

Labeling a large music catalog

Université d'Angers
September 25th 2023

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Deezer Research



<https://research.deezer.com/>

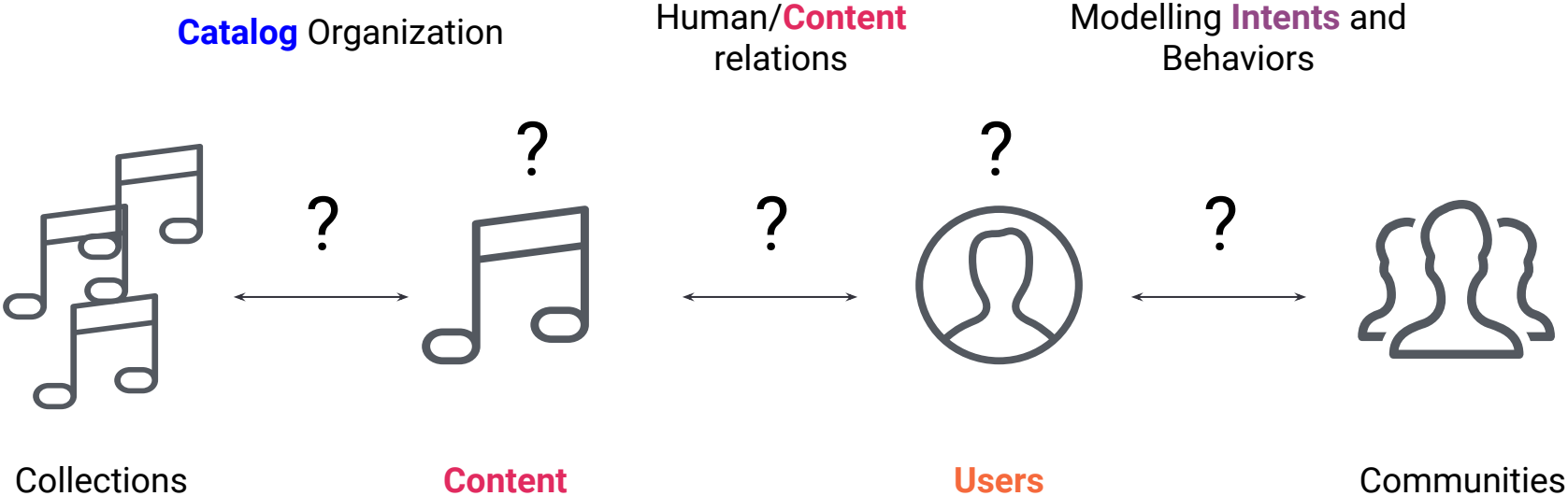


Deezer Research fields

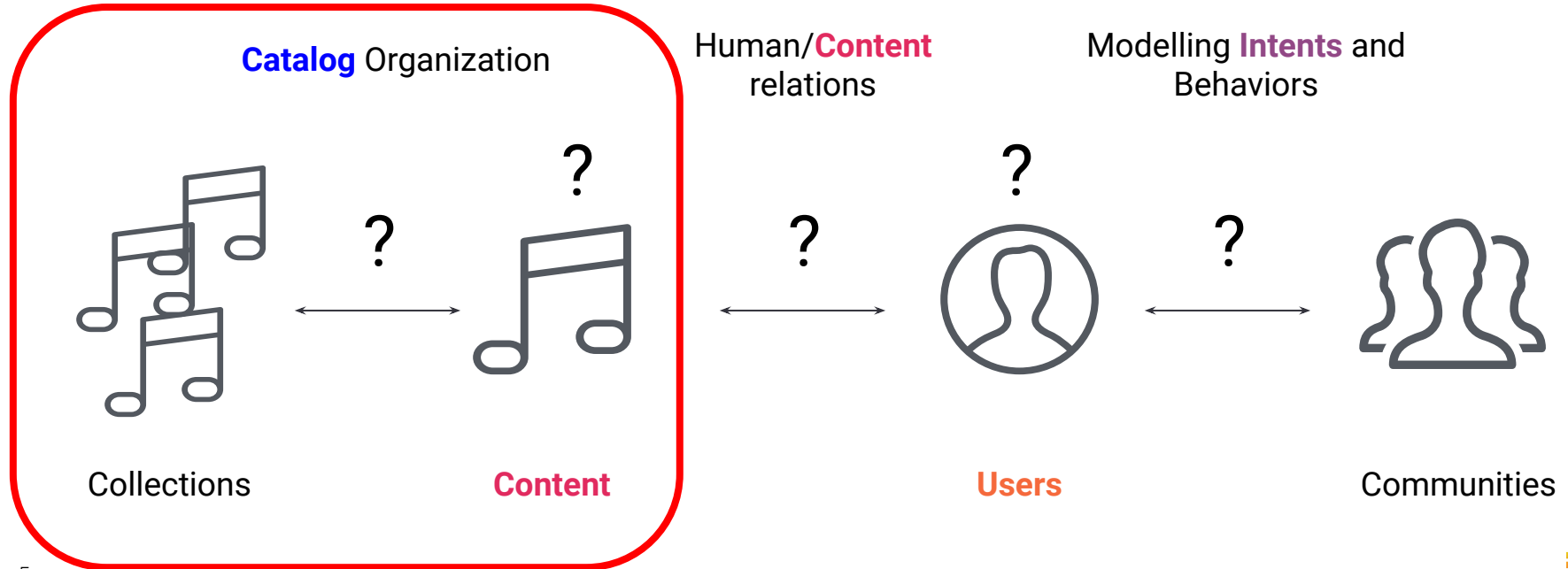
- Music Information Retrieval
- Audio Signal Processing
- Natural Language Processing
- Recommender Systems
- User Modeling
- Human/Machine Interaction
- Graph Mining
- Explainability in Machine Learning
- ...



Deezer Research topics



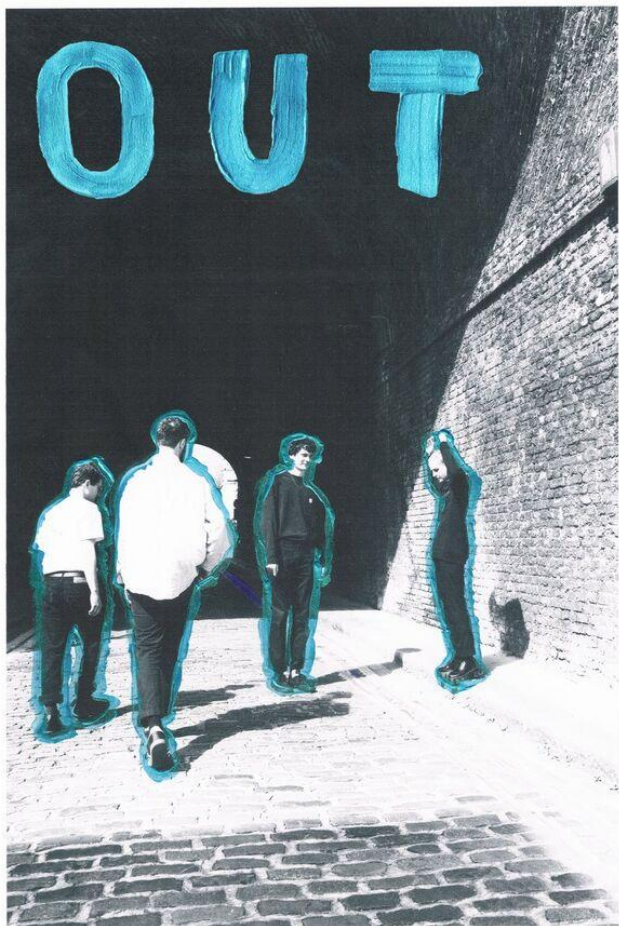
Talk's focus : content description



This talk's focus

- Not that much about labeling automation (not much ML from audio...).
- But rather about what is **music labeling** and the issues it raises.
- In particular **ambiguities** that come with music labeling.





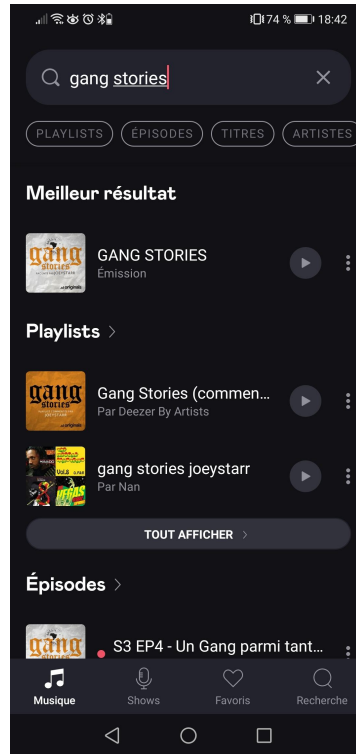
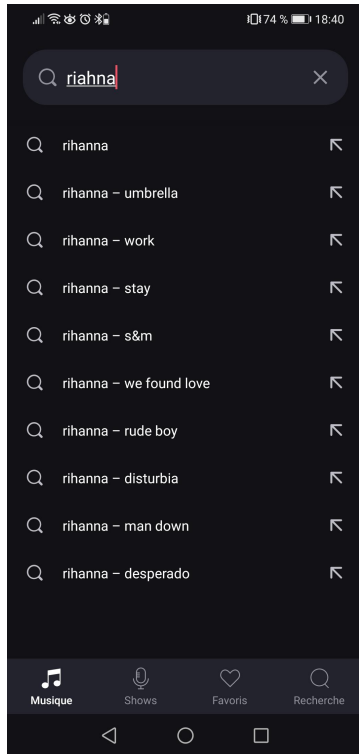
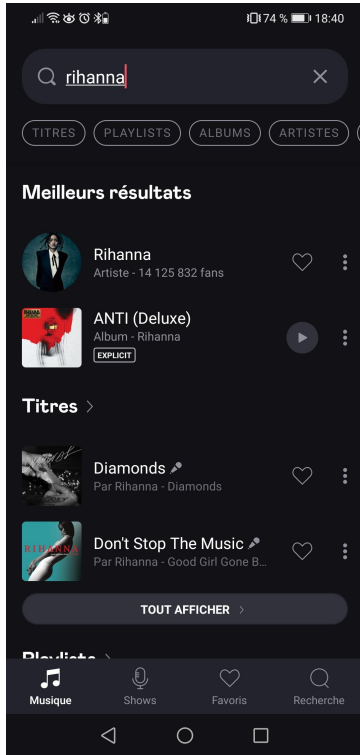
LINESES

- A bit about music streaming
- Troubles with artists
- Ambiguities in music tagging

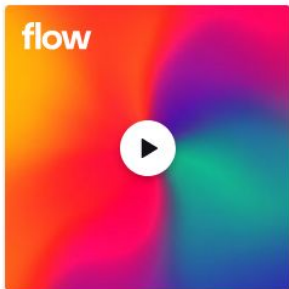
Music Labeling on music streaming platforms



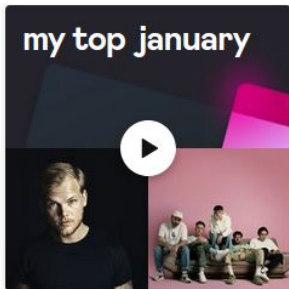
MSP features : access



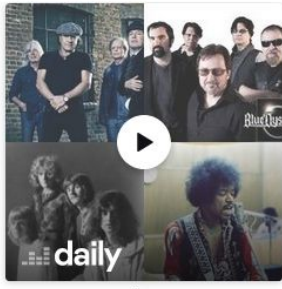
MSP features : recommendation



An infinite mix of favourites and new tracks



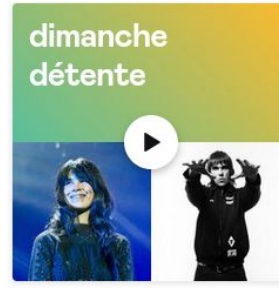
Featuring Avicii, Easy Life, 2 Chainz, Julien Baker



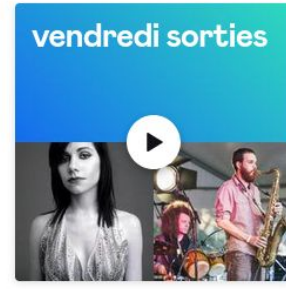
Avec AC/DC, Blue Öyster Cult, Led Zeppelin, Jimi Hendrix



Avec Orla Gartland, Mansionair, Lola Marsh, Lea Porcelain



Avec Maria Mena, Ian Brown, KALEO, Tom Odell



Avec PJ Harvey, Polar Bear, Zella Day, thys

MSP features : editorialized recommendation

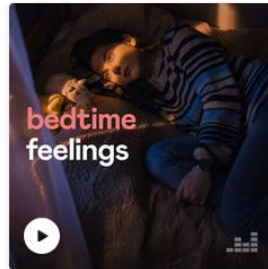
Playlists pour vous



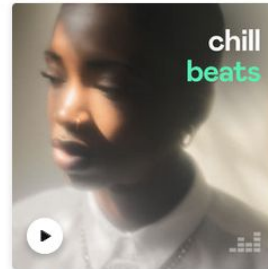
Indietronica
50 titres - 3 352 fans



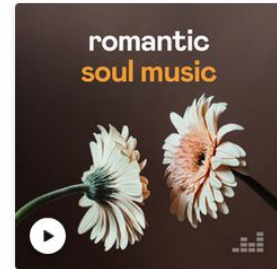
Young & Free
50 titres - 72 043 fans



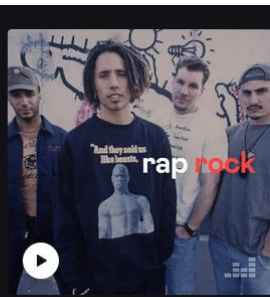
Bedtime Feelings
40 titres - 3 090 fans



Chill Beats
50 titres - 46 293 fans



Romantic Soul Music
50 titres - 104 166 fans



“Labeling” music

Interested in **describing** music in multiple dimensions:

- **Who** made the music?
- What **musical genre** is it?
- What **instruments** are played?
- What kind of **mood** does it carry?
- In what kind of **context** could it be listened to?
- What are the **lyrics**?
- What is **mainstream** or not?
- ...



“Labeling” music

What can we use?



Metadata from providers



Deezer editors



Music press / social media



External **databases**



Content with ML



A large music catalog

Deezer:

- **90 million** tracks (whatever it means)
- **Tens of thousands** of tracks delivered every day



A large music catalog

Deezer:

- **90 million** tracks (whatever it means)
- **Tens of thousands** of tracks delivered every day

Automation needed!



The Root of All Evil



Audio

Images
Metadata



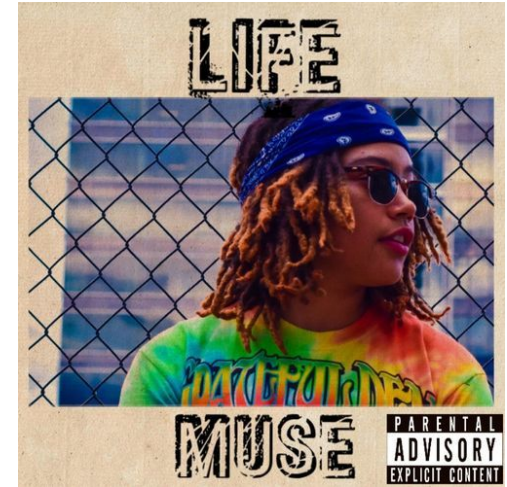
```
<DisplayArtist>
  <PartyName><FullName>Muse</FullName></PartyName>
  <ArtistRole>MainArtist</ArtistRole>
</DisplayArtist>

<Genre>
  <GenreText>Alternative</GenreText>
</Genre>

<OriginalReleaseDate>1991-09-28</OriginalReleaseDate>
```



Artist Ambiguities

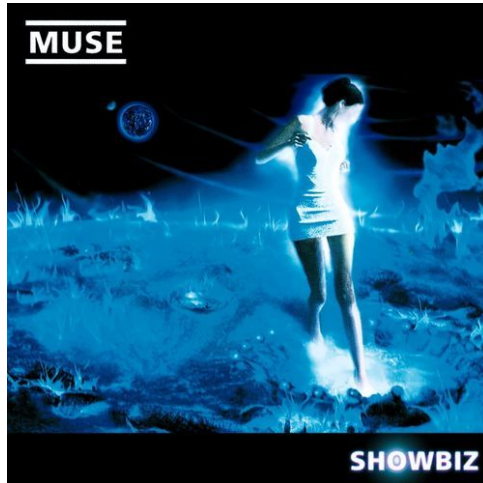


The Root of All Evil



Audio

Images
Metadata



```
<DisplayArtist>  
  <PartyName><FullName>Muse</FullName></PartyName>  
  <ArtistRole>MainArtist</ArtistRole>  
</DisplayArtist>  
  
<Genre>  
  <GenreText>Alternative</GenreText>  
</Genre>  
  
<OriginalReleaseDate>1991-09-28</OriginalReleaseDate>
```



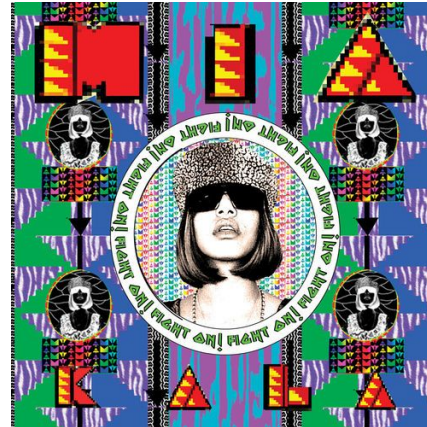
Music Genre Ambiguities



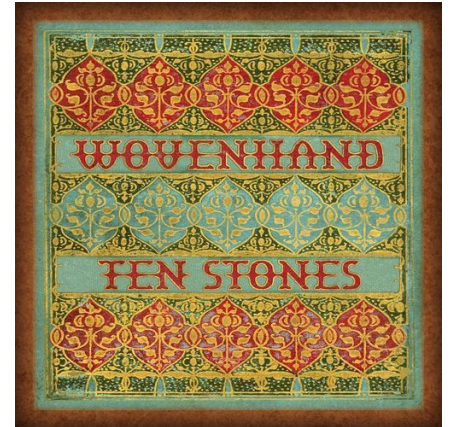
Alternative **Rock**



Alternative **Metal**



Alternative **Hip/Hop**



Alternative **Country**



Artist ambiguities



Artists

- Artists: singer, instrumentalist, band, composer, producer...
- There exists a standard universal identifier for creators (**ISNI**)...
- ...But **rarely provided**.
- Only available identifier: **artist name**.

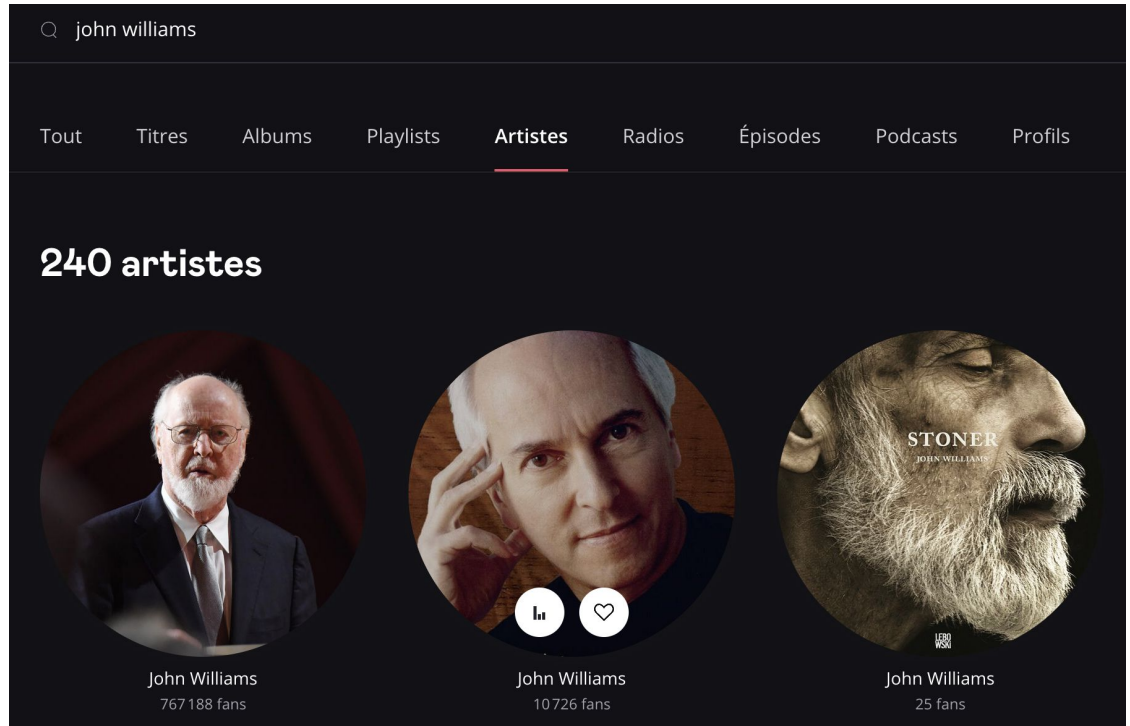


Artists

Q john williams

Tout Titres Albums Playlists **Artistes** Radios Épisodes Podcasts Profils

240 artistes



The screenshot shows a search interface for 'john williams'. Below the search bar, there are navigation tabs: 'Tout', 'Titres', 'Albums', 'Playlists', 'Artistes' (which is highlighted with a red underline), 'Radios', 'Épisodes', 'Podcasts', and 'Profils'. Below the tabs, it says '240 artistes'. Three artist profiles are displayed in circular frames. Each profile has a name 'John Williams' and a fan count. The first profile shows a man with a beard and glasses, with 767,188 fans. The second profile shows a man with a shaved head, with 10,726 fans. The third profile shows a man with a long beard and the word 'STONER' overlaid, with 25 fans. Each profile also has a small icon for a list and a heart.

Artist Profile	Name	Fans
Profile 1 (Beard and Glasses)	John Williams	767 188 fans
Profile 2 (Shaved Head)	John Williams	10 726 fans
Profile 3 (Long Beard, Stoner)	John Williams	25 fans

Issues:

- Different artists may have the **same name**



Artists

Issues:

- Different artists may have the **same name**
- An artist may have **several names**



[More Images](#)

David Bowie

Real Name: David Robert Jones

Profile: British pop/rock singer, musician, songwriter, and actor.

Born: 8 January 1947 in Brixton, London, England, UK.

Died: 10 January 2016 in Manhattan, New York City, USA (aged 69).

Bowie is recognized as one of the most respected contemporary musicians of his period. He was a [More](#) ▾

Sites: [davidbowie.com](#), [davidbowiecatalogue.com](#), [Facebook](#), [instagram.com](#), [Last.fm](#), [SoundCloud](#), [Twitter](#), [Wikipedia](#), [YouTube](#), [YouTube](#), [biography.com](#), [bowieontape.com](#), [bowiesongs.wordpress.com](#), [bowiewonderworld.com](#), [crackedactor.com](#), [davidbowienews.com](#), [geni.com](#), [illustrated-db-discography.nl](#), [imdb.com](#), [britannica.com](#), [musicianbio.org](#), [musicanguide.com](#), [songhall.org](#)

Aliases: [Davey Dream](#), [David Robert Jones](#), [The Actor \(2\)](#), [The Rebels \(12\)](#), [Ziggy \(32\)](#)

Variations: [Viewing All](#) | [David Bowie](#)

[Boh Oui](#), [Bowie](#), [Bowie '74](#), [Bowie D.](#), [Bowie David](#), [Bowie!](#), [Bowie](#), [David](#), [Bowre](#), [D .Bowie](#), [D Bowie](#), [D. Bowie](#), [D.Bowie](#), [DB](#), [DBowie](#), [Dave Bowie](#), [David](#), [David B.](#), [David Boh Oui](#), [David Boowie](#), [David Bowie](#), [David Bow-ie](#), [David Bower](#), [David Bowie '83](#), [David Bpwie](#), [David Dowie](#), [DavidBowie](#), [Dawid Bowie](#), [Mister Bowie](#), [Mr Dave Bowie](#), [Mr. David Bowie](#), [bowie](#), [db](#), [Д. Боуи](#), [Дейвид Боуи](#), [Дејвид Боуви](#), [Дэвид Боуи](#), [デビッドボウイ](#), [デビッド・ボウイ](#), [デビッド・ボウイ](#), [デビッド・ボウイー](#), [デヴィッド・ボウイ](#), [デヴェッド・ボウイ](#), [デヴット・ボウーイ](#), [大衛鮑伊](#), [대](#)
[More](#) ▾

Discogs page for David Bowie



Artist disambiguation

Metric learning from **audio**:

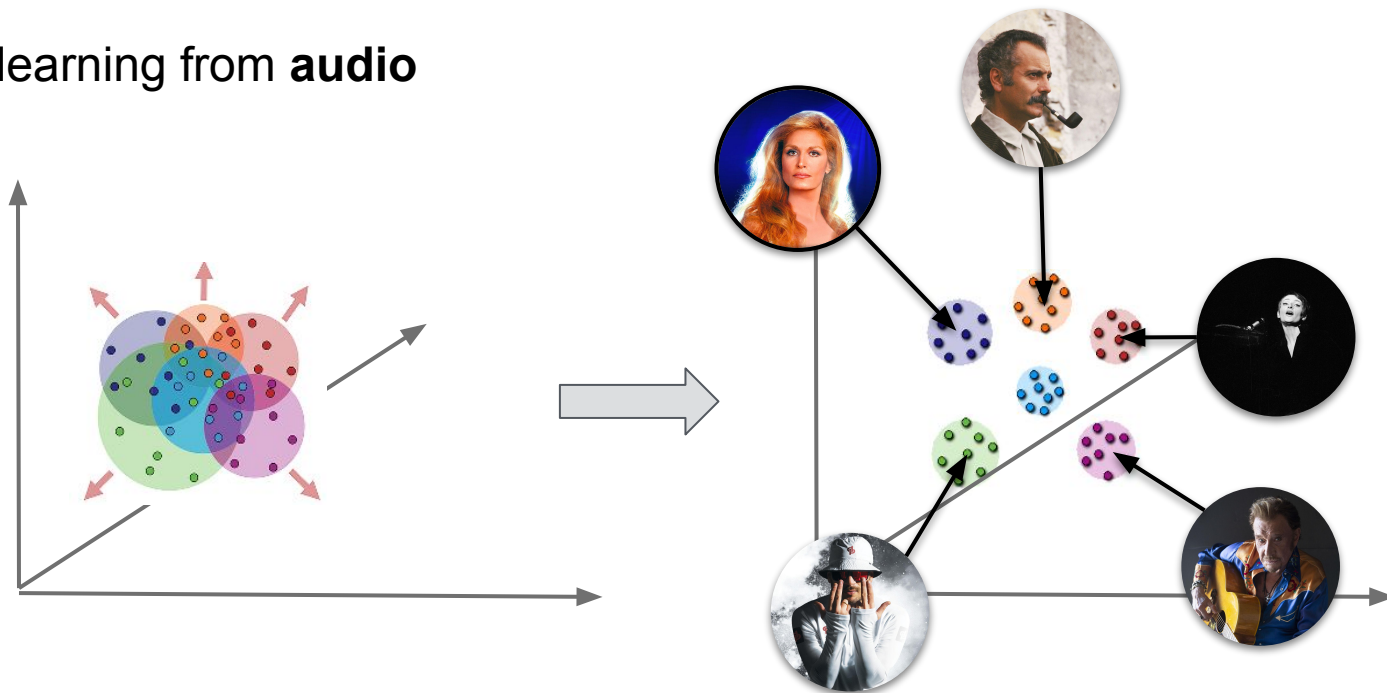
- Learn a representational function f that maps audio excerpts to a low dimension space.
- Minimize a **contrastive loss** (e.g. triplet loss) where positive are excerpts by the same artist and negative excerpts by a different artist.
$$\mathcal{L}(\mathcal{X}) = \left| \left\| f(x) - f(x^+) \right\|_2^2 - \left\| f(x) - f(x^-) \right\|_2^2 + \alpha \right|_+$$

- Hope that **clusters** corresponding to artists appear.



Artist disambiguation

Metric learning from **audio**



Artist disambiguation

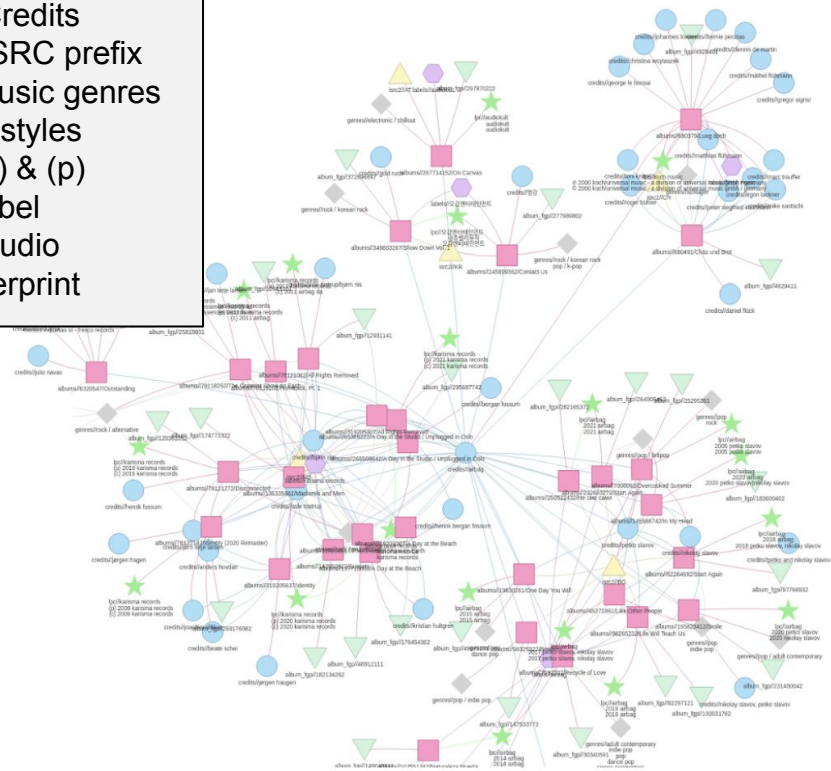
Ambiguity detection from large feature set:

- labels info
- albums popularity/listening behaviors
- albums global infos: nb tracks, songs duration, titles
- languages, release dates, ...
- genres
- album covers (band logos)
- audio
-

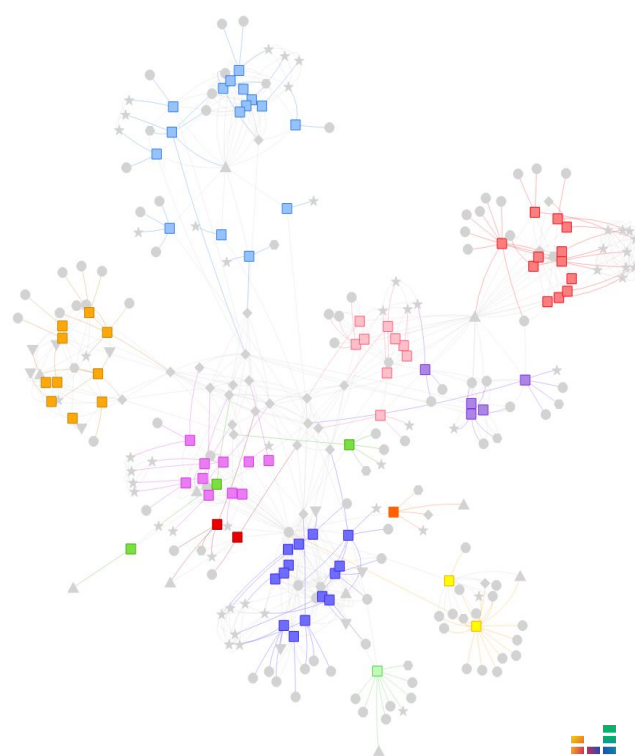


Artist disambiguation

- Albums
- Credits
- △ ISRC prefix
- Music genres and styles
- ☆(c) & (p)
- label
- ▽ Audio fingerprint



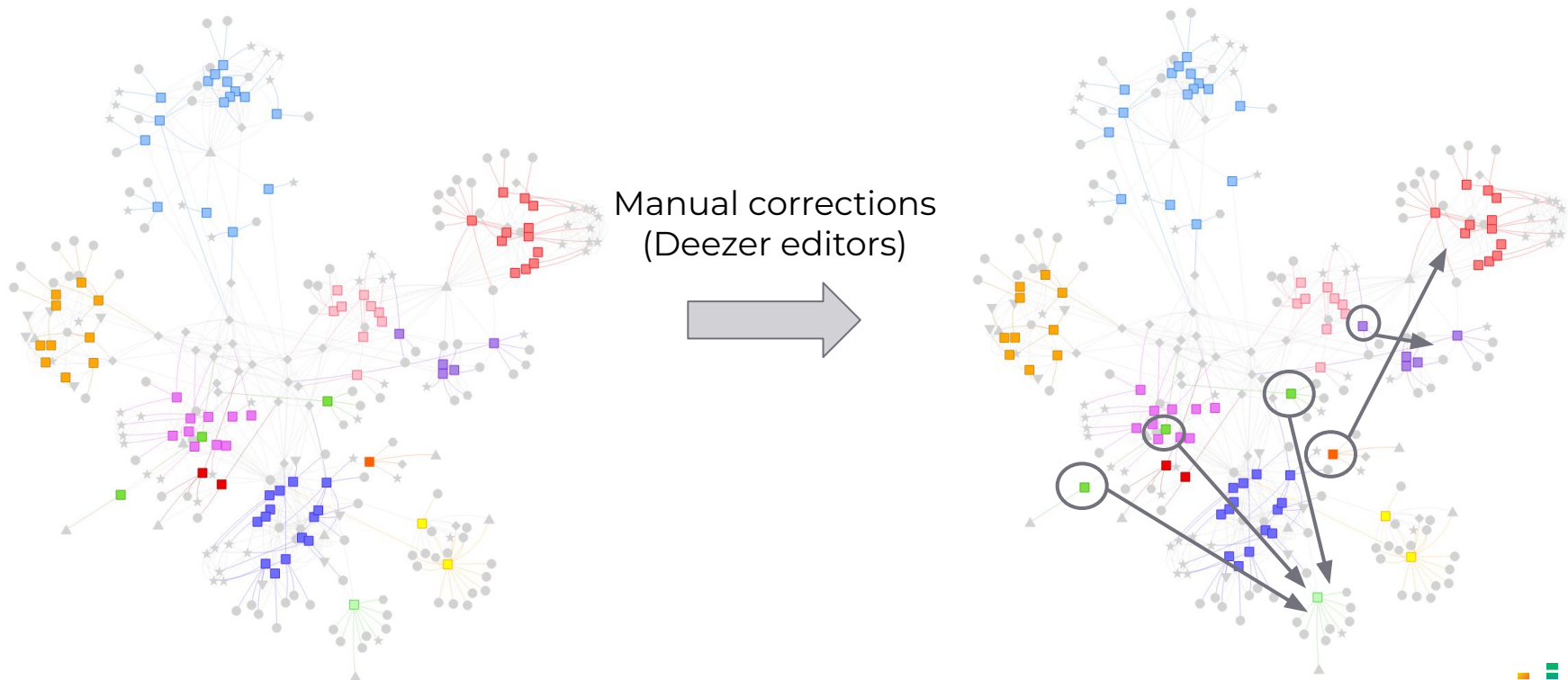
Community detection on albums



Graph of albums with the same artist name



Artist disambiguation



Artist disambiguation

Manual correction prioritization:

- **Most listened** artists are systematically checked.
- **Users reports** of problem about wrong artist association.



Tagging ambiguities



Binaural Beta 25 Hz

- Motivation, Alertness, Problem Solving

How can we describe music ?



From a 20th century sociologist perspective

Tableau 13 – Les principaux genres de musique

Sur 100 Français de 15 ans et plus

	Genres écoutés le plus souvent	Genre préféré
Chansons ou variétés françaises	44	31
Variétés internationales (disco, dance, techno, funk...)	22	13
Musique classique	18	10
Musiques du monde (reggae, salsa, musique africaine...)	11	5
Rock	10	5
Jazz	7	3

Source : Département des études et de la prospective, Ministère de la culture et de la communication

TABLEAU 1. – Genres musicaux écoutés le plus souvent (en pourcentage)

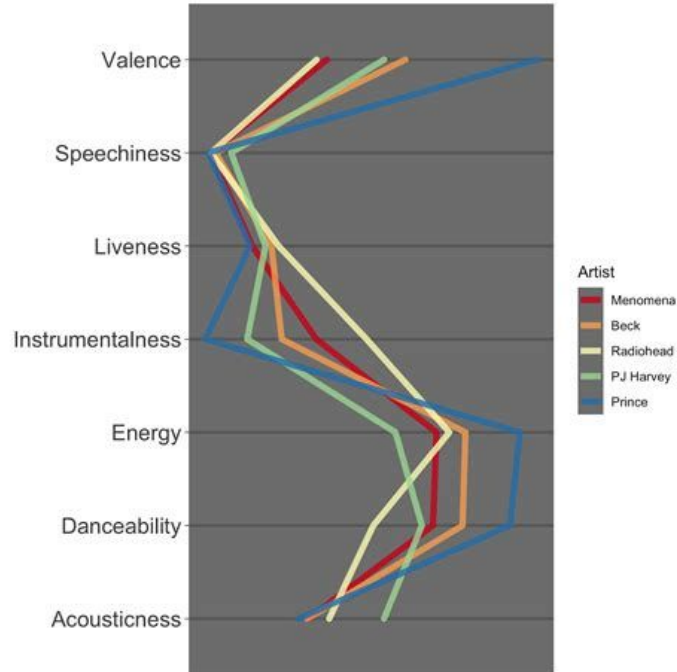
Variétés, chansons	47,0
Variétés internationales (disco, dance, techno, funk, etc.)	19,9
Musique classique (dont musique baroque)	18,6
Musiques du monde (reggae, salsa, musique africaine, etc.)	10,4
Rock	10,2
Musique d'ambiance ou musique pour danser (tango, valse)	7,3
Jazz	7,3
Musique folklorique ou traditionnelle	4,9
Opéra	3,8
Musique de film ou de comédie musicale	3,5
Opérette	3,5
Hard rock, punk, trash, heavy metal	2,4
Rap	2,2
Musique contemporaine	1,3
Chansons pour enfants	1,0
Musique militaire	0,9
Autres genres	1,5

Source : Enquête sur les pratiques culturelles des Français, 1997, DEP/Ministère de la Culture.
Lecture : 47 % des répondants cite les variétés et les chansons parmi les genres musicaux qu'ils écoutent le plus souvent. La question sur les genres musicaux écoutés le plus souvent admettant des réponses multiples, le total des taux de citation associés à chaque genre est, logiquement, supérieur à 100.

From an early 21st century computer scientist perspective

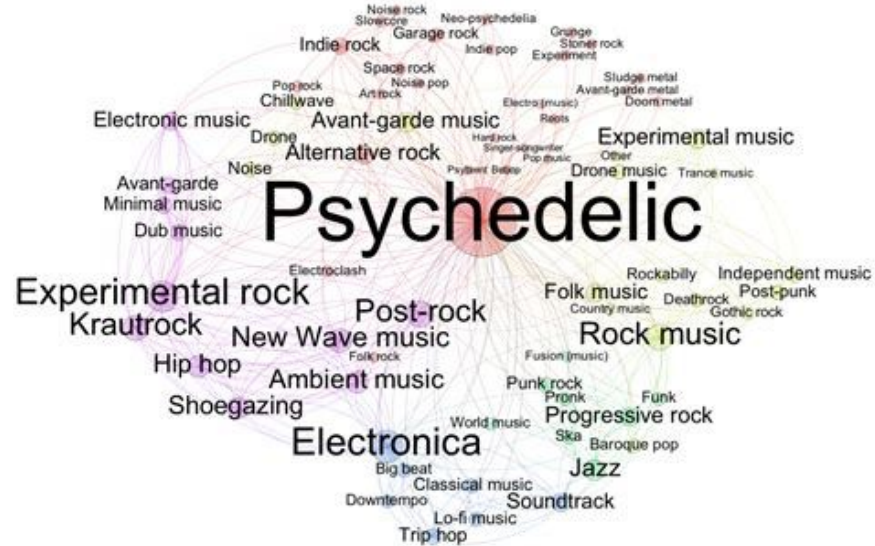


The Music Genome Project®



Mid-way perspective : Tagging

- **Folksonomies**: Open set of tags
Ex: Last.fm
- **Taxonomies** : Closed set, hierarchical tags (tree)
Ex: Discogs
- **Ontologies** : Closed set, linked concepts (graph)
Ex: Wikipedia



Booba

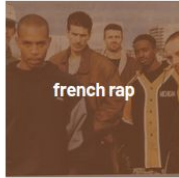
Overview Tracks Albums Photos Similar Artists Events Biography **Tags** Shouts Listeners

Tags

+ ADD TAGS



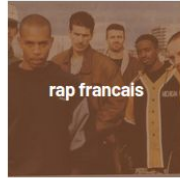
Including Eminem, Kanye West and Gorillaz



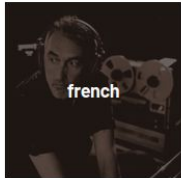
Including IAM, Kény Arkana and Booba



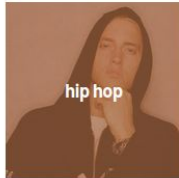
Including Eminem, Kanye West and Beastie Boys



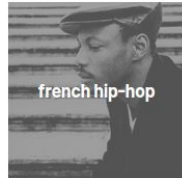
Including IAM, Suprême NTM and Oxmo Puccino



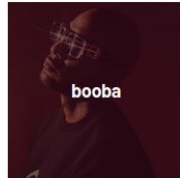
Including Yann Tiersen, Air and Justice



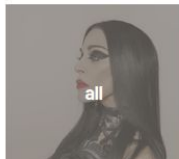
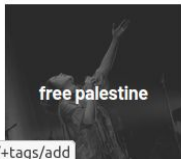
Including Eminem, Kanye West and Beastie Boys



Including MC Solaar, Fonky Family and IAM



Including Booba, Lunatic and La Fouine



Folksonomies

+ Large **quantity** of data and coverage

last.fm

Diam's

PLAY ARTIST

Listeners **80.8K** Scrobbles **906.1K**

LATEST RELEASE
cœur De Bombe - Single
15 January 2010

POPULAR THIS WEEK
La Boulette (Génération ...
311 listeners



Join others and track this artist

Scrobble, find and rediscover music with a Last.fm account

SIGN UP TO LAST.FM

Diam's (born July 25, 1980 in Cyprus) is a French-language rap artist. Her family moved to Paris in 1984. She appeared in a song on DJ Mehdi's album " (The Story Of) Espion". In 1998, when she was just 18 years old, Diam's signed a development deal with BMG Music Publishing France. With the publisher's help, Diam's worked on her... [read more](#)

Born 25 July 1980 (age 42)

Born In Nicosia, Lefkosia, Cyprus

rap hip-hop french **worst of 2010** **omg its a wig** + View all tags

From last.fm (Nov. 2022)

Folksonomies

- + Large **quantity** of data and coverage
- No control on the **quality**:
 - of the set of tags
 - of the annotation



Taxonomies

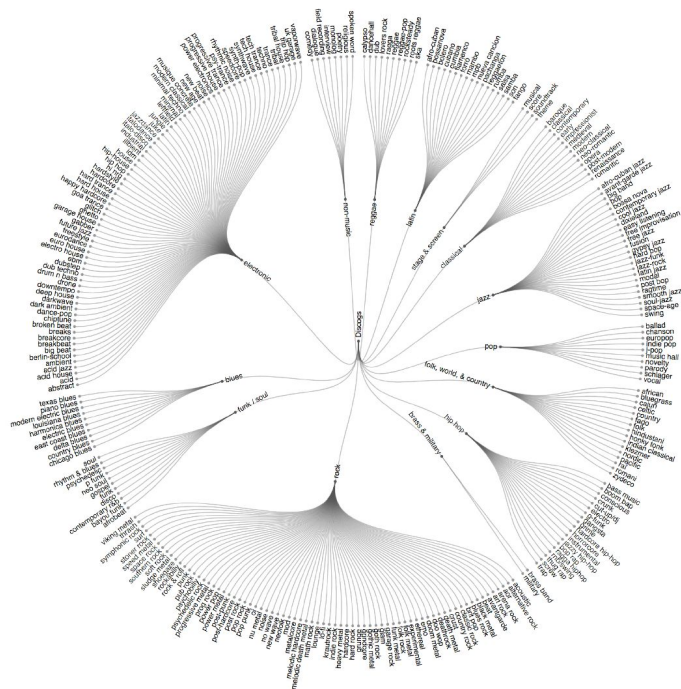


Figure 1: Discogs taxonomy

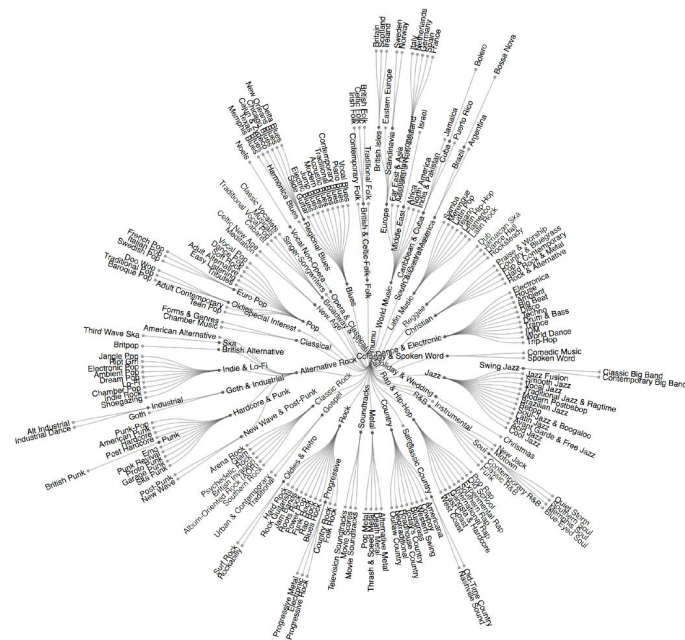


Figure 2: MuMu taxonomy



Taxonomies

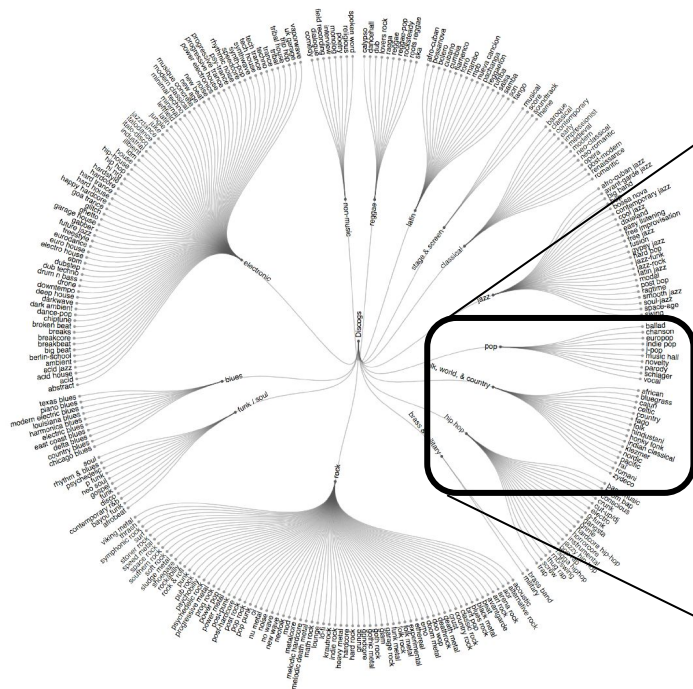


Figure 1: Discogs taxonomy

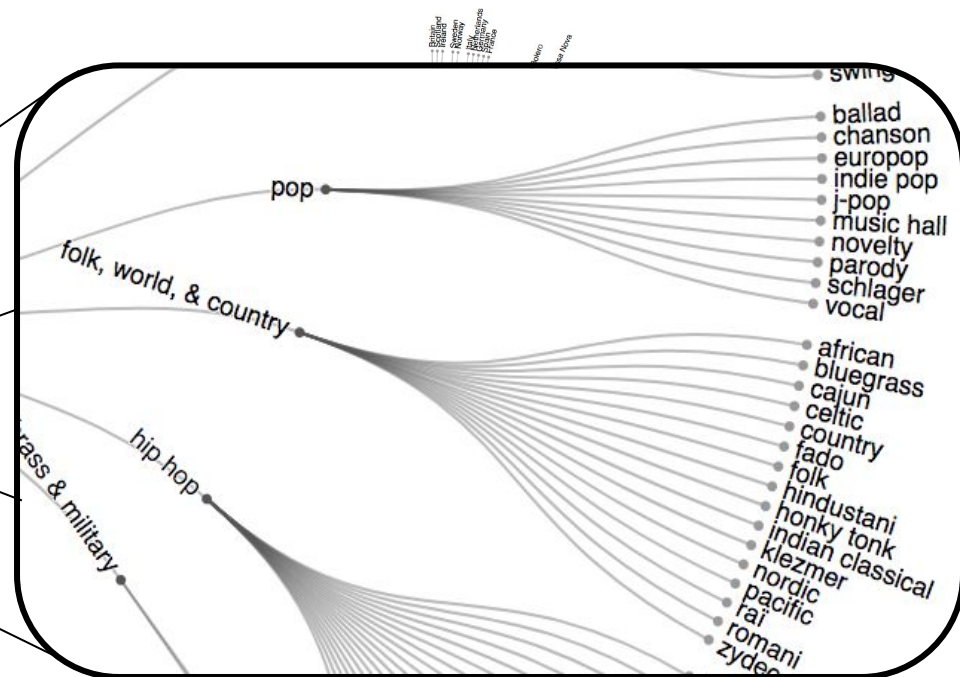
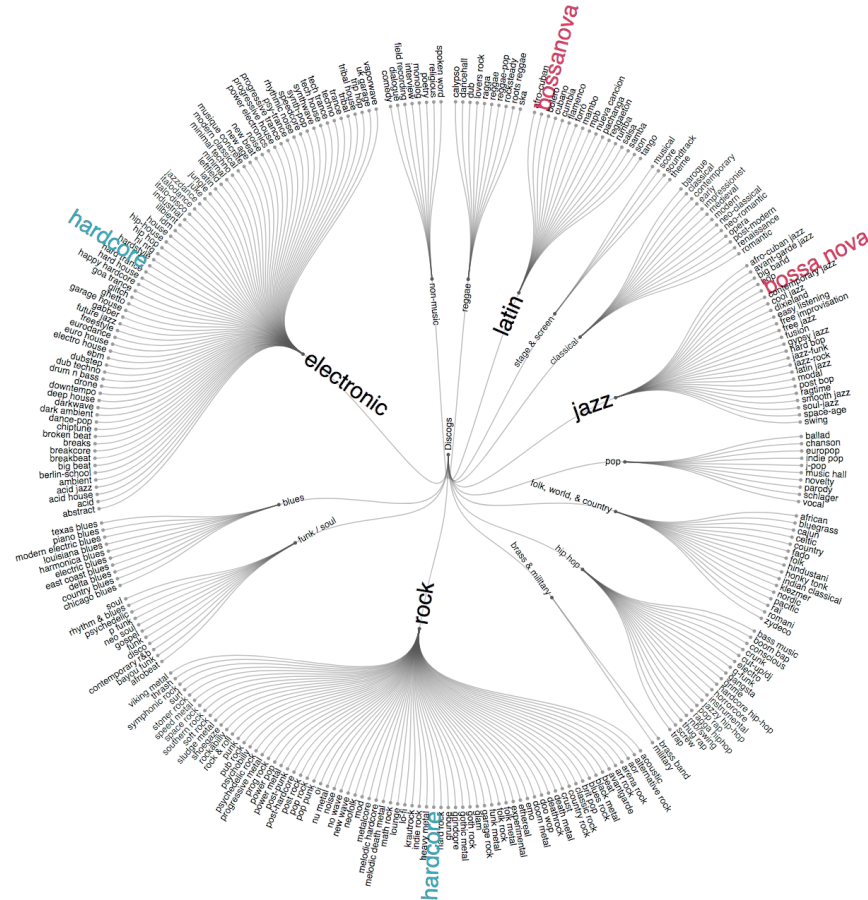


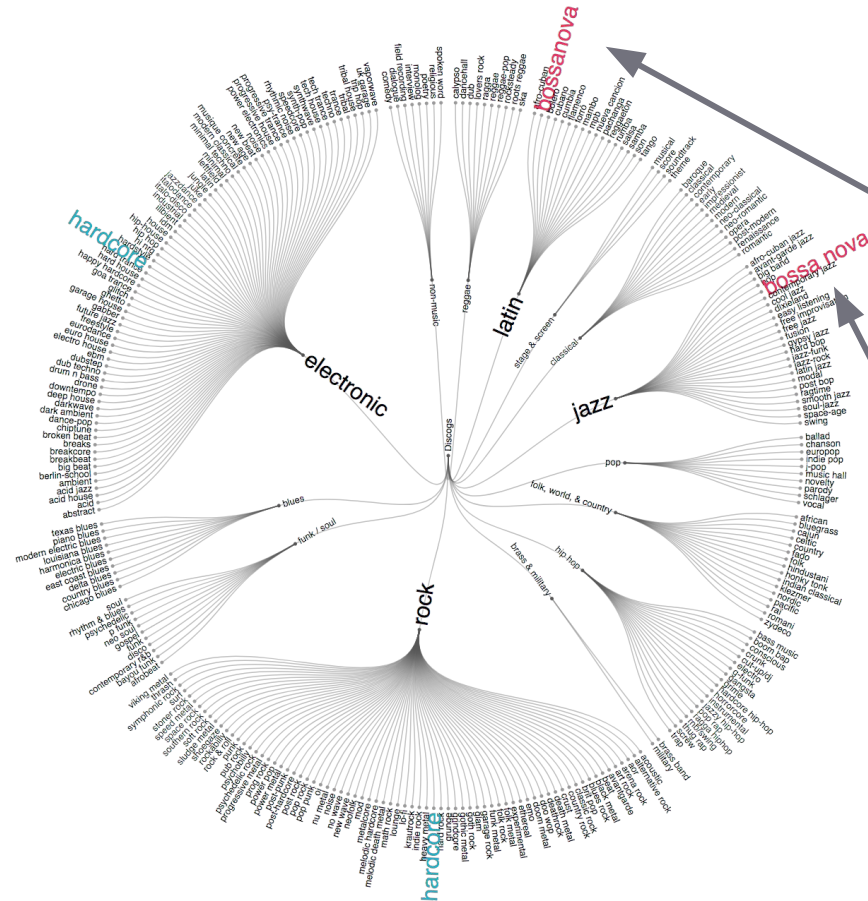
Figure 2: MuMu taxonomy



Within-taxonomy ambiguities



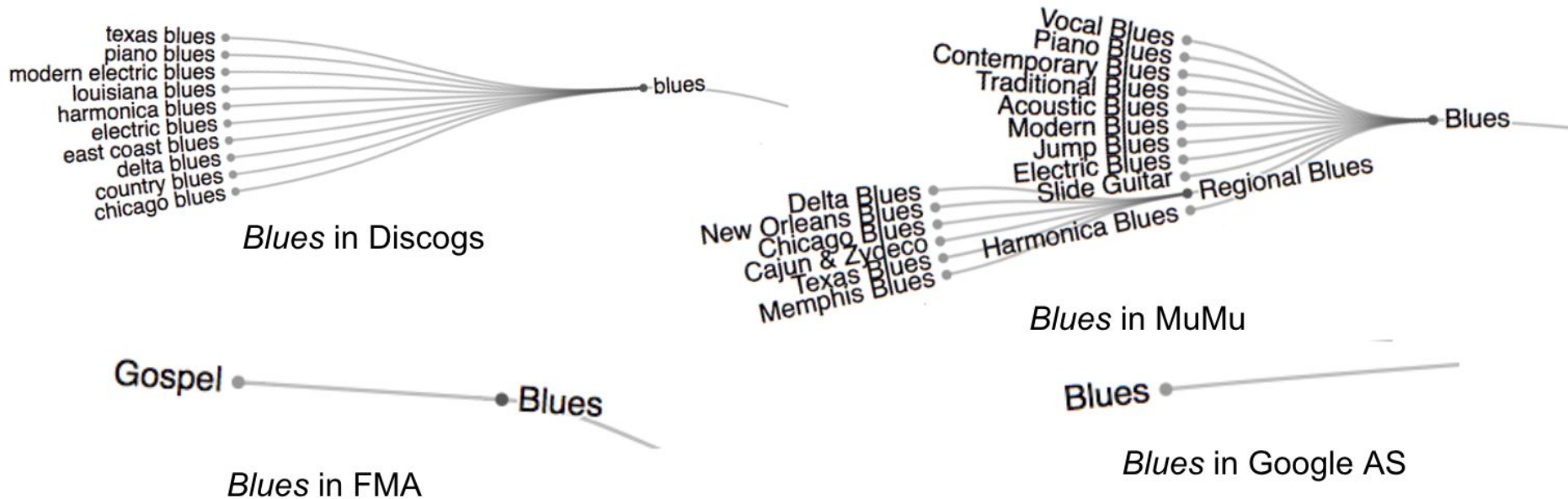
Within-taxonomy ambiguities



latin: bossanova
=
jazz: bossa nova



Between-taxonomy ambiguities



Cultural discrepancies



↔ **Brazil**
vs.
US ↔



We have a lot of different providers



WARNER MUSIC GROUP



SONY MUSIC



UNIVERSAL MUSIC GROUP

believe[®]



We have a LOT of different providers



WARNER MUSIC GROUP



SONY MUSIC



UNIVERSAL MUSIC GROUP

believe[®]



We have signed deals with over **700 providers** distributing **800 000 labels**



To sum up

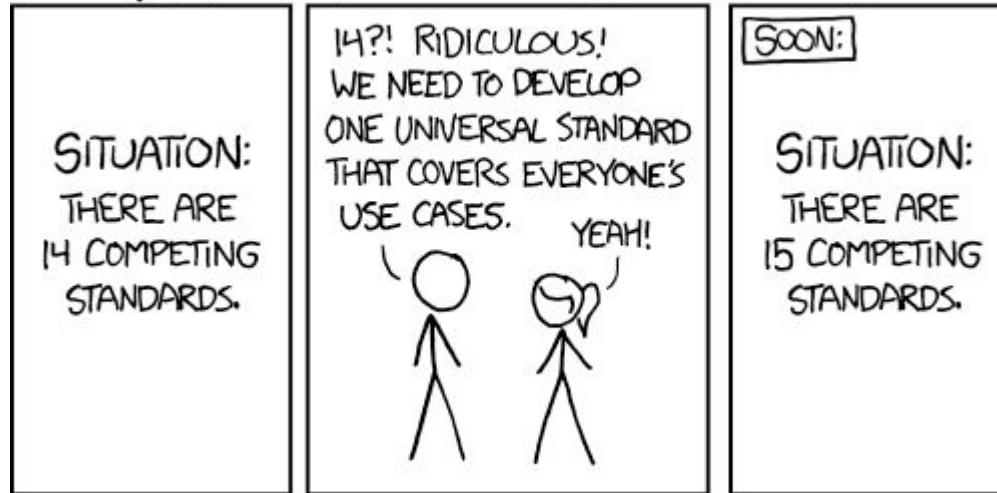
- Each provider / database has its **own taxonomy**
- **Link** between items (songs / artists) and genre tags can be ambiguous: depends on the own **understanding** of the annotator.



The situation

MUSIC TAXONOMIES

HOW ~~STANDARDS~~ PROLIFERATE:
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)



Choosing a lingua franca



- Open/Free
- Comes with **definitions**
- Can leverage ontology to perform **logical operations**
- Large coverage of musical **genres** and **languages**
- **Evolving** and **mutable**

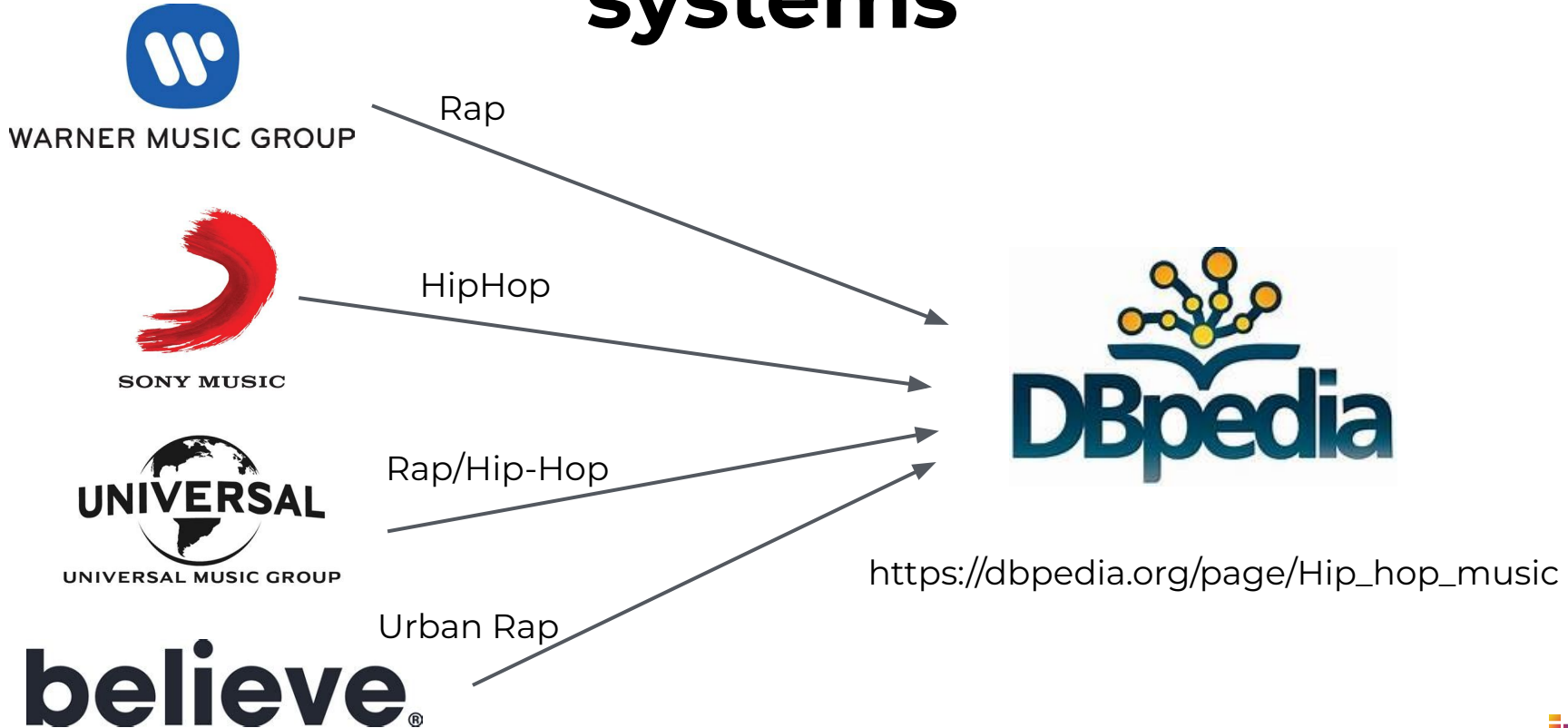
At deezer, genre **tags** are linked to **dbpedia urls**

Any **musical genre** that has a **definition** on dbpedia can be used

Simple, two-level taxonomy



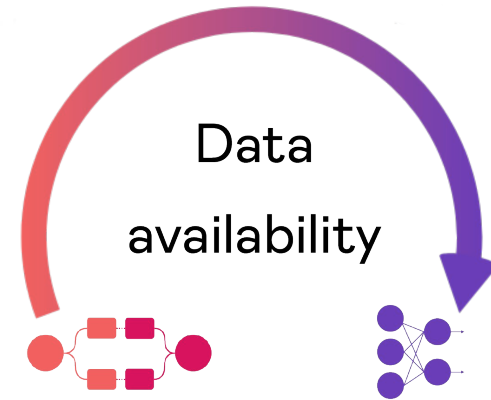
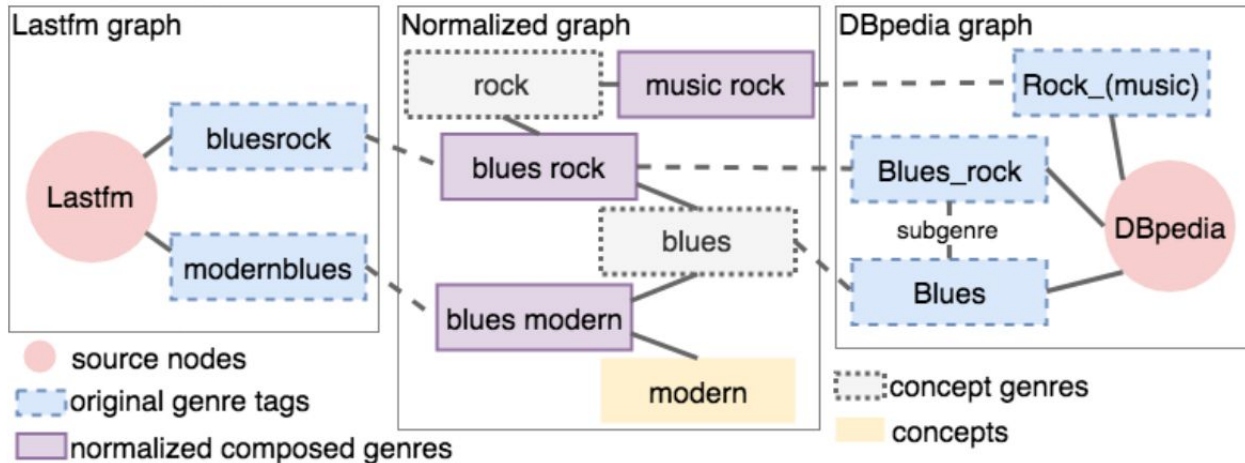
“Translating” between Tag systems



Music Genre Mapping across English-language Taxonomies

Leveraging:

- Knowledge graph
- Parallel annotations



Music Genre Mapping across Multilingual Taxonomies

Leveraging:

- **Knowledge graphs**
- **Distributional concept embeddings** (static, contextual)



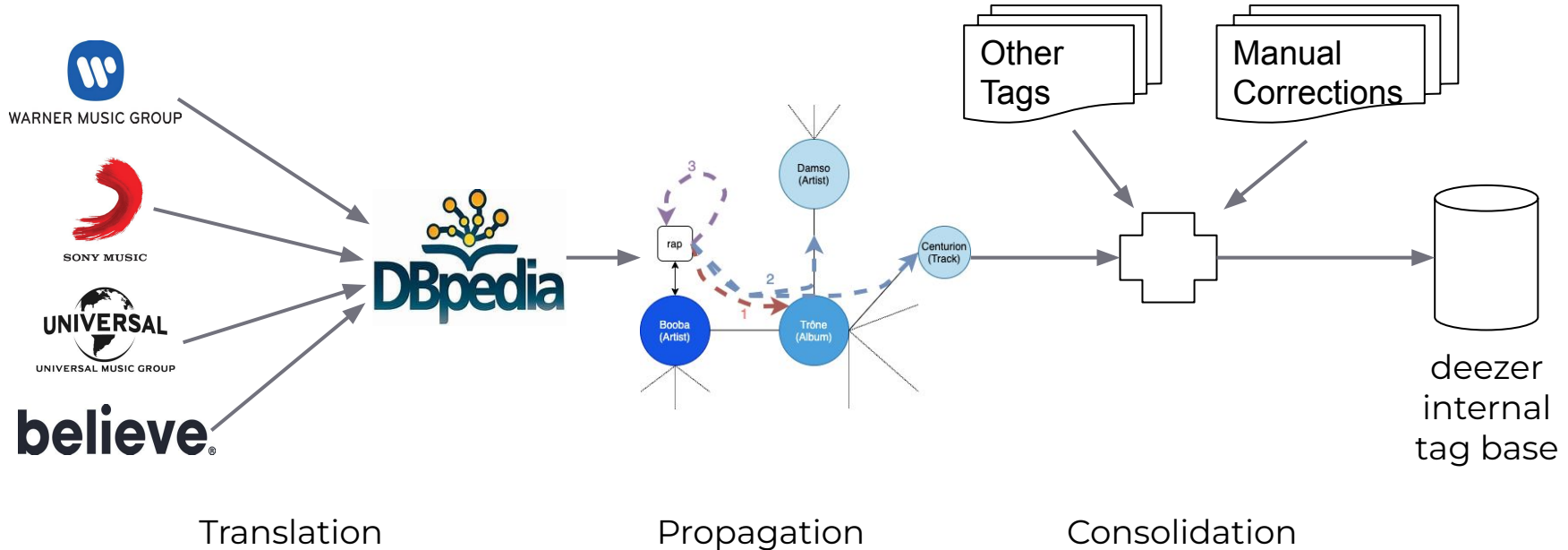
Musique électronique
Musique du monde



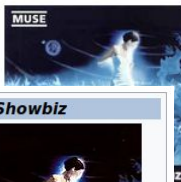
Música electrónica
Salsa



Whole tagging pipeline



Cross-Checking Information

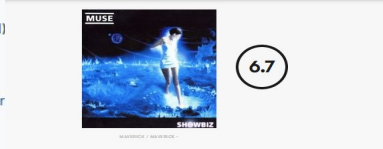
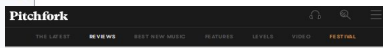


Muse – Showbiz

Genre: Rock
 Style: Alternative Rock, Prog Rock
 Année: 1999



Released 7 September 1999
Recorded April and May 1999
Studio RAK (London)
 Sawmills (Fowey, England)
Genre Alternative rock
Length 49:36
Label Mushroom • Taste • Maver
Producer John Leckie • Muse • Paul Reeve



by Brent DiCrescenzo
 Contributor
 • ROCK
 SEPTEMBER 24, 1999

The majority of young bands are unsure of what they truly want their band to be, aside from famous. This ...

The majority of young bands are unsure of what they truly want their band to be, aside from famous. This would explain the glittering rayon shirts, the frosted tips lacquered with D&B, and the I-stuck-my-chin-in-a-bowl-of-graphite-powder goatees. At least Muse also know they want to be Radiohead, which would explain the enlisting of producer John Leckie from *The Bends* and Matthew Bellamy's falsetto-laden yelps, which sound so much like Thom Yorke they could pass as Andy Yorke. It was inevitable after *OK Computer* that

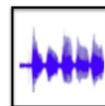


deezer
 Tags
 Mood
 Genres
 Instruments
 Language
 Dates

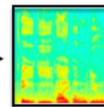
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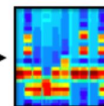
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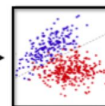
audio data



sparse transformation



audio descriptors



classification system

Showbiz

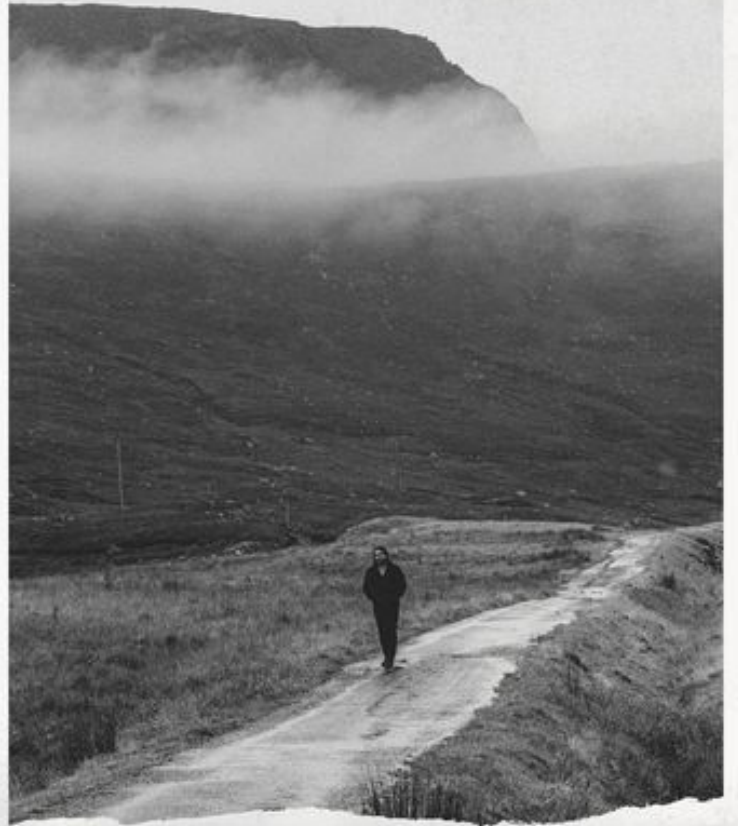
Muse

Controlling my feelings far too long
 Controlling my feelings far too long
 Controlling my feelings far too long
 Controlling my feelings far too long
 Forcing our darkest souls to unfold
 Forcing our darkest souls to unfold
 And pushing us into self destruction
 And pushing us into self destruction

They make me
 Make me dream your dreams
 They make me
 Make me scream your screams



Conclusion and Remaining Challenges



T H E L O N G R O A D

Take Home Message

- Even problems that looks simple may require **manual** annotations.
- Use **existing standards** as much as possible.
- Spot and try to mitigate **annotation ambiguities**.
- Have the same **labeling objectives** for every stakeholders (annotators, ML engineer/data scientists...)



Open issues

Evolving vocabulary: genres appear and/or change meaning. Taxonomy needs to be kept up-to-date.

Reception: music genre understanding is cultural and highly subjective. How do we handle discrepancies between our tags and various user perception?

Blindspots and Biases: data mostly available for western music. Hard to have clean data on uncommon / non western genres.

Getting rid of taxonomy limitations: description in natural language is emerging => needs data.



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AUDIO BASED DISAMBIGUATION OF MUSIC GENRE TAGS

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Modeling the Music Genre Perception across Language-Bound Cultures

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LEVERAGING KNOWLEDGE BASES AND PARALLEL ANNOTATIONS FOR MUSIC GENRE TRANSLATION

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Romain Hennequin
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Muzeeglot : annotation multilingue et multi-sources d'entités musicales à partir de représentations de genres musicaux

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Marion Baranes **Romain Hennequin**
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