

# Spotify Playlist Analysis with Song Recommendation

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Pharoah Evelyn

# Overview

This project aims to analyze & compare song features within my curated playlist vs. Spotify playlists

- Followed by selecting a model that can best predict song inclusion in my playlist
- We also explore different song recommendation options

# Outline

- Business Problem
- Data
- Methods Used
- Song Recommenders
  
- Conclusions
- Recommendations
- Next Steps

# Business Problem

**Spotify** is a digital music, podcast, and video service that gives you access to millions of songs and other content from creators worldwide.

Content recommendation is vital for its success and maintaining user satisfaction.



# Data

## 1. My curated playlist

- 204 songs & counting
- Built up over years

## 2. Spotify curated Playlists

- Based on listening history
- Inspired by music taste

The screenshot shows a Spotify playlist titled "Instrumentals" by Pharoah Evelyn. The playlist is public and contains 204 songs, totaling 9 hours. The interface is dark-themed with a red header. The playlist cover art is a collage of four images. Below the header, there are playback controls (a green play button, a download icon, a share icon, and a menu icon) and a search bar with a "Date added" filter. The playlist is displayed as a table with columns for song number, title, album, date added, and duration. Each song has a green heart icon next to it, indicating it has been liked.

#	TITLE	ALBUM	DATE ADDED		
1	Caliber yeyts.	Caliber	Apr 6, 2022	♥	2:11
2	Football Head Flamingosis	Pleasure Palette	Apr 1, 2022	♥	3:45
3	m i s t eevee	ep seeds	Apr 1, 2022	♥	1:58
4	Space Cowboy Saib	Ipanema	Apr 1, 2022	♥	2:33
5	Oh How Lovely (feat. Tomppabeats) wūsh, Tomppabeats	For Her	Apr 1, 2022	♥	1:20
6	Noon Jaeden Camstra	Noon	Apr 1, 2022	♥	1:30
7	Your Name Xfruge	Imma Keep It Mellow Till the Grave	Apr 1, 2022	♥	1:36
8	jasmine eevee	unexpected	Apr 1, 2022	♥	2:28

Based on your recent listening



**lofi beats**  
Let yourself be sunkissed with beats to chill, relax,...



**Music for Plants**  
Mellow vibrations for green leaves, green thumbs and...



**Indie Sunshine**  
Fun in the sun with these indie pop jams!



**Lowkey**  
just chill... respectfully



**golden hour**  
For me, golden hour is all about being surrounded by...



**Lofi Hip-Hop**  
Lofi's crispiest beatmakers. Cover: Cookin Soul



**RetroWave / Outrun**  
Equal parts nostalgic synthwave sounds and...



**chill lofi study beats**  
The perfect study beats, twenty four seven.



**Electronica Romantica**  
Delicate digital expressions of the heart.



**Brain Food**  
Hypnotic electronic for studies and a relax.



**Jazz Vibes**  
The original chill instrumental beats playlist.



**metaverses**  
01110000 01101100  
01100001 01111001 0110110...



**Chill Vibes**  
Just chill...

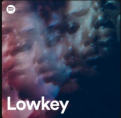


**Gold Instrumental Beats**  
Beats inspired by the golden era of hip hop.



**The Lofi Garden**  
beats + birds = <3

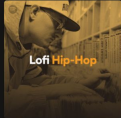
More of what you like



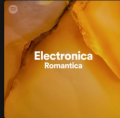
**Lowkey**  
just chill... respectfully



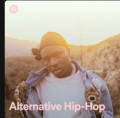
**golden hour**  
For me, golden hour is all about being surrounded by...



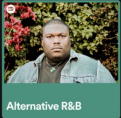
**Lofi Hip-Hop**  
Lofi's crispiest beatmakers. Cover: Cookin Soul



**Electronica Romantica**  
Delicate digital expressions of the heart.



**Alternative Hip-Hop**  
New, leftfield, and for the real hip-hop stans! Cover:...



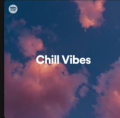
**Alternative R&B**  
These progressive R&B and soul tracks can't be put in a...



**floating**  
Lay back. Chill out.



**Serotonin**  
100% good vibes.



**Chill Vibes**  
Just chill...



**Poolside Disco**  
Disco, house, funk and soul for the good times.



**Gold Instrumental Beats**  
Beats inspired by the golden era of hip hop.



**French Touch**  
Some of the biggest french touch classical! Cover: Daft...



**park hangs**  
Spring has SPRUNG. Time to vibe outside



**POLLEN**  
Genre-less. Quality first always. Cover: Flume



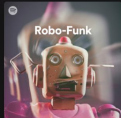
**Modern Psychodelia**  
The best of modern psychodelic rock, neo...



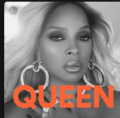
**'fit check**



**Nu-Funk**



**Robo-Funk**



**Queen**



**Levitate**

# Methods Used

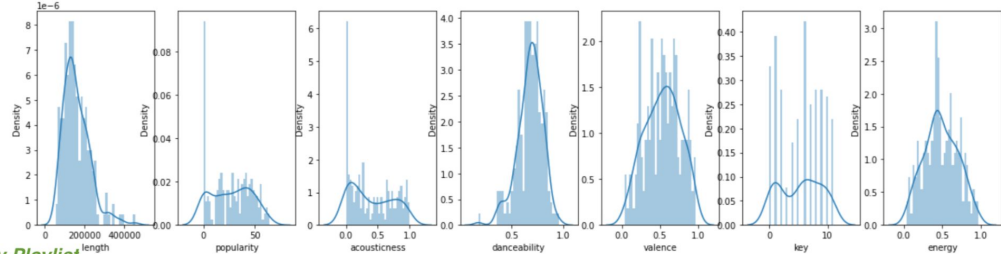
- Spotify API
- Feature Evaluation on both datasets
- Feature Correlation
- Scikit Learn
- Content Based Recommendation

# Conclusions

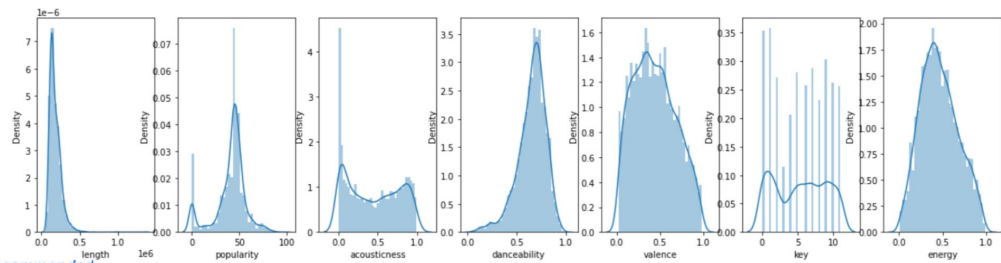
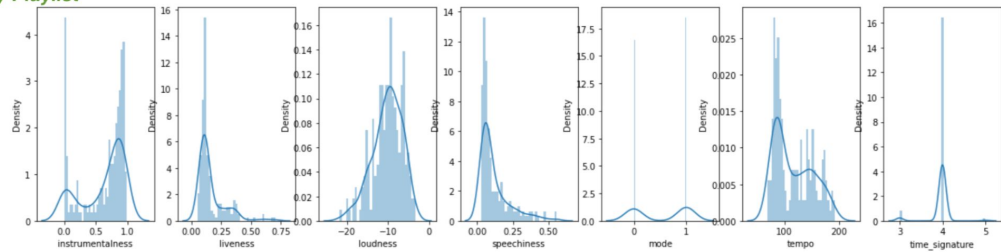


# What I Discovered in my Playlist

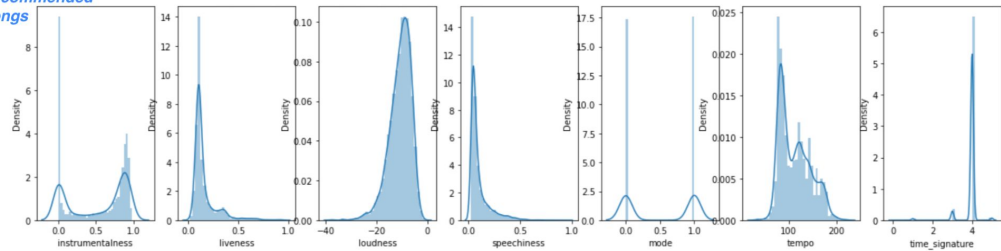
- Energy, instrumentalness, acousticness, & loudness have the most impact on playlist inclusion.
- Valence & danceability are a key feature
- Song length, speechiness, popularity & time signature are least relevant
- Energy & loudness are highly correlated
  - Songs with high energy tends to have an increasing rhythmic complexity



My Playlist



Recommended Songs



# Conclusions

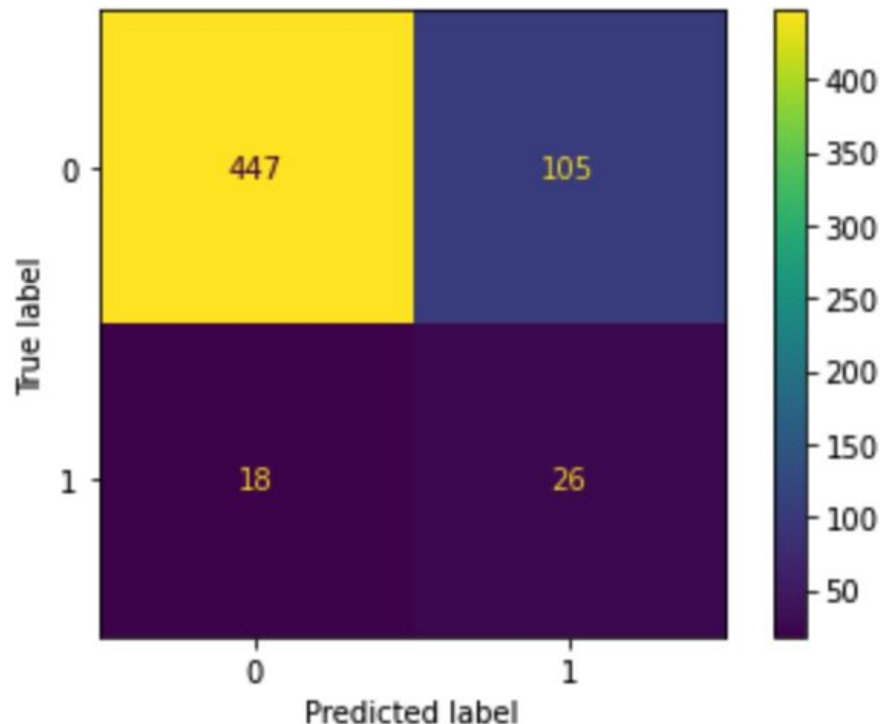
## The best model is the Support Vector Machine

- SVM best predicted songs in my playlists and songs outside of the playlist
- This classifier correctly predicts True Negatives better than Logistic Regression
  - Retains a similar correct prediction rate as Logistic Regression
- In this case, Decision Trees & Random Forests, despite accounting for class imbalances, seem to rely on automatically predicting songs not belonging to my playlist

# Model Output

Interpretation of Playlist Inclusion with a Support Vector Machine classifier:

- **447 True Negatives:** Songs not in my playlist
- **105 False Positives:** Predicted songs to be in my playlist, but are not present
- **18 False Negatives:** Predicted songs to not be in my playlist, but are present
- **26 True Positives:** Songs in my playlist



# Conclusions

Though the two different recommenders return different results, there appears to be an agreement with some songs in their results.

Due to the songs having similar features throughout all variables, tracks that appear in both recommenders must be reliable matches

There are also some instances of recommended songs that are already present in my playlist. But that can be attributed to them being present in this dataset.

# Recommender Comparisons

```
generate_recommendation('5:32pm',cosine)
```

Recommended Songs:

2688	Tessin
2810	Hit Snooze
1500	Kalmar
1599	Nest
1192	Moving Day
2648	Aquarell
1569	Slanger
3746	Cruisin'
3687	pole mokotowskie
1546	Beside Myself

Name: name, dtype: object

```
recommender.get_recommendations('5:32pm', 10)
```

100% ██████████ 3968/3968 [00:00<00:00, 22409.02it/s]

	name	artist
798	Retro Jam	Blu Tone
1274	Coolin'	Snazzy
1192	Moving Day	Paul Lovett
1599	Nest	don C
3877	intentions	shawn pink
1569	Slanger	pesto tree
1248	Sunset	Clifford
3931	Latitude	Xyla
1006	Padron Peppers	Burrito Eats
1175	When The Past Turned Present	Sebastian Kamae

```
generate_recommendation('Caliber',cosine)
```

Recommended Songs:

3647	Liza waited
2643	Sleepwalking
3744	florida keys
822	Crescent
1155	Algud
3818	City Lights Spell Your Name
2672	Portal Beach
974	Head High
1417	Memories
27	I'll Be Loving You

Name: name, dtype: object

```
recommender.get_recommendations('Caliber', 10)
```

100% ██████████ 3968/3968 [00:00<00:00, 31779.03it/s]

	name	artist
3647	Liza waited	Sail & Weep
3744	florida keys	Kolorama
1545	RU-LAX	Steven Lamar Moore
1109	Afternoon Break	Raouf Beats
1614	Jaunt	Lizlov
1484	Mellow Mood	Stereo Fear
974	Head High	Glimlip
249	Kindness	HNNY
3543	At Night	Mylo B
27	I'll Be Loving You	Yellow Days

```
generate_recommendation('Space Cowboy',cosine)
```

Recommended Songs:

115	Samui Sunrise
573	Keep On
2594	Sweet Sunset
851	va y viene
3606	As a friend
2451	no song without you
4144	Certain People
1109	Afternoon Break
2164	Out All Night
72	sunny

Name: name, dtype: object

```
recommender.get_recommendations('Space Cowboy', 10)
```

100% ██████████ 3968/3968 [00:00<00:00, 32077.82it/s]

	name	artist
2164	Out All Night	Ray Ben Rue
903	Carrousel	Shin-Ski
958	Pode Ser	Chancla
2576	blitzlys	damaa.beats
2526	Valencia	.multibeat
1221	Self Fulfillment	jawima
2594	Sweet Sunset	lassu
4045	In the Cypher	Bonkers Beat Club
851	va y viene	Jlony
871	Green in Blue	Jazzinuf

# Recommender Comparisons

```
generate_recommendation('Sugar - Original Mix',cosine)
```

Recommended Songs:

117                    When You Call Me  
187        How Long Have You Been Away?  
2282                    THE BOTTOM  
149                    Lost Myself  
3185                    ketamine  
3124                    The Look  
4257                    Doin' It  
4173                    Happy Music  
4239                    Give Life Back to Music  
1970                    19 - Josh Butler Remix  
Name: name, dtype: object

```
recommender.get_recommendations('Sugar - Original Mix', 10)
```

100%|██████████| 3968/3968 [00:00<00:00, 31945.56it/s]

	name	artist
117	When You Call Me	STR4TA
187	How Long Have You Been Away?	kryptogram
149	Lost Myself	Eric Krasno
2282	THE BOTTOM	MICHELLE
194	Certified Juice	Beard-o-Bees
3185	ketamine	siouxxie sixxsta
1899	Zdarlight	Digitalism
4257	Doin' It	Herbie Hancock
1948	Seventies	Theo Kottis
173	I Found You (feat. Benjamin Ingrosso) - Dimitr...	Vantage

```
generate_recommendation('Green Lights',cosine)
```

Recommended Songs:

787                    Mango Bathing  
3990                    Rotterdam Rita  
786                    Light-Hearted Lady  
250                    Night Owl  
750                    Hour and half  
1367                    caperata  
2151                    By the Fire  
99                    Fireworks  
3549                    Vitalization  
3375                    Lunar  
Name: name, dtype: object

```
recommender.get_recommendations('Green Lights', 10)
```

100%|██████████| 3968/3968 [00:00<00:00, 31697.15it/s]

	name	artist
3990	Rotterdam Rita	Fletcher Reed
3375	Lunar	Hotel Pools
786	Light-Hearted Lady	High John
250	Night Owl	Cihangir Aslan
99	Fireworks	Nyman
1267	Summer Sunsets	Aesthetic Sounds
772	Unsung Stories	Alma Animo
3549	Vitalization	Guustavv
3809	Ferrochrome	C-90
779	Hanami	Natasha Ghosh

```
generate_recommendation('Don't Give Up',cosine)
```

Recommended Songs:

164                    Say Yes  
3824                    Slow Gaze  
45                    Gardens  
1071                    olvido  
3159        Asdikte Akal - Yugen Blakrok Remix  
4042                    Watch Your Back  
990                    when i ate a persimmon  
1013                    Before the Sun  
129                    Night 1  
288                    Way Ur Touchin Me  
Name: name, dtype: object

```
recommender.get_recommendations('Don't Give Up', 10)
```

100%|██████████| 3968/3968 [00:00<00:00, 31996.54it/s]

	name	artist
129	Night 1	Ta-ku
4193	Baby - Short Version	Girls of the Internet
3159	Asdikte Akal - Yugen Blakrok Remix	Mdou Mocrat
1992	Cruel Summer - Part I (feat. Zampera & Muttokfunk)	North of Loreto
1577	sundays	Grmmr.126
1013	Before the Sun	Dr. Dundiff
3824	Slow Gaze	SASAF
2542	Warm Flicker	rocomoco
534	Hold On	Axel Boman
1329	Know Pain, Know Gain (Ode To Beatmojo)	Hubert Daviz

# Recommendations

- Use the best model to predict songs in other playlists
- Use recommenders in conjunction with each other to find music that's closely related to your favorite songs
- Spotify can employ different techniques at different times in the backend,
  - Running different models and recommender systems on a playlist level as well as on the song level



# Suggestions

- We could also implement this on a smaller sample size of songs, thus will impact model performance if necessary
- To further increase model performance:
  - Implement a grid search on all models to discover if higher model performance is probable.
  - Use on a smaller dataset

# Next Steps

- One can run a cumulative recommendation for every song in a given playlist.
- Utilize Spotify deep audio analysis & neural networks.
  - In-depth & complex information about tracks
  - An analysis of this type will be based on the actual audio samples of songs.
  - This will lead to a much deeper analysis & model-building methodology.
- Automate radio stations based on playlists or most played songs from the playlist.

Questions?