Waiting At The Gate | Love Grocer | Fresh Produce | 4:47 | ☆ |
| ⋮ | Liliana Felipe - Fallamos c... | Unknown Artist | Unknown album | 2:10 | ☆ |
| ⋮ | Waiting At The Gate | Love Grocer | Fresh Produce | 4:47 | ☆ |
| ⋮ | Focus - Hocus Pocus Live | Unknown Artist | Unknown album | 4:37 | ☆ |
| ⋮ | Trans-Universal Express | Tom Furse | PZYK Vol. 2 | 2:52 | ☆ |
| ⋮ | Sleeve | The Rubber Duck Orchestra | Jack Tombs's Album | 4:30 | ☆ |
| ⋮ | Shrimp | Mr. Scruff | Trouser Jazz | 7:01 | ☆ |
| ⋮ | She Likes to Smile | RokkaTone | In This Life | 5:10 | ☆ |

Summary



- Recommenders are here to stay.
- **Calliope** lets you build lo-fi music recommendations... and more.

<https://calliope-music.readthedocs.io/>

<https://gitlab.com/samthursfield/calliope/>

```
pip install calliope-music
```

- Same design can work for developing other recommenders:
videos, web history, suggested apps, local files...

Thanks for watching!