Building Spotify Playlists Using Machine Learning

Group 9

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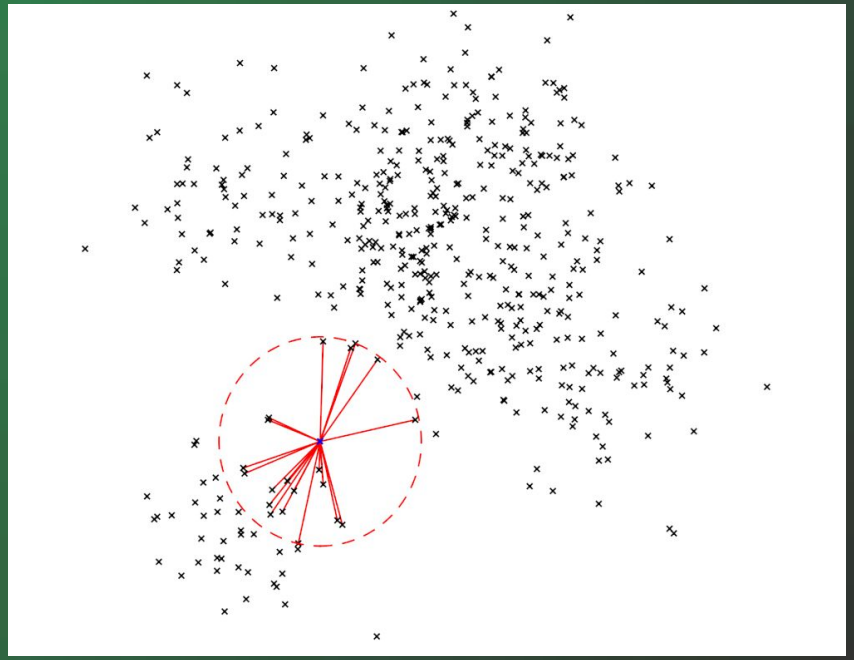
The Problem

- We are trying to create a recommended playlists with songs that have similar features to a single song or songs in a playlist songs
- Song recommendation is used by several digital music platforms such as Spotify®, Deezer, iTunes
- Challenging part: there are no labels for the songs which shows the user’s preference.
- So, we approach this problem with three different models:
    - Classification - kNN, Random Forest
    - Regression - Linear Regression

k-Nearest Neighbours

- Suitable and basic algorithm for the recommendation task since there are no labels in the set.
- For the playlist that we constructed with kNN, we took the nearest 25 songs by looking at their distances.



Results of kNN

	BAŞLIK		SANATÇI
♡	STARGAZING	EXPLICIT	Travis Scott

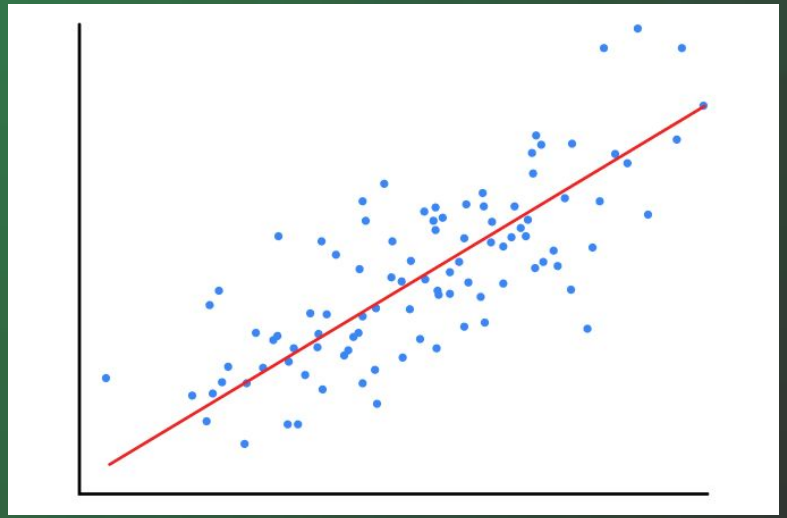
Input song

	BAŞLIK		SANATÇI	ALBÜM
♡	All Of The Lights	EXPLICIT	Kanye West	My Beautiful Dark Twisted Fant...
♡	11 Minutes (with Halsey feat. Travis Barker)	EXPLICIT	YUNGBLUD, Halsey, Travis Barker	11 Minutes (with Halsey feat. Tra...
♡	I'll Be Fine	EXPLICIT	Juice WRLD	Goodbye & Good Riddance
♡	Love It If We Made It	EXPLICIT	The 1975	A Brief Inquiry Into Online Relati...
♡	Welcome To The Party	EXPLICIT	Pop Smoke	Meet The Woo
♡	God is a woman	EXPLICIT	Ariana Grande	Sweetener
♡	Dear my friend (feat. Kim Jong Wan of NELL)	EXPLICIT	Agust D, Kim Jong Wan	D-2
♡	Kiss	EXPLICIT	Lil Peep	Kiss
♡	All I Do Is Win (feat. T-Pain, Ludacris, Snoop...	EXPLICIT	DJ Khaled, Ludacris, T-Pain, Sn...	Victory
♡	It's Been Awhile	EXPLICIT	Staind	Break the Cycle
♡	UCLA	EXPLICIT	RL Grime, 24hrs	NOVA
♡	'Till I Collapse	EXPLICIT	Eminem, Nate Dogg	The Eminem Show
♡	Snowchild	EXPLICIT	The Weeknd	After Hours
♡	Nothing Compares - Bonus Track	EXPLICIT	The Weeknd	After Hours (Deluxe)
♡	Bound 2	EXPLICIT	Kanye West	Yeezus
♡	Bugatti	EXPLICIT	Ace Hood, Future, Rick Ross	Trials & Tribulations

Recommended playlist

kNN + Linear Regression

- To assign labels to songs, we used kNN and used the 5000 nearest neighbours
- Relevance score was assigned to these 5000 songs, with the first song having 100 points and the last song with 97 points
- Based on a desired number of n, n songs with a relevance score closest to 100 are determined and a playlist of n songs was created



Results of kNN + Linear Regression

BAŞLIK	SANATÇI
Suite for Cello Solo No.1 in G, BWV 1007: 6. Gigue	Johann Sebastian Bach,

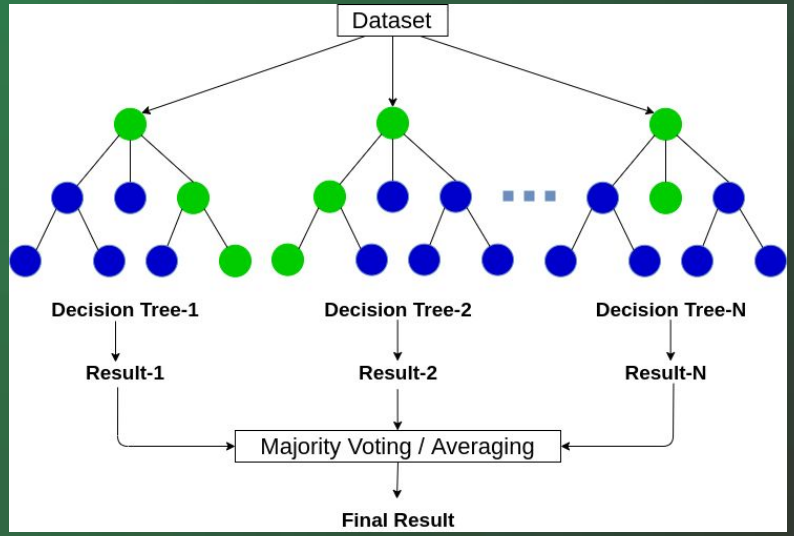
Input Song

	TITLE	ARTIST
♡	Phir Kabhi (From "M.S.Dhoni - The Untold Story")	Arijit Singh
♡	Contador de Reencontros - Ao Vivo	Gusttavo Lima
♡	Resala Men Taht El Maa Live Record	Abdel Halim Hafez
♡	Falstaff / Act 2: Siam pentiti e contriti...Reverenza	Giuseppe Verdi, Robert Bowman, Michael...
♡	Symphony No. 2 in C minor "Resurrection": V. Im Tempo des Sche...	Gustav Mahler, New York Philharmonic, B...
♡	Contador de Reencontros - Ao Vivo	Gusttavo Lima
♡	Symphony No. 2 in C Minor "Resurrection": V. Finale. Im Tempo d...	Gustav Mahler, Leonard Bernstein, New Y...
♡	Symphony No. 2 in C Minor "Resurrection": V. Finale. Im Tempo d...	Gustav Mahler, Bruno Walter, New York P...
♡	Mistake (Live At The Berlin Jazz Festival - 1978)	Fela Kuti
♡	Burn Down The Mission (Incl. My Baby Left Me / Get Back)	Elton John
♡	Symphony No. 7 in C Major, Op. 60 "Leningrad": I. Allegretto	Dmitri Shostakovich, Arturo Toscanini
♡	Symphony No. 3 in D Minor, Part I: I. Kräftig, Entschieden - Rema...	Gustav Mahler, Leonard Bernstein, New Y...
♡	Mulligan's Too	Gerry Mulligan Band
♡	Faker Lma Kont Ganby	Umm Kulthum
♡	He Loved Him Madly	Miles Davis

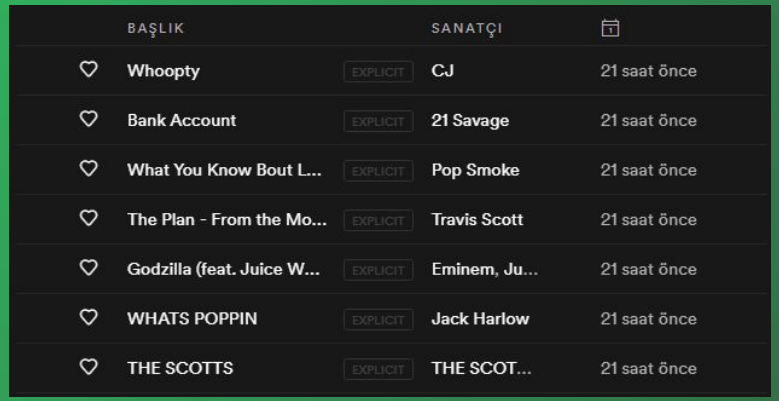
Recommended playlist

kNN + Random Forest Classifier

- Can be used in classification tasks
- Has the power to handle a large data set with higher dimensionality
- 5-fold Cross Validation is used to improve the performance
- To assign labels to songs, we used kNN and used the 5000 nearest neighbours



Results of kNN + Random Forest Classifier



	BAŞLIK		SANATÇI	
♡	Whoopty	EXPLICIT	CJ	21 saat önce
♡	Bank Account	EXPLICIT	21 Savage	21 saat önce
♡	What You Know Bout L...	EXPLICIT	Pop Smoke	21 saat önce
♡	The Plan - From the Mo...	EXPLICIT	Travis Scott	21 saat önce
♡	Godzilla (feat. Juice W...	EXPLICIT	Eminem, Ju...	21 saat önce
♡	WHATS POPPIN	EXPLICIT	Jack Harlow	21 saat önce
♡	THE SCOTTS	EXPLICIT	THE SCOT...	21 saat önce

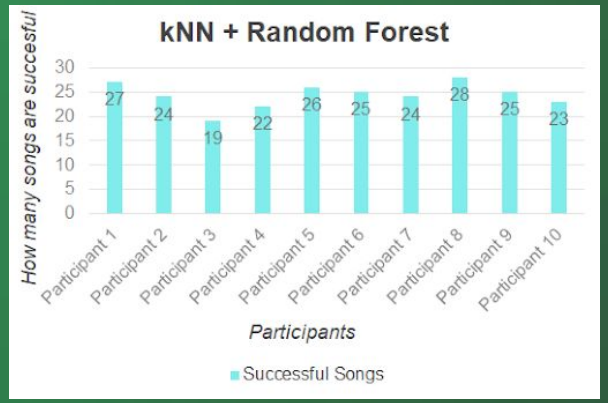
Input playlist

	BAŞLIK		SANATÇI	
♡	Breaking Me		Topic, A7S	16 saat önce
♡	FIND MY WAY	EXPLICIT	DaBaby	16 saat önce
♡	Hot (Remix) [feat. Gunn...	EXPLICIT	Young Thu...	16 saat önce
♡	ZEZE (feat. Travis Scott...	EXPLICIT	Kodak Blac...	16 saat önce
♡	Hot (Remix) [feat. Gunn...	EXPLICIT	Young Thu...	16 saat önce
♡	Faucet Failure	EXPLICIT	Ski Mask T...	16 saat önce
♡	NASA		Ariana Gra...	16 saat önce
♡	Yo x Ti, Tu x Mi		ROSALÍA, ...	16 saat önce
♡	Hot (Remix) [feat. Gunn...	EXPLICIT	Young Thu...	16 saat önce
♡	The Truth		Kygo, Valer...	16 saat önce
♡	Lights Up		Harry Styles	16 saat önce
♡	In My Bed		Rotimi, Wale	16 saat önce
♥	Envy Me	EXPLICIT	Calboy	16 saat önce

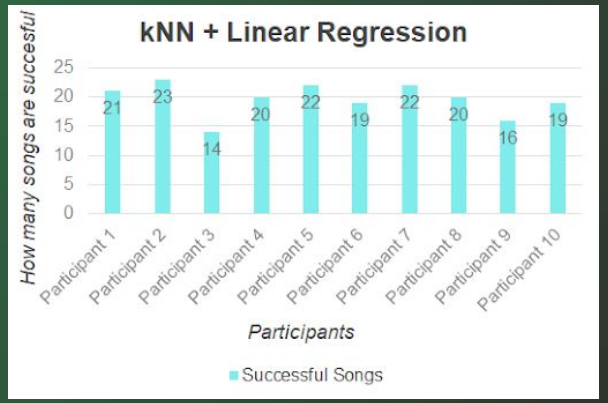
Recommended playlist

Results of Surveys

Survey of kNN



Survey of
kNN + Random Forest



Survey of kNN +
Linear Regression

Discussion

- KNN still performed well although it gives better score when merged with classifier or regression
- Random Forest Classifier performed well when we used a larger dataset.
- Linear Regression is faster in training than RFC

Why our Dataset is sometimes problematic?

	danceability	energy	valence	tempo	liveness	popularity
Enter Sandman	0.577	0.828	0.604	123.257	0.0581	80
DNA	0.598	0.775	0.687	129.819	0.0677	72

Even though songs **look like** they are similar,

actually they are **not**

Conclusion

- KNN was a good choice for this task although some minor errors
- There are not any predetermined labels
- Linear Regression was the best among participant’s score

Bonus: Recommended Playlist for Furkan Özden

BAŞLIK	SANATÇI
In the Ghetto	Elvis Presley
London Calling	The Clash
Hard to Say I'm Sorry	Chicago

Input Playlist

BAŞLIK	SANATÇI
Astral Weeks - 1999 Remaster	Van Morrison
Everything I Own	Bread
Bleecker Street	Simon & Garfunkel
Lay Back in the Arms of Someone	Smokie
Xanadu	Olivia Newton-John, Electric ...
All The Love In The World	The Outfield
Adia	Sarah McLachlan
Tough Little Boys	Gary Allan
I Do (Cherish You)	98º

Recommended playlist

https://sptfy.com/5IsW

Double Bonus: Recommended Playlist for Ercüment Çiçek

BAŞLIK	SANATÇI	ALBÜM
Bliss	Muse	Origin of Symmetry
I Know EXPLICIT	Placebo	Placebo
Belki De Dönerim	Sertab Erener	Belki De Dönerim
Black Moon Spell	King Tuff	Black Moon Spell
We Are The People	Empire of the Sun	Walking On A Dream

Input Playlist

Collapse (feat. Memorecks)	Zeds Dead, Memorecks	Somewhere Else
Far From Home EXPLICIT	Five Finger Death Punch	War Is the Answer
Homewrecker	MARINA	Electra Heart (Deluxe)
Let Down	Radiohead	OK Computer
Black Hole Sun	Soundgarden	Telephantasm
I Need Your Love	Boston	Walk On
Bridges	Broods	Evergreen
Why Try	Ariana Grande	My Everything (Deluxe)
You Know You're Right	Nirvana	Nirvana
Crumble	Dinosaur Jr.	Beyond
Prelude 3.0	Slipknot	Vol. 3: The Subliminal Verses
Desert Cruiser	Truckfighters	Gravity X
The Dope Show EXPLICIT	Marilyn Manson	Lest We Forget - The Best Of
Hold On, Hold On	Neko Case	Fox Confessor Brings The Flo...
Ringling Road	William Clark Green	Ringling Road

Recommended playlist

https://sptfy.com/5ltg