

Let's Get it Started! ♪

Fostering the Discoverability of New Releases on Deezer

Léa Briand, Théo Bontempelli, Walid Bendada, Mathieu Morlon, François Rigaud,
Benjamin Chapus, Thomas Bouabça, and Guillaume Salha-Galvan



ECIR 2024 - Industry Day



DEEZER

DEEZER

Artists, tracks, podcasts...

Mixes inspired by...

- My Best Friend by Ty Segall
- Sacatela by La Femme
- Taxi by Angèle
- Motion Picture Soundtrack by Cigarettes After Sex
- ...baby one more time by The Marias
- La vie est belle by Checler
- Michelle by The Beatles
- Snow by Angus & Julia Stone
- Corner Of My Eye by The Lemon Twigs

Women who top the pop charts

View all

Women of Pop

Mixes

00:37 02:42

Michelle (Remastered 2009) by The Beatles

Home Explore Favourites Playlists Favourite tracks janvier 2024 by lb calmos 2024 by lb Guitare to be

10:01

Favorites

Favorite tracks

- Santé by Stromae
- Nocif by Hamza
- Σ. MOROSE by Damso

Playlists

LES TITRES DU MOMENT RADAR WEEKLY

Paint The Town Red by Doja Cat

Home Explore Favorites Search

147 376



147 376

The number of **new albums**
released **last week** on Deezer.



The swift integration and
discoverability of new releases
on Deezer...

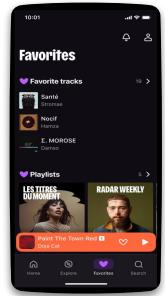
**The swift integration and
discoverability of new releases
on Deezer...**

**...holds significant importance
for the music industry.**

The swift integration and discoverability of new releases on Deezer is important

For **Deezer**, it improves the user experience:

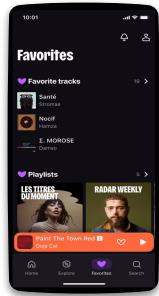
- Users have access to the latest music of their favorite artists;
- Users easily come upon new music they might like.



The swift integration and discoverability of new releases on Deezer is important

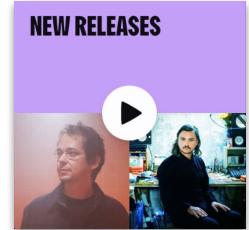
For **Deezer**, it improves the user experience:

- Users have access to the latest music of their favorite artists;
- Users easily come upon new music they might like.



For **artists**, the proper exposure of new releases:

- Amplifies their visibility;
- Contributes to their success and boosts their revenues;
- Fosters the emergence of new talents.



But...

But...

Displaying the “right” releases to
the “right” users is challenging!

Fostering the discoverability of new releases on Deezer is challenging

We have **limited prior information** on this fresh content,
especially for new artists unknown from Deezer.

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In this **Industry Day presentation**

We present our recent efforts to **better showcase new releases** on Deezer,



In this **Industry Day presentation**

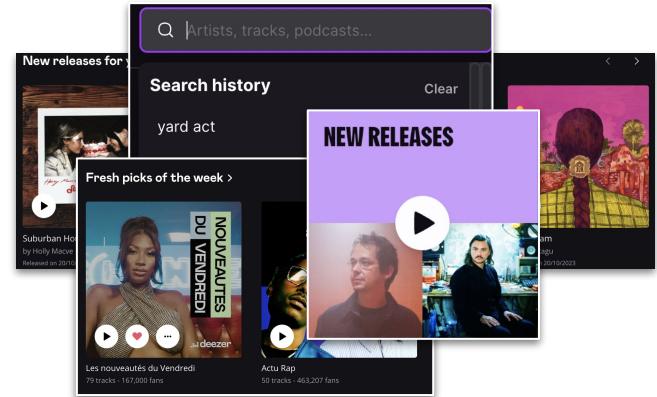
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in terms of **recommendation performance** and **release exposure**.

Industry Day presentation

We present our recent efforts to better showcase new releases on Deezer,
in terms of **recommendation performance** and **release exposure**.

① We describe our **search** and
recommendation features dedicated to
new releases...

...with their objectives/differences.

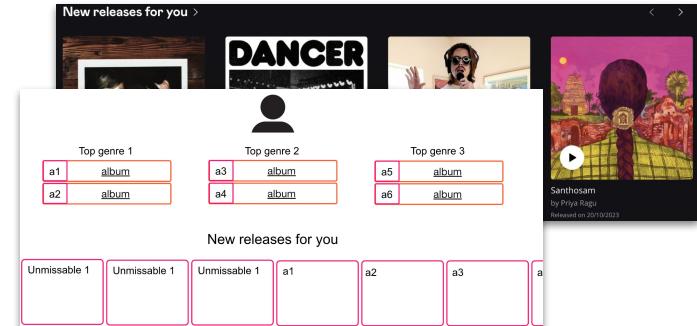


Industry Day presentation

We present our recent efforts to better showcase new releases on Deezer,
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- ② We dive into our historical solution
for new release discovery based on
editorial pre-selection...

...and its limitations, motivating our work.

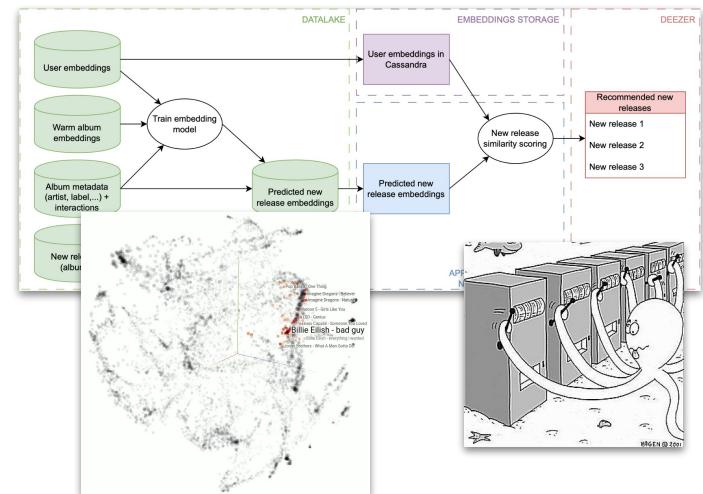


Industry Day presentation

We present our recent efforts to better showcase new releases on Deezer,
in terms of recommendation performance and release exposure.

- ③ We discuss the **cold start embedding**
and **bandit-based system** we deployed to
overcome these limitations...

...along with **online experiments** on Deezer.



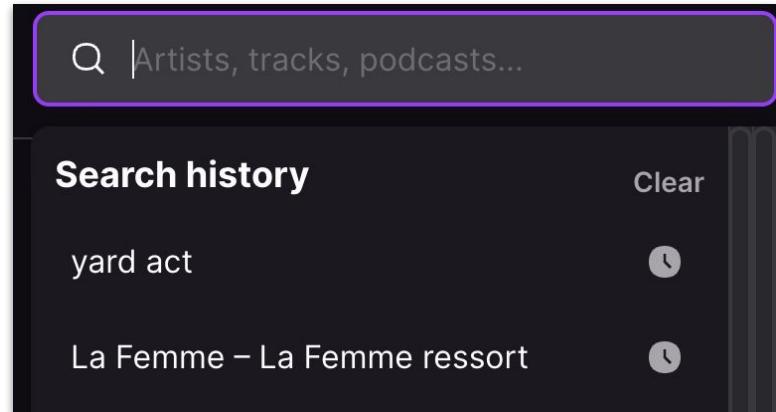
Listening to New Releases on Deezer



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Listening to new releases on Deezer

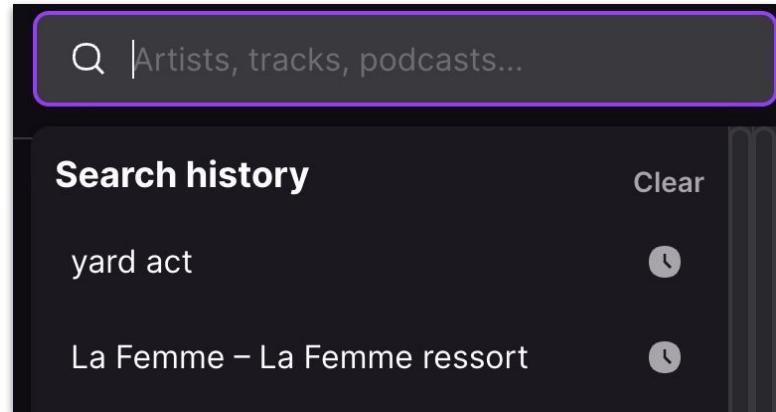
Users can instantly access releases
using our **search engine**.



Listening to new releases on Deezer

Users can instantly access releases
using our **search engine**.

Based on an Elasticsearch index,
plugged into a Kafka topic
refreshed in real-time.



Listening to new releases on Deezer

Users also get **notifications** about releases from their favorite artists.

Notifications



A notification card with a dark background. At the top, the word "Notifications" is displayed in white. Below it is a thumbnail image of a butterfly, which is the cover art for the single "That Golden Time" by Villagers. To the right of the thumbnail, there is a purple circular icon followed by the text "That Golden Time" and "Villagers". At the bottom of the card, the text "11 HOURS AGO - NEW SINGLE" is visible.

Listening to new releases on Deezer

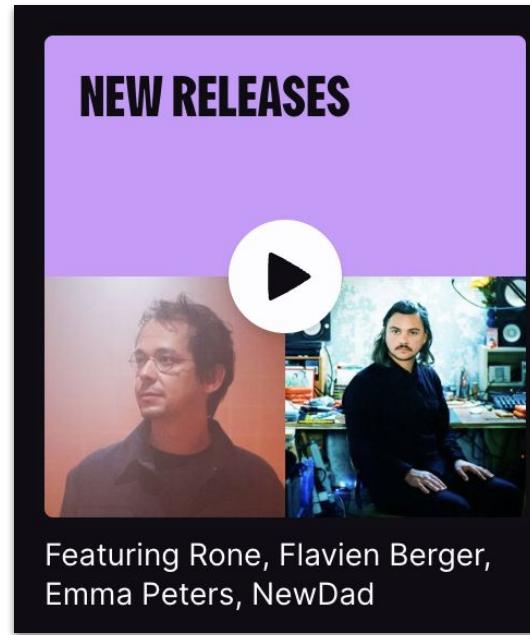
Users also get **notifications** about releases from their favorite artists.

We refer to these updates as **“unmissable” releases**.



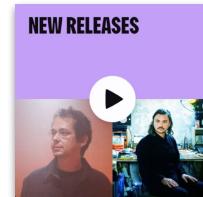
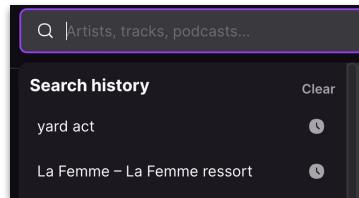
Listening to new releases on Deezer

In addition, Deezer proposes **weekly playlists** mixing **unmissable tracks**.



Listening to new releases on Deezer

All these features help users
retrieve new releases... **from**
artists they already know.



But...

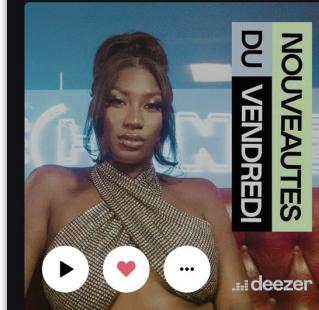
But...

They hardly permit **discovering**
new music from emergent or
unfamiliar artists.

Discovering new releases on Deezer

Fresh picks of the week playlists.

Fresh picks of the week >



Les nouveautés du Vendredi
79 tracks - 167,000 fans



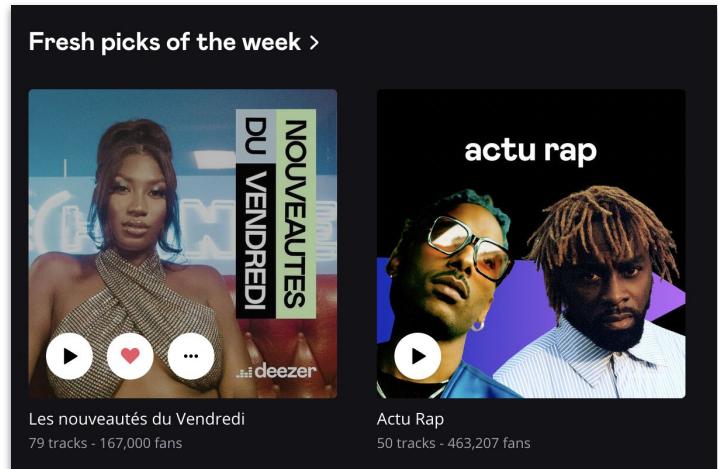
Actu Rap
50 tracks - 463,207 fans

Discovering new releases on Deezer

Fresh picks of the week playlists.

Presents the biggest releases according to professional editors from Deezer.

Not personalized.



Discovering new releases on Deezer

New releases for you album carousel, for personalized recommendations.

New releases for you > < >

Suburban House
by Holly Macve
Released on 20/10/2023

Dancer
by IDLES
Released on 18/10/2023

I Want to Die
by Marc Rebillet
Released on 20/10/2023

Santhosam
by Priya Ragu
Released on 20/10/2023

New Releases for You

How it used to work (until 2023)



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New releases for you

New releases for you >

< >

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First showcasing the user's unmissable albums...

New releases for you

New releases for you >



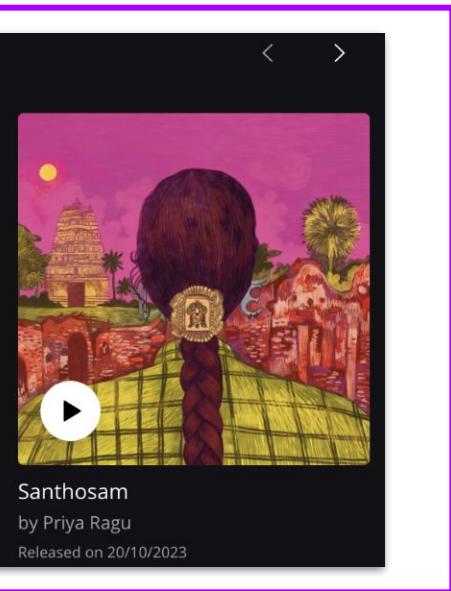
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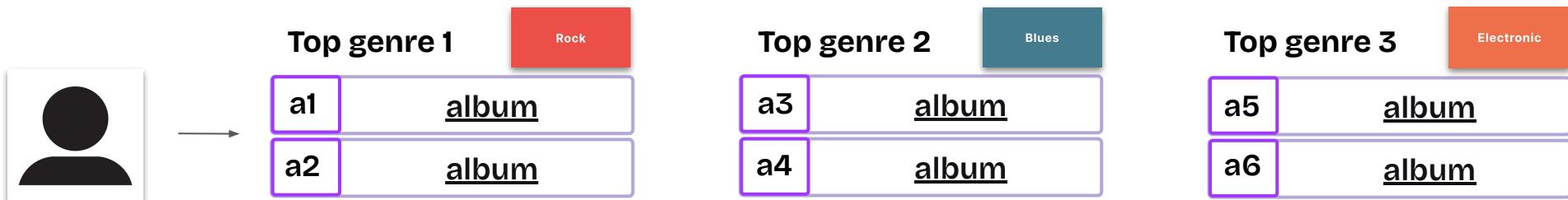
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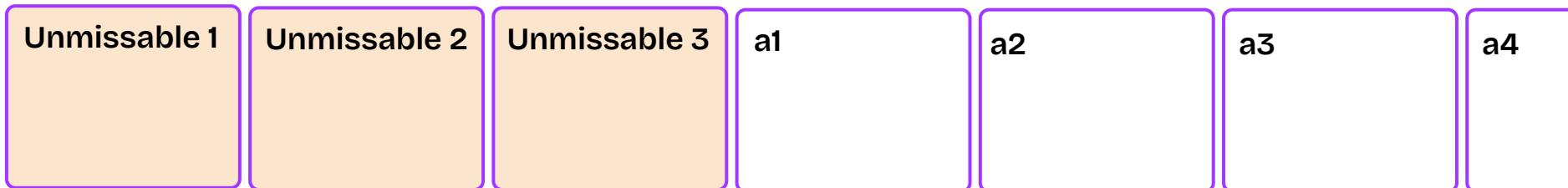
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...followed by new album **discoveries.**

How it used to work, up to early 2023



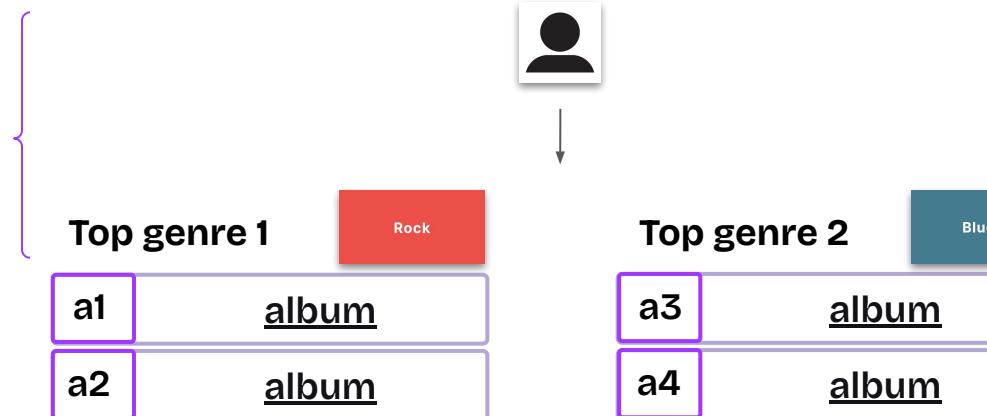
"New releases for you" carousel



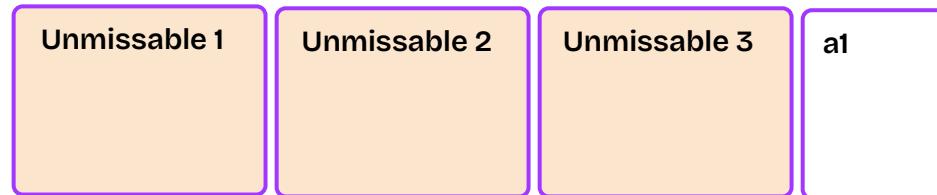
How it used to work, up to early 2023

Each user's **favorite music genres**.

Computed by our data scientists.



***"New releases for you"* carousel**



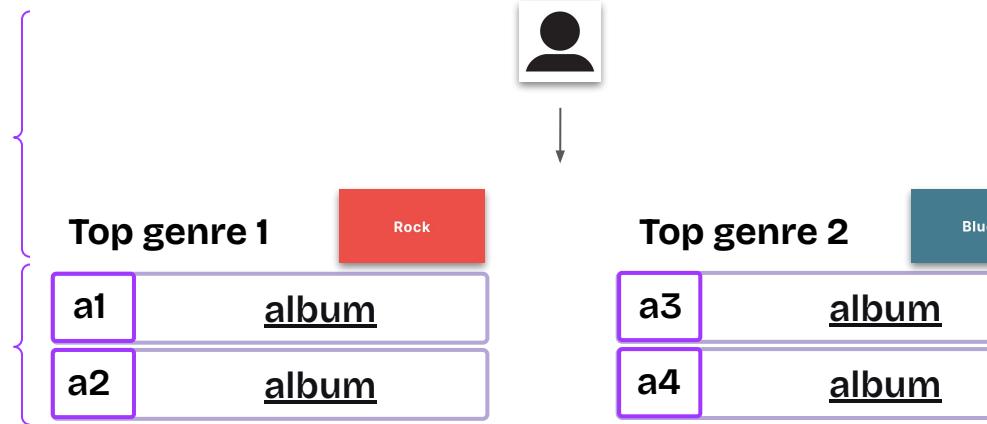
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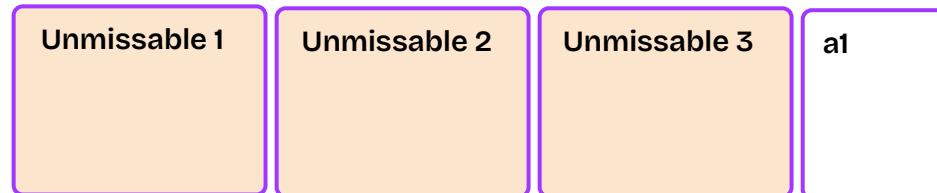
Computed by our data scientists.

Lists of **new albums** per genre.

Manually pre-selected by our editors.



"New releases for you" carousel



**Deezer editors provide
high-quality recommendations.**

But...

Limitations

"New releases for you" carousels were only **partially personalized**:

- All fans from a genre would receive the same recommendations.

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Editorial lists were only **updated once a week**, on Fridays:

- Static feature, less engaging;
- User interactions not factored in for improved recommendations.

Limitations

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- All fans from a genre would receive the same recommendations.

Editorial lists were only updated once a week, on Fridays:

- Static feature, less engaging;
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Only albums handpicked by editors were recommended:

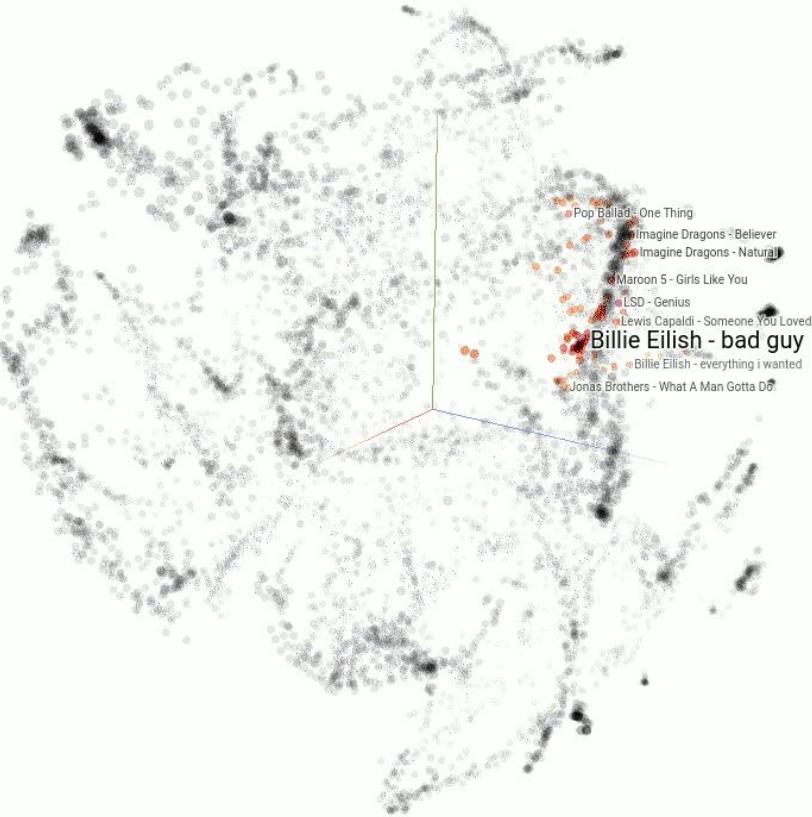
- Most new releases never got the chance to even be exposed to users!

Improving the Discoverability of New Releases



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Embedding representations for recommendation



Dataset of user-made playlists.

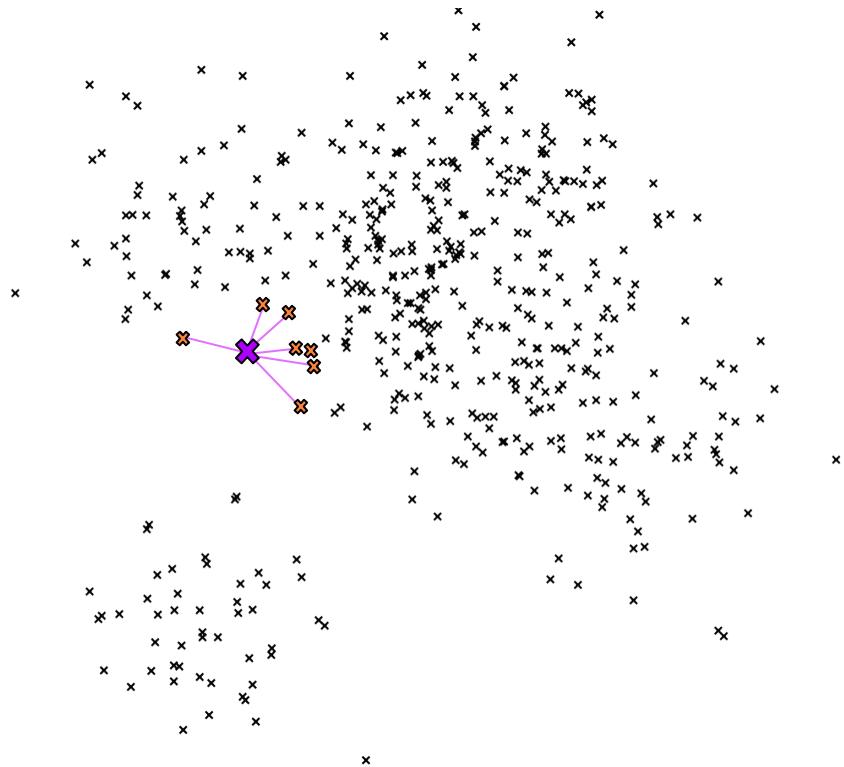
Build a track co-occurrence matrix.

Factorize it using Singular Value Decomposition (SVD).

1 track = 1 embedding vector.

Track Mix Generation on Music Streaming Services using Transformers
Bendada, W., Bontempelli, T., Morlon, M., Chapus, B., Cador, T., Bouabça, T., & Salha-Galvan, G.
RecSys 2023

Embedding representations for recommendation

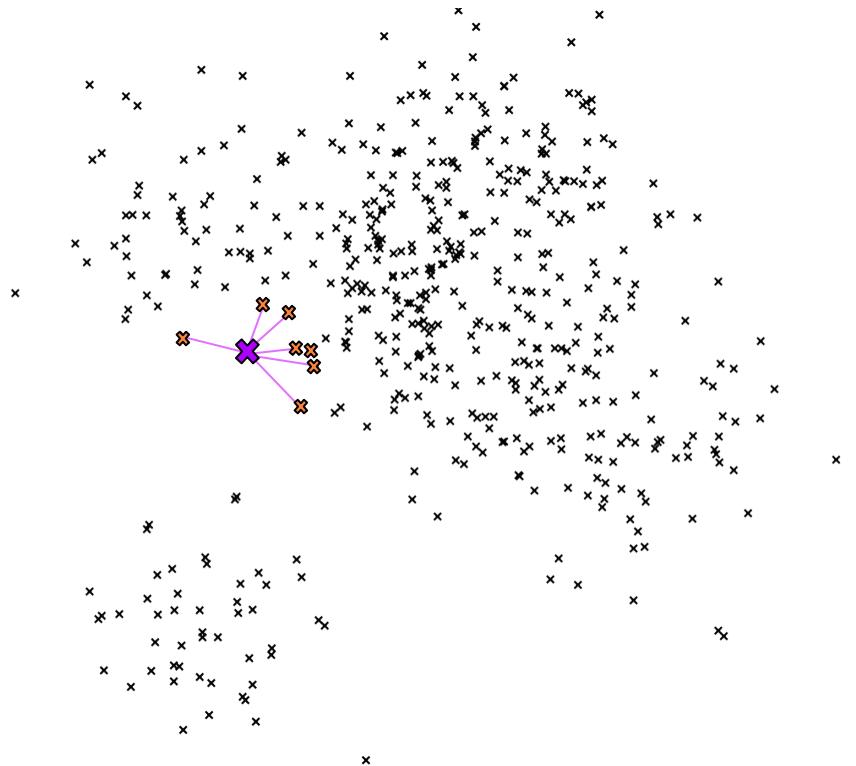


From track embeddings, we compute:

- Album embeddings;
- User embeddings.

Approximate nearest neighbour search (**ANN**) for recommendation.

Embedding representations for recommendation



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Cold start challenge:

How to project new releases in this space, despite having few/no usage data?

In 2023,
we developed **CF-Cold-Start**.

Cold start embedding prediction

CF-Cold-Start: predicts future embedding vectors of new items such as new albums,

Cold start embedding prediction

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Advantages:

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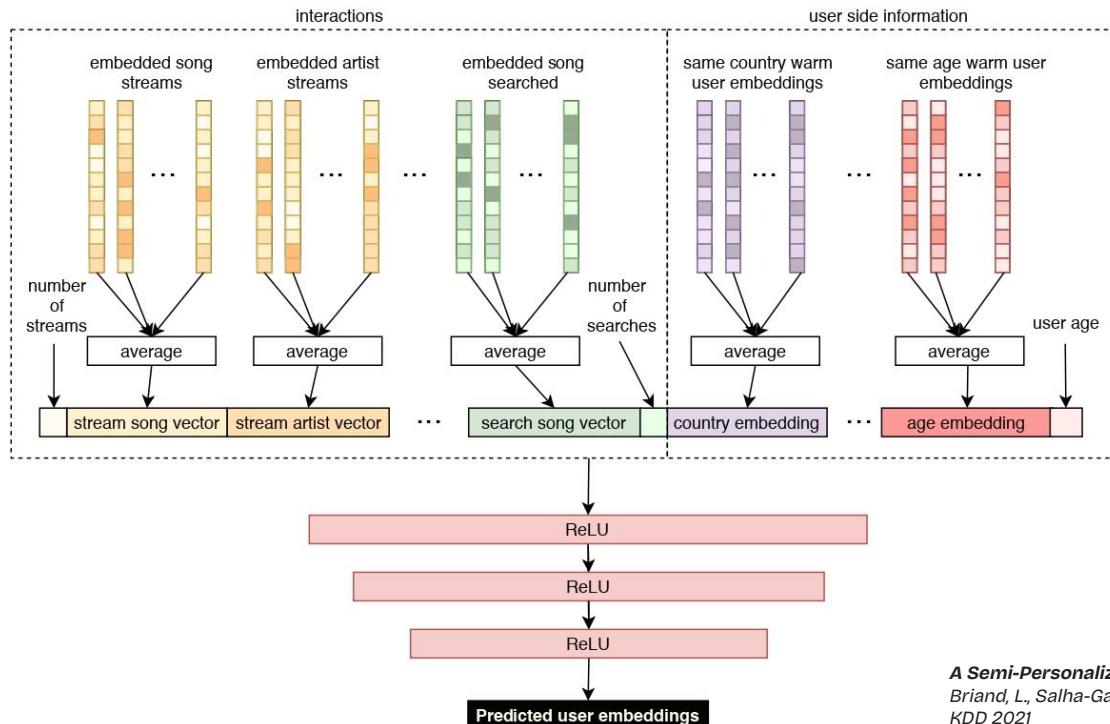
Cold start embedding prediction

CF-Cold-Start: predicts future embedding vectors of new items such as new albums, as early as their release date, without requiring usage data.

Advantages:

- Fully personalized recommendations;
- All new releases eligible for recommendation (not limited to editorial selections);
- We have already successfully deployed a comparable system, for user cold start.

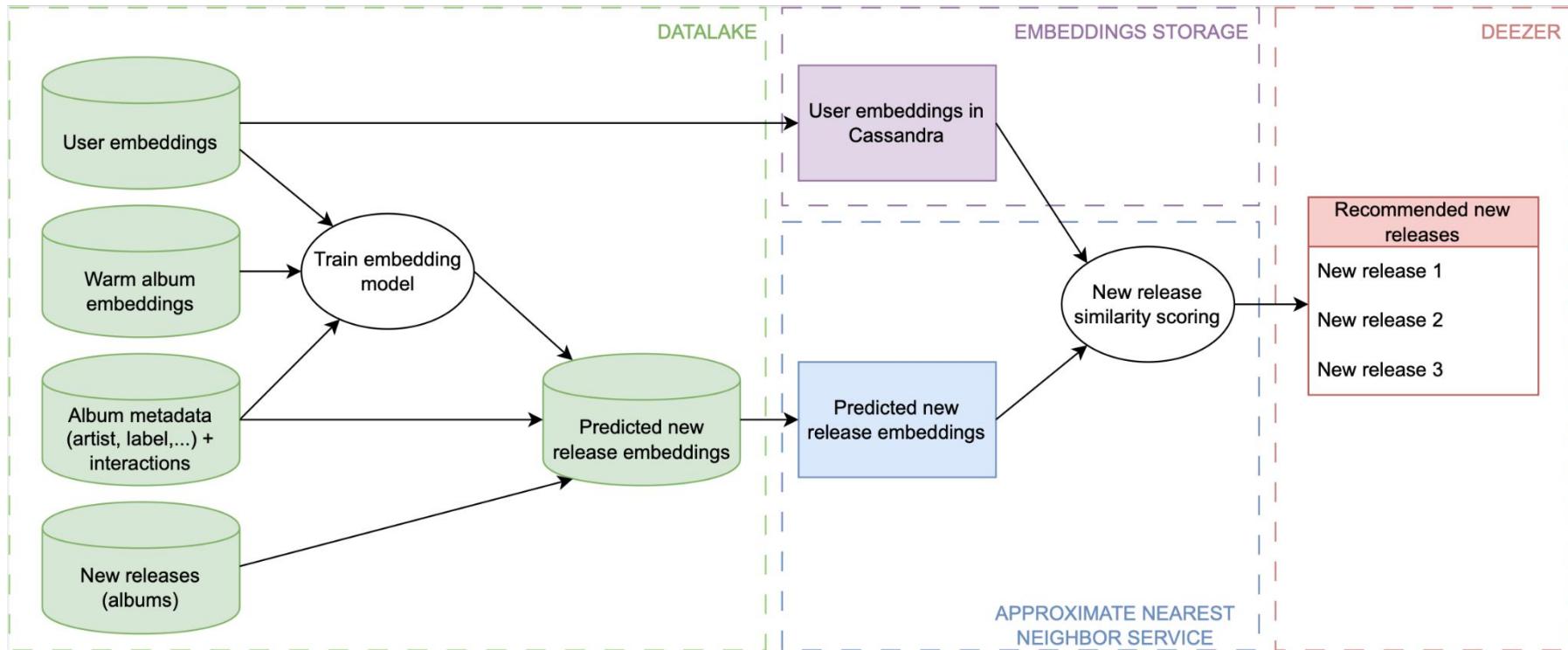
CF-Cold-Start model



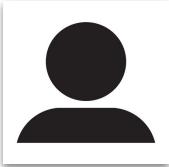
In our case :
CF-Cold-Start would project
“cold” new releases in the
“warm” embedding space.

A Semi-Personalized System for User Cold Start Recommendation on Music Streaming Apps
Briand, L., Salha-Galvan, G., Bendada, W., Morlon, M., Tran, V.A.
KDD 2021

CF-Cold-Start framework



CF-Cold-Start in “*New releases for you*”

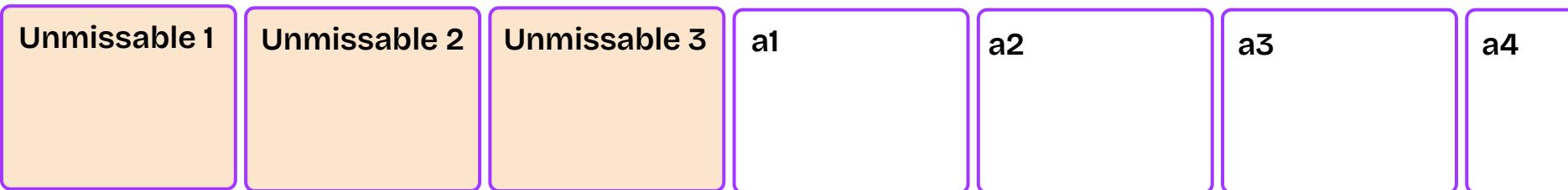


Top-K new albums
recommended by
CF-Cold-Start



a1	<u>album</u>
a2	<u>album</u>
a3	<u>album</u>
a4	<u>album</u>

“*New releases for you*” carousel



Online experiments on Deezer

A/B test on “*New releases for you*” carousels (Jan-March 2023).



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By replacing editorial selections with CF-Cold-Start recommendations:



More performance: +6% in average display-to-click rates.

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All new releases are eligible for recommendation.

How can we go further?

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By taking into account
user feedback.

Limitations of CF-Cold-Start

CF-Cold-Start recommends **the most tailored albums based on usage data.**

- CF-Cold-Start **always “exploits”** usage data.

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But, one might want to **occasionally deviate from them:**

- Goal: to **“explore”** less popular but promising albums;

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- CF-Cold-Start **always “exploits”** usage data.

But, one might want to **occasionally deviate from them:**

- Goal: to **“explore”** less popular but promising albums;
- These albums could be overlooked by solely relying on the existing usage data.

TS-CF-Cold-Start

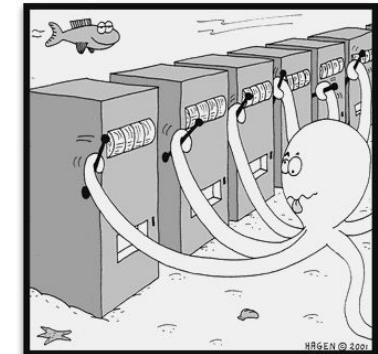
TS-CF-Cold-Start: a CF-Cold-Start variant with a **multi-arm bandit** component for adaptive “*New releases for you*” album ranking.

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Bandits: why?

- Effectively handle **exploration-exploitation** face-offs;

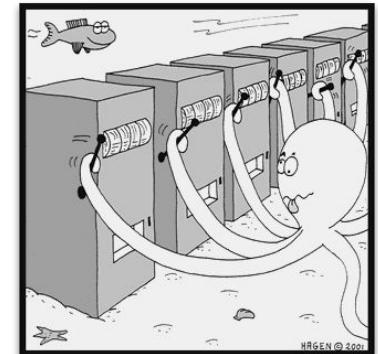


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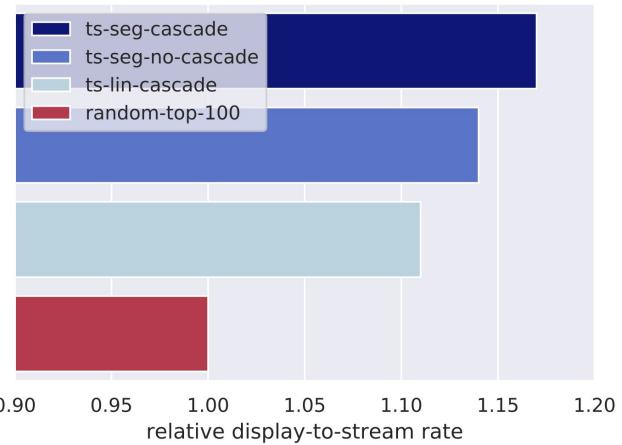
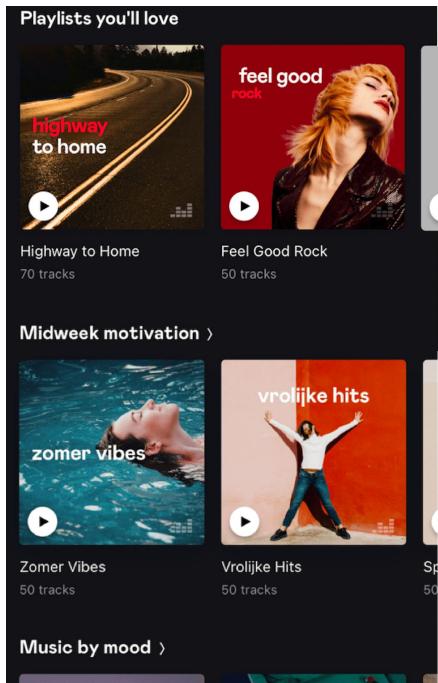
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Bandits: why?

- Effectively handle exploration-exploitation face-offs;
- Bandits have already been successfully deployed on Deezer to improve carousel personalization.



Carousel personalization on Deezer with bandits



Since 2020, **Thompson Sampling (TS)** bandit algorithms have been helping us improve recommendations in **editorial playlist carousels**.

TS-CF-Cold-Start

TS-CF-Cold-Start: uses **Thompson Sampling (TS)** for adaptive album ranking:

- “Rounds”: each carousel display by the user.

TS-CF-Cold-Start

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- The set of arms evolves over time.

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TS-CF-Cold-Start

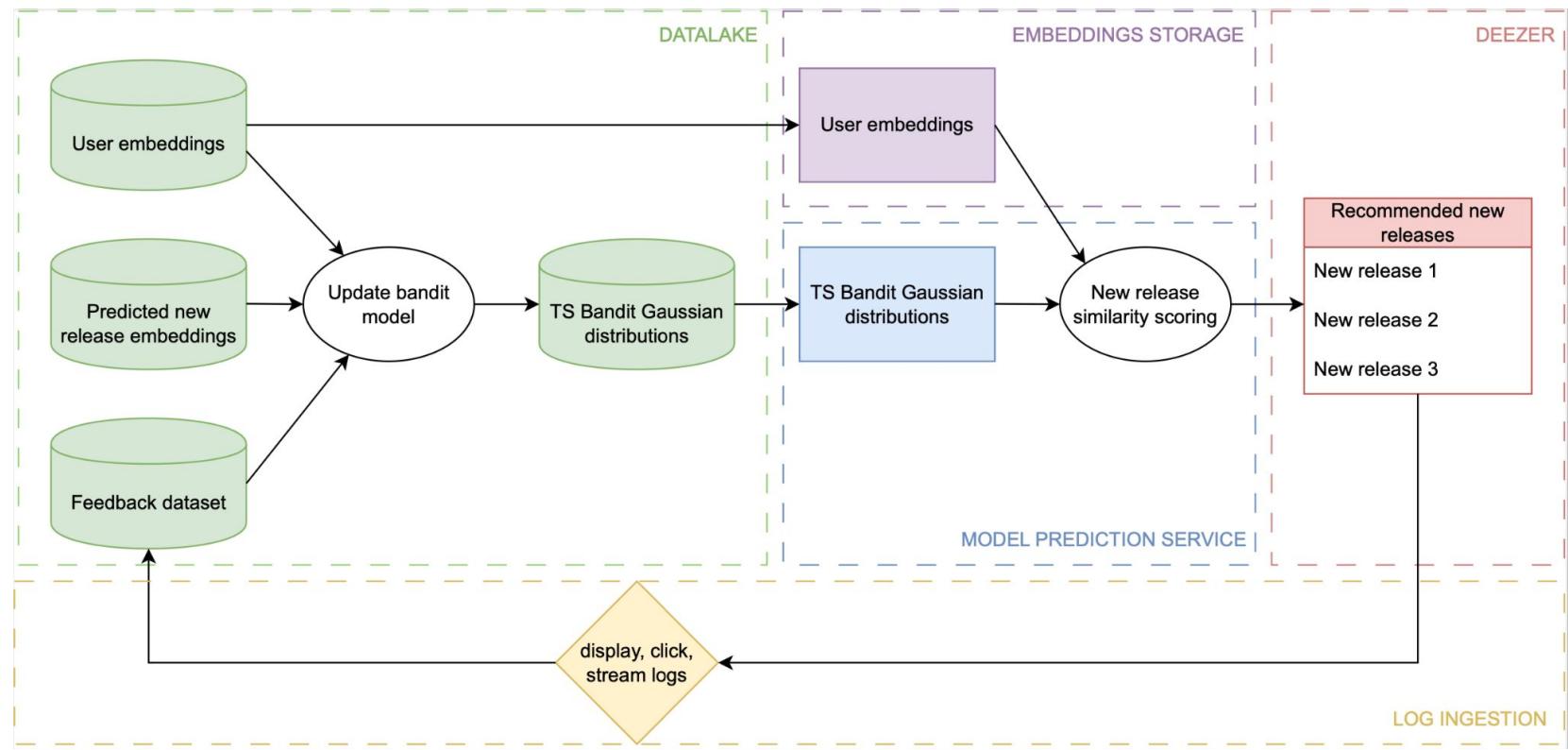
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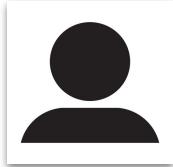
Training:

- “Prior” expected arm distributions: CF-Cold-Start embedding predictions;
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- Updates based on user click “rewards”;
- A “cascade”-based scheme accounts for the album position in the carousel.

TS-CF-Cold-Start framework



TS-CF-Cold-Start in “*New releases for you*”

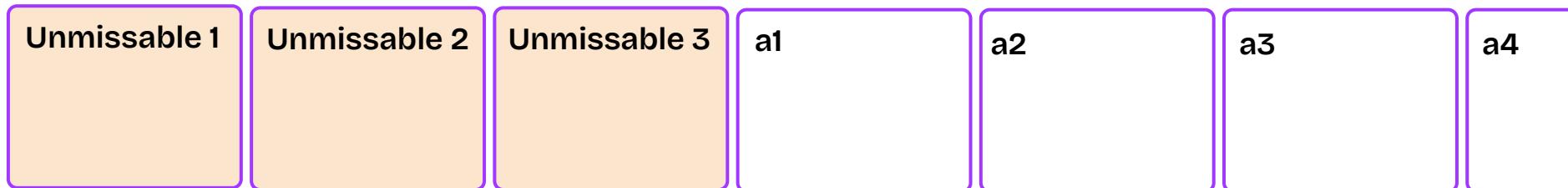


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“*New releases for you*” carousel



Online experiments on Deezer

A/B test on “*New releases for you*” carousels (March-May 2023).



By replacing CF-Cold-Start with TS-CF-Cold-Start:

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By replacing CF-Cold-Start with TS-CF-Cold-Start:

- More dynamism:

Online experiments on Deezer

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By replacing CF-Cold-Start with TS-CF-Cold-Start:

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By replacing CF-Cold-Start with TS-CF-Cold-Start:

- More dynamism:
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- But... The same performance as CF-Cold-Start regarding clicks and exposure.

Online experiments on Deezer

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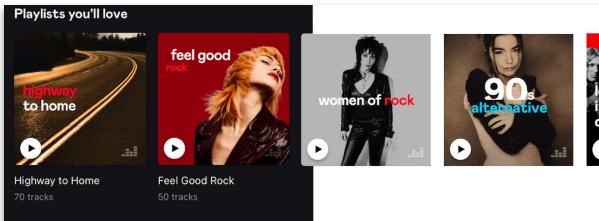
By replacing CF-Cold-Start with TS-CF-Cold-Start:

- More dynamism:
 - TS-based exploration is stochastic;
 - Recommends different albums **with each app refresh**, even between two arm updates.
- But... The same performance as CF-Cold-Start regarding clicks and exposure.

Why?

Discussion

Why were TS bandits helpful for **editorial playlists carousels** (RecSys 2020)
but not for "**New releases for you**" carousels?



VS



Discussion

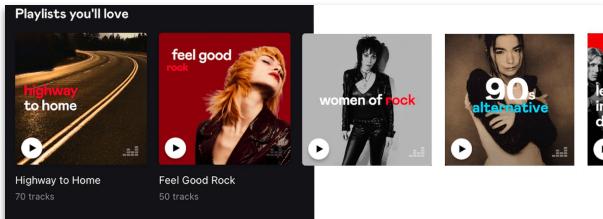
Reason 1:

Unmissable new albums restrict bandit actions to less visible carousel slots.

Discussion

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Editorial playlists carousel

TS Reco 1

TS Reco 2

TS Reco 3

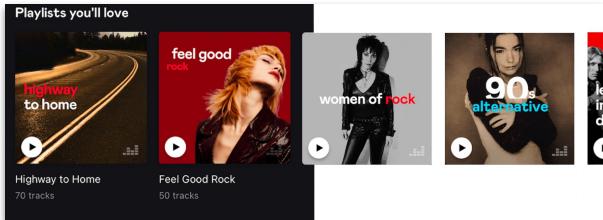
TS Reco 4

TS Reco 5

Discussion

Reason 1:

Unmissable new albums restrict bandit actions to less visible carousel slots.



Editorial playlists carousel

TS Reco 1

TS Reco 2

TS Reco 3

TS Reco 4

TS Reco 5



"New releases for you" carousel

Unmissable 1

Unmissable 2

Unmissable 3

TS Reco 1

TS Reco 2

Discussion

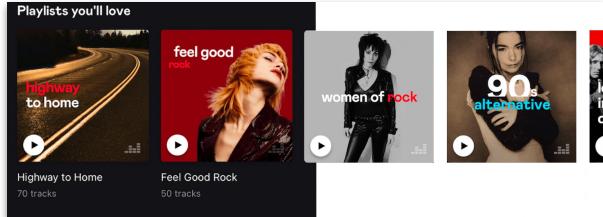
Reason 2:

The **set of new albums constantly evolves**, hindering model convergence.

Discussion

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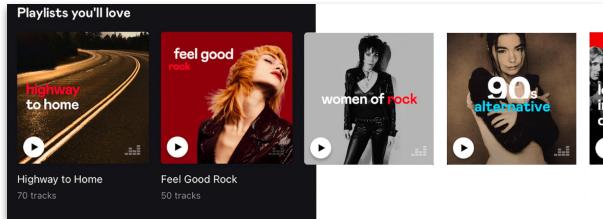


Editorial playlists carousel:
Quite **stable** set of editorial playlists/arms.

Discussion

Reason 2:

The **set of new albums constantly evolves**, hindering model convergence.



Editorial playlists carousel:
Quite **stable** set of editorial playlists/arms.



"New releases for you" carousel:
New albums/arms enter the catalog daily.
They exit the new release set after 7 days.

Conclusion

Using **CF-Cold-Start** and **TS-CF-Cold-Start** in “*New releases for you*”:

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Using **CF-Cold-Start** and **TS-CF-Cold-Start** in “*New releases for you*”:

- Improves **display-to-click** metrics, with respect to our historical solution;
- Improves **album exposure**;
- Leads to more **dynamic updates**.

Conclusion

Using **CF-Cold-Start** and **TS-CF-Cold-Start** in “*New releases for you*”:

- Improves **display-to-click** metrics, with respect to our historical solution;
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These initiatives foster the overall **discoverability of new releases** on Deezer.

Conclusion

Using **CF-Cold-Start** and **TS-CF-Cold-Start** in “*New releases for you*”:

- Improves **display-to-click** metrics, with respect to our historical solution;
- Improves **album exposure**;
- Leads to more **dynamic updates**.

These initiatives foster the overall **discoverability of new releases** on Deezer.

They also open up interesting avenues for **future work**.

Future work: machine learning approaches



Bandits with “*equity-of-exposure*”

for improved **fairness**.

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Bandits with “*equity-of-exposure*”
for improved **fairness**.



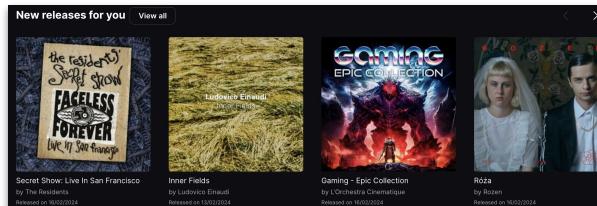
Better input data for cold start models,
e.g., **audio-based embeddings**.

Future work: improving the Deezer product

Separate **unmissable albums** from **discoveries** into **two carousels**?



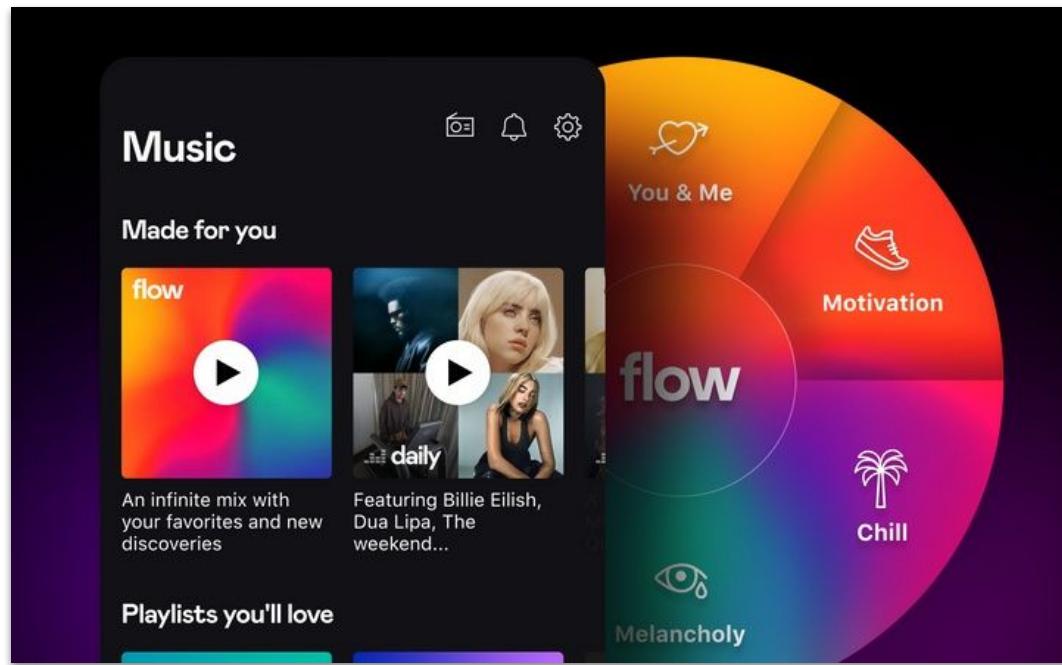
Carousel 1:
All **unmissable** albums.



Carousel 2:
Album discoveries.
Fully controlled by bandits.

Future work: improving the Deezer product

Use CF-Cold-Start in other Deezer features, e.g., our Flow personalized radio.



Let's Get it Started! ♪

Fostering the Discoverability of New Releases on Deezer

Léa Briand, Théo Bontempelli, Walid Bendada, Mathieu Morlon, François Rigaud,
Benjamin Chapus, Thomas Bouabça, and Guillaume Salha-Galvan



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