



Search



Home



Library



Unsupervised ML

From Moosic Classification to Playlist Creation

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Data Processing



#1

Data Cleaning

Fix strings, drop
duplicates & outliers

#2

Separate Data

Descriptive vs.
numerical features

#3

Scaling

Relevant features
using MinMax scaler

#4

Song Classification

Using a layered strategy

#5

Push Playlists

To Spotify

Layered Classification: Steps

1. Main clusters

- a. Identify relevant features for the main clustering
 - i. PCA
 - ii. Exploratory analysis
- b. Select the number of main clusters (Elbow + Silhouette plots)
- c. Create main clusters (*num_clusters = 5*)

2. Subclusters

- a. Select the number of subclusters
- b. Create subclusters (*num_clusters = 5*)

Step 1: Identify Distinguishing Features

	PC_1	PC_2	PC_3
danceability	-0.141786	-0.018445	-0.145324
energy	-0.213625	-0.053883	0.185191
key	-0.036622	0.091124	0.013083
loudness	-0.115993	-0.027323	0.032489
mode	0.133547	-0.477993	0.010980
speechiness	-0.018823	-0.001102	0.016863
acousticness	0.276062	0.062073	-0.229004
instrumentalness	0.273114	0.084209	0.221462
liveness	-0.019377	-0.003109	0.016083
valence	-0.171626	-0.053570	-0.152796
tempo	-0.041197	-0.011335	0.027233

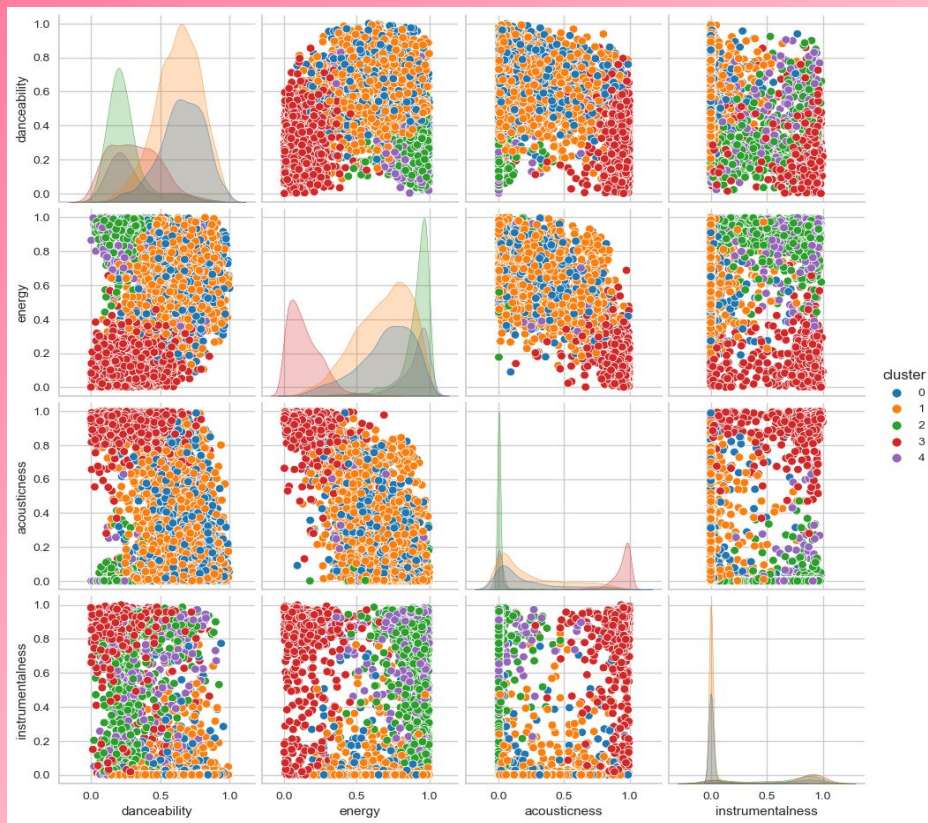
PCA

For PC_1

- Positively loading features in blue
- Negatively loading features in pink

Note: we drop *valence* from the first step as it needn't drive broad categorizations

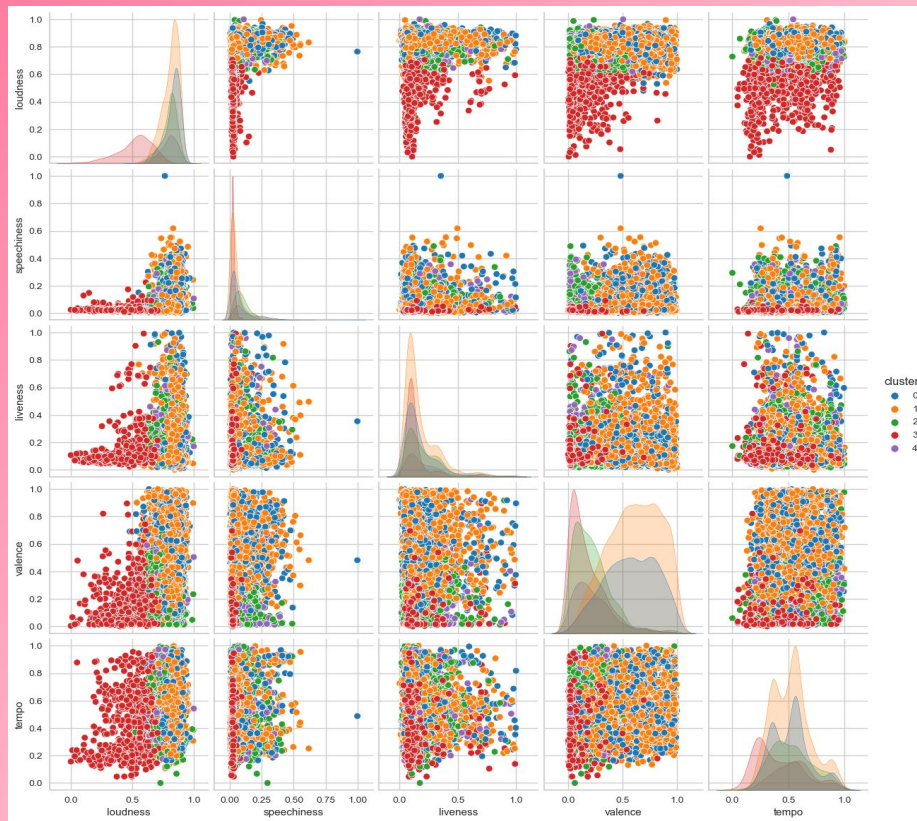
Step 1: Identify Distinguishing Features



Exploratory analysis

These four are also able to distinguish clusters!

Step 1: Identify Distinguishing Features

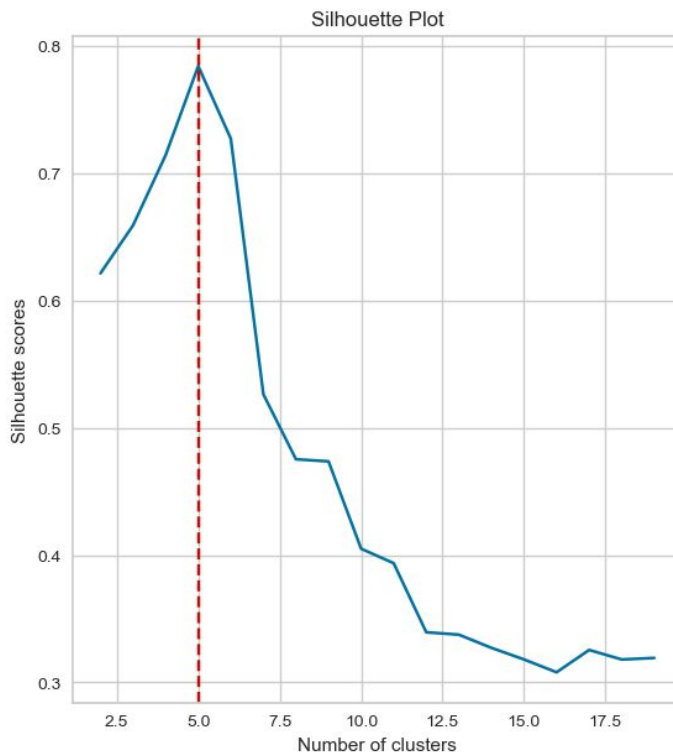
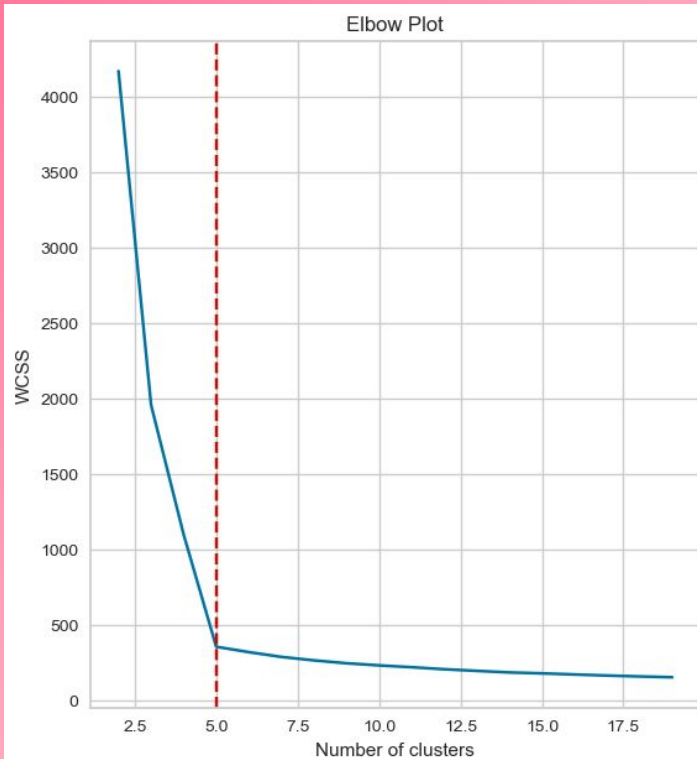


Exploratory analysis

The remaining features do not do an equally good job.

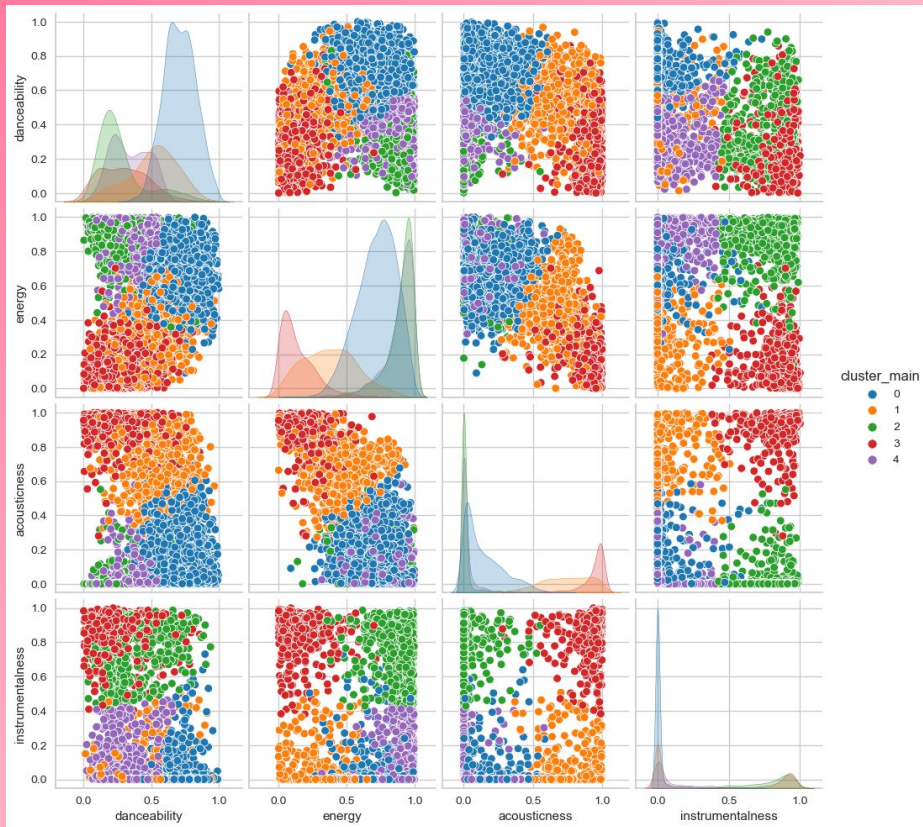
→ Hence dropped from the first clustering layer, considered later!

Step 2: Select number of main clusters



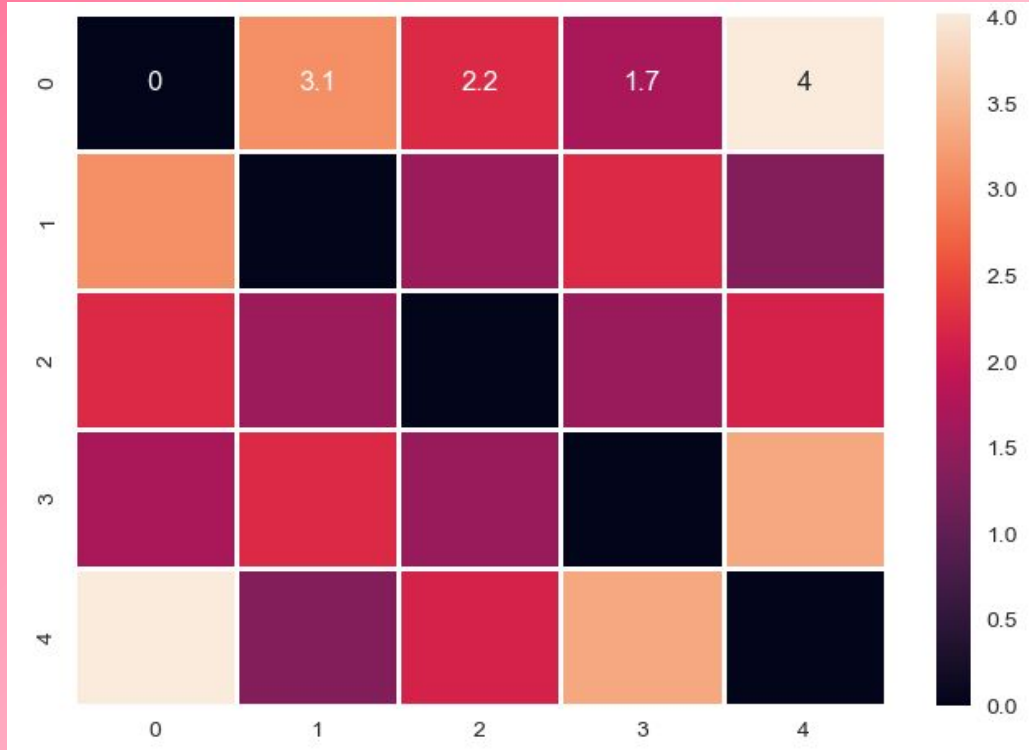
5 seems
about
right!

Step 3: Create 5 Main Clusters



Main clusters are distinguishable!

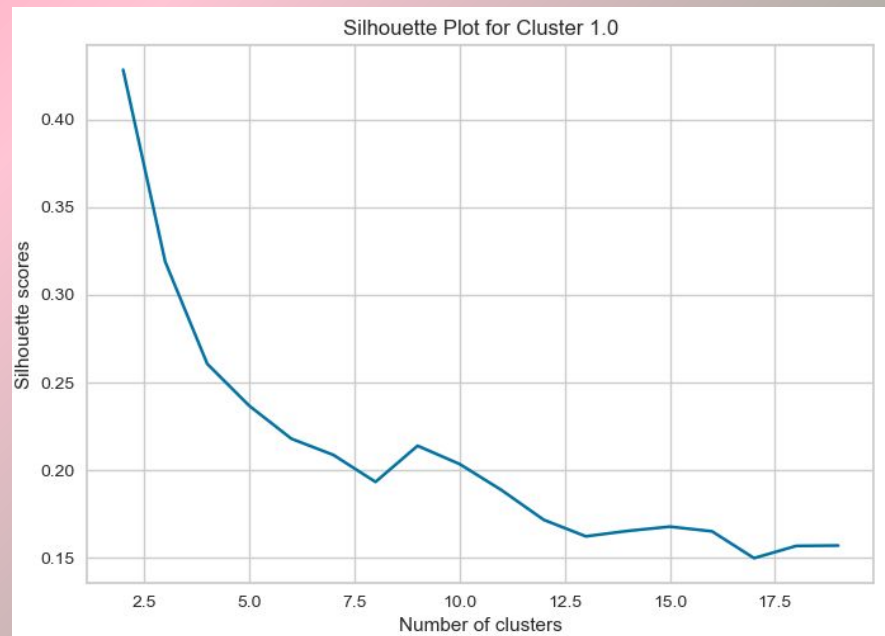
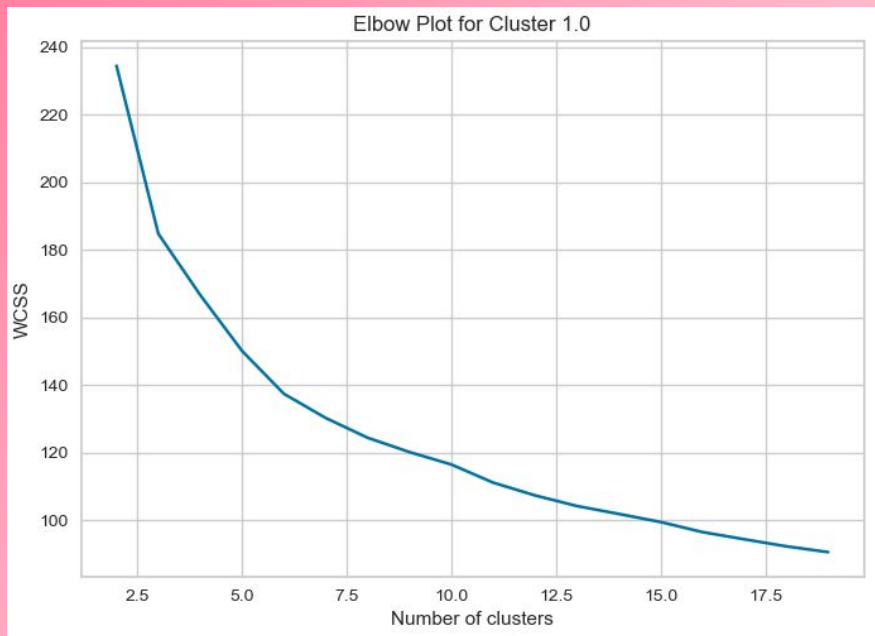
Step 3: Create 5 Main Clusters



Centroids are distinct!

Steps 4+5: Create Subclusters

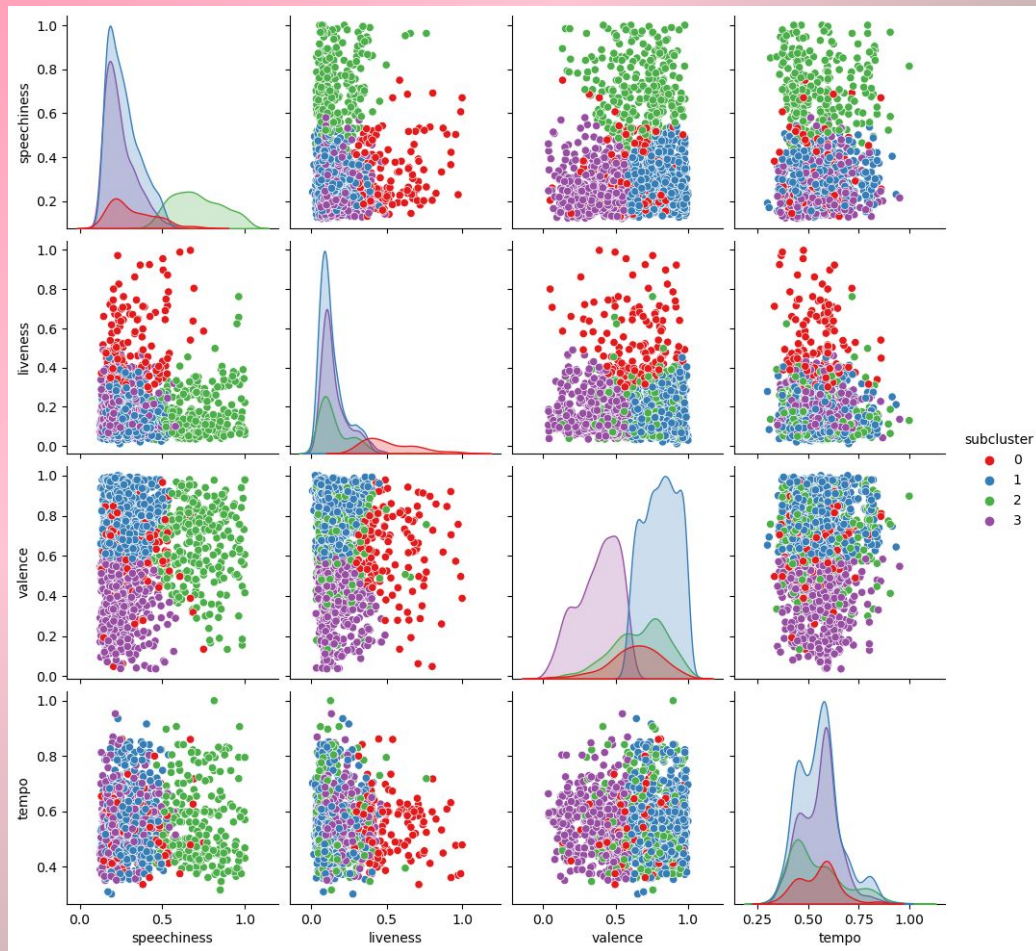
4-5 subclusters seem to work!



Steps 4+5: Create Subclusters

Subclusters
well-separated for
good choice of
features for
clustering!

Requires manual tests!





Example Playlists



main sub

playlist_0_1:

Pop & Rock Happy
Vocals



works!

works!

not really...

sort of...

works!

sort of...

works!

works!

sort of...

works!

works!

21



Cecilia
Simon & Garfunkel

22



Manic Monday
The Bangles

23



Yeah! (feat. Lil Jon ...
USHER, Lil Jon, Luda...

24



Dynamite
Taio Cruz

25



Stitches
Shawn Mendes

26



Milk & Honey
Hollie Cook

27



Grace Kelly
MIKA

28



You Get What You ...
New Radicals

29



Fight Music
D12

30



Still The Same
Bob Seger

31



Uptown Girl
Billy Joel



Example Playlists



playlist_3_1:

Relaxing to
acoustical piano

works!

not really...

works!

works!

what

not really...

works!

works!



1



Symphony No. 3 in...
Louise Farrenc, North...

Farrenc: Sympho...

2



Introspection - Edit
Laraaji

Introspection (E...

3



I'm Going to Make ...
Philip Glass, Khatia B...

Labyrinth

4



Music for Strings, ...
Béla Bartók, Hungaria...

Bartok New Seri...

5



Sky and Sand
Paul Kalkbrenner, Frit...

Berlin Calling (Th...

6



O Pato
Stan Getz, Charlie Byrd

Jazz Samba

7



Symphony No. 6 in...
Pyotr Ilyich Tchaikovs...

Tchaikovsky: Sy...

8



The Seasons, Op. ...
Pyotr Ilyich Tchaikovs...

Lang Lang in Paris



Example Playlists



playlist_4_0:

Obscure Death
Metal

works!

works!

does not work!

sort of works...

works!

nope!

works!



Depression
Desultory

5



Disembowel
Autopsy

6



Wie schön du bist
Sarah Connor

7



Nemo
Nightwish

11



Rites of Red Giving
Equinox

9



School
Frankie Cosmos

10



Malevolent Creation
Raining Blood



Concluding remarks



01

Are Spotify's audio features able to identify “similar songs”, as defined by humanly detectable criteria?

In principle yes - to a certain degree - but tricky!

02

Is K-Means a good method to create playlists ?

Clusters are sensitive to feature selection.

Requires a lot of manual fine-tuning and using relevant musical features/business logic!