Music Analysis

DA-rwin

DA Project Report

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I) Literature review:

1) LEARNING A METRIC FOR MUSIC SIMILARITY

Source:https://www.slaney.org/malcolm/yahoo/Slaney2008-MusicSimilarityMetricsISMIR.pdf
Published Year: 2008.
By: Adithya S Oasis - PES2201800007

This paper describe five different principled ways to embed songs into a Euclidean metric space.
In particular, we learn embeddings so that the pairwise Euclidean distance between two songs reflects semantic dissimilarity.
This allows distance-based analysis, such as for example straightforward nearest-neighbor classification, to detect and potentially suggest similar songs within a collection.
k-nearest neighbour classification is used for identification.
Here the paper assumes that if the metric space is “good” then similar songs will be close together and kNN classification will produce the right identification.
Extraction of song-features are done using echo nest analyze api which provides the 18 features needed to characterize global properties of the songs.
The api splits a song into segments, each a section of audio with similar acoustic qualities. These segments are from 80ms to multiple seconds in length and for each of these segments, the features are checked.
After mapping the features onto the euclidean space, they used mahalanobis distance to find the similarity between the different songs.

This paper defines the different algorithms that can be used to learn the semi-definite matrix needed to find the mahalanobis distance.
The different algorithms touched upon in the paper were Linear discriminant analysis(LDA),Relevant component analysis(RCA),neighborhood component analysis(NCA),large-margin nearest neighbor(LMNN) and whitening.
Where LDA,RCA and whitening were algorithms based on second order statistics, NCA and LMNN were algorithms based on optimization. These algorithms also used meta-data to tune their learnings.
They found out that applying whitening before any algorithm improved their performance. It was also shown that RCA gave the best result within the experimented algorithms.
We plan on using the techniques given here to extract the feature vectors from our music data set and use whitening and RCA for finding the needed similarities as proved efficient in the following paper.

2) MUSIC DATA ANALYSIS: A STATE-OF-THE-ART SURVEY MUSIC DATA

Source:https://www.researchgate.net/publication/268525089_Music_Data_Analysis_A_State-of-the-art_Survey
DATE PUBLISHED: November 2014
By : Dhruv Sharma - PES2201800115

Music data analysis is widely used for automated prediction or recognition of various musical aspects like musical style, genre, mood, emotion etc along with predicting the success of a song.We are finding & extracting & performing various operations for prediction.

We are using this paper in our project for 2 main purposes:-

1) Recognition of musical aspects

Genre classification/prediction:-
The approach for the application is statistical classification method which consists of KNN, SVM, Random Forest, Naive Bayes and J48 Decision Tree which are used for large scale music genre classification. In order to capture the temporal domain, using six motley combinations of Echonest features, statistical moments were calculated. In another attempt, a kNN classifier combined with SMBGT was used for music genre classification of symbolic music.

2) Classification

MUSIC CLASSIFICATION:-

Many areas of research in MIR involve music classification (genre speech segmentation, emotion chord recognition etc.) The fundamental tasks of music classification includes analysing
musical data collections (called instances). which also include metadata about the instances . This musical data collection undergoes feature extraction and then , Machine Learning
algorithms (classifiers and learners) learn to associate feature patterns of instances with their classes for music classification. JMIR, a powerful, flexible and accessible software has been developed to meet the need for standardized MIR research software in order to design, share and apply a wide range of automatic music classification technologies it also uses machine learning techniques to build classification models automatically.

All in all this paper was attempted to offer a state-of-the-art survey
of research efforts involving music data analysis. The objective is to investigate and report various analytical approaches to classify & predict various characteristics of music

3) INFERRING DESCRIPTIONS AND SIMILARITY FOR MUSIC FROM COMMUNITY METADATA

Surce:http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.131.1237&rep=rep1&type=pdf
Date Published: March 2009
By: Abishai Ebenezer - PES2201800038

This paper deals with unsupervised learning of text profiles from unstructured text data like metadata. As we can observe from the dataset we have chosen, metadata of the music files contain various information like artist, genre, release date etc. This metadata could leverage the use of various data analysis and machine learning techniques to create meaningful insights into the music dataset that has been chosen by the team.

In this paper, the authors have proposed a method of unsupervised learning of text profiles of the music. Also, they have suggested a formal method for analyzing the data of the profiles and use them to find similar artists.

To accomplish this task, the technique of natural language processing(NLP) is used. Using NLP, and after analyzing the features of a particular song, a textual summary is produced. This textual summary is then used to compute similarity between artists.

As a part of the NLP, various algorithms like N-grams, Part of speech tagging, noun phrase extraction etc are used. These are simple noise reduction techniques that are used for a better search of similar artists/songs. This also leads to adjective term extraction. Adjectives contain a large amount of generalized content about the artists. The adjectives help speed learning and reduce complexity.

After we obtain our textual summary, we use TF-IDF for scoring each summary. As a last step of the process, we use peer to peer similarity to find out the score of artist similarity. We then test the setup using various scoring metrics like the TF-IDF scoring metric and the Gaussian Scoring Metric. Using these metrics , various meaningful data visualizations could be shown using graphs and similarity matrices.

II) EDA:

=> The dataset contains various music parameters such as acousticness, tempo etc by which characterize a song. Each song has a unique id.

=> The dataset has no null values

=> The dataset is already preprocessed.

=> We will be adding an extra column for each song. Each entry in that column will contain the specifics of the lyrics of the song.

=> Another column we are looking to add is the genre column, where we would classify each song to a particular genre

=> We found that a scatter plot of loudness versus duration(ms) contains outliers.

=> We also found that loudness and energy are highly correlated i.e they have high positive correlation coefficient = 0.8.

=> We also found that the number of songs per year uploaded onto spotify has largely seen an increase between 1920 to about 1950 and has largely remained constant till 2020.

=> We also observed that speechiness and popularity have a correlation coefficient almost equal to 0, which could infer that speechiness is not related to popularity

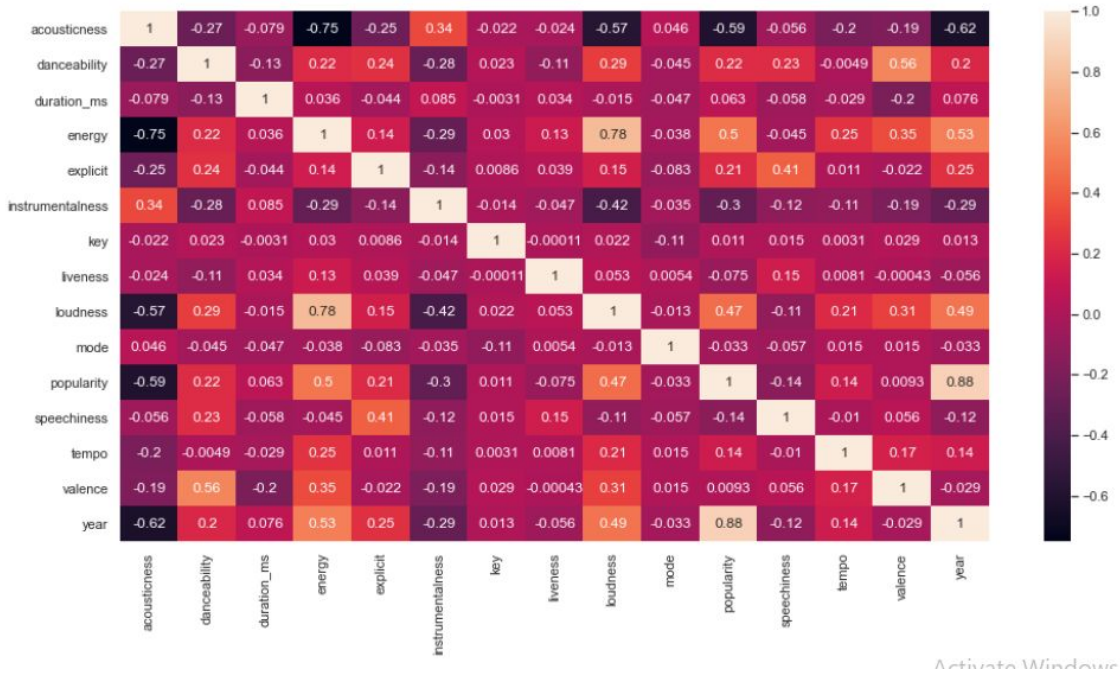
=> We also observed that energy and acousticness have high negative correlation = -0.8

III) Problems that we wish to solve:

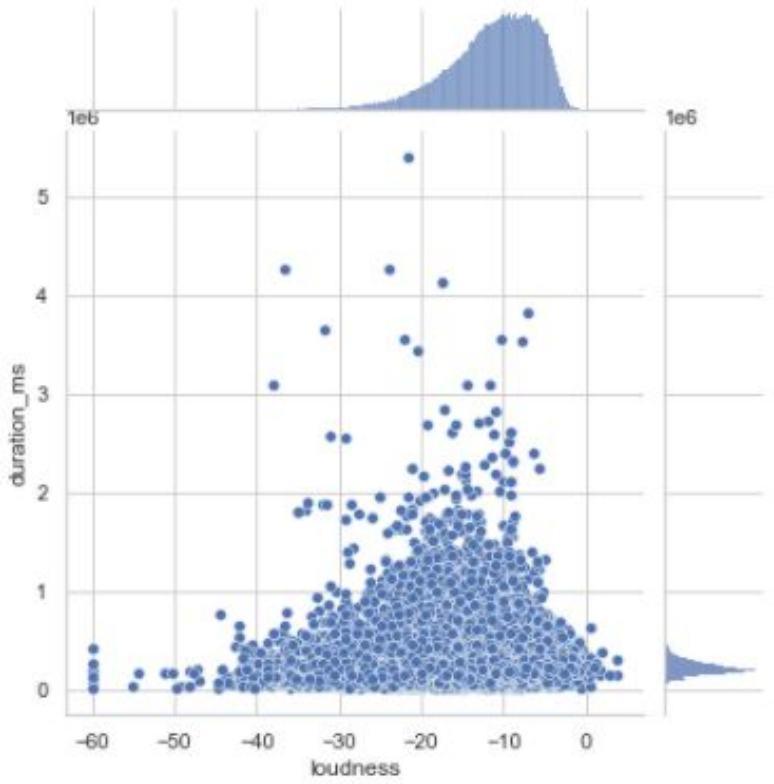
1. genre classification
2. correlation between various variables
3. Predict the popularity of a song based on various music parameters
4. Recommending similar songs based on a group of music similarities
5. find similar songs based on lyrics

IV) Visualizations:

Heat map:



Scatterplot for loudness vs duration:



Histograms for the data: