University of Warsaw

Faculty of Economic Sciences

Ewa Włodarczyk Karolina Sierocka Tymoteusz Mętrak

Album N°: 432571 Album N°: Album N°:

**Which type of song is the most popular: happy, sad, angry or relaxed? (mood classification of song lyrics from Billboard Hot 100)**

Project for

Text Mining and Social Media Mining course

Project written under the supervision of

Dr. Hab. Jacek Lewkowicz

from Department of Political Economy

WNE UW

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**INTRODUCTION**

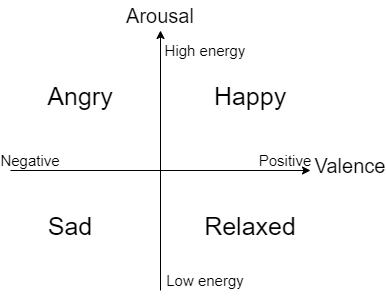
Listening to music can influence our mood, which can then in turn impact our behavior. But what kind of music are we listening to? The sentiment analysis of popular songs’ lyrics done by Napier and Shamir (2018) shows a significant increase in anger and sadness and a decrease in joy in the tone of popular music from 1951-2016. Still, in the same study, while analyzing tone expressed in lyrics, most popular genres, apart from rap, scored higher in joy than in sadness and anger. Additionally, as pointed out by Schellenberg and Von Scheve (2012) popular music has changed over the years to involve more mixed emotional cues.

The purpose of the project is to find out which type of music is the most popular: happy, sad, angry or relaxed based on mood classification of song lyrics from the Billboard Hot 100. Our main assumption, taking into account the fact that most popular genres are: pop music, which mood is usually happy, and rap/hip-hop, which mood is rather angry, would be that most popular types of music have happy or angry lyrics. However even looking at the title of the current (written on the 8th of November 2023) number 1 song from the Billboard Hot 100 - “Is it over now?”, which clearly signals a sad tone, we can see that deciding which type of music is the most popular will pose a greater challenge.

The organization of the paper is as follows. The related work and background of the research is discussed in Chapter I, description of the data used is in Chapter II, proposed methodology is presented in Chapter III, discussion about the results, model evaluation and comparison is showed in Chapter IV, which is then followed by conclusion.

**CHAPTER I. BACKGROUND**

Recently, several studies have been concentrated on a lyric-based mood classification through natural language processing techniques. In most of them mood categories are derived from the Russell’s (1980) circumplex model, which maps emotions across two dimensions: valence and arousal, as shown in Figure 1. In this study, we will also use Russel's model, but in a simplified version, classifying song lyrics into four mood categories: Happy, Sad, Angry and Relaxed. As there are more than two classes and each data point can only be assigned to one class this will be a multi-class classification.

Fig. 1. Simplified Russel's circumplex emotion model.

*Source:* Own study, based on: Russell J. (1980) A circumplex model of affect, Journal ofPersonality and Social Psychology, vol. 39, 1161–1178.

Mood classification is performed with varying success using different machine learning processes and algorithms. Akella and Moh (2019) achieved an accuracy of 71% using Convolutional Neural Network. Similarly, Abdillah, Asror and Wibowo (2020) created a Recurrent Neural Network, which can produce an accuracy of 91%. Siriket, Sa-ing and Khonthapagdee (2021) however, instead of using deep learning techniques, used a boosting algorithm with 89% accuracy. This proves that multi-class classification can be successfully performed using not only neural networks, but also simpler machine learning techniques, which will be used in this study.

**CHAPTER II. DATASET**

Two distinct datasets were used for this analysis. The first one is from Spotify and it contains data of around 10 thousand songs released from 1999 to 2019. Apart from lyrics it also consists of important song features: energy and valance, which determine the mood label in accordance with Russel's model. For both traits, their values range between 0.0 and 1.0, with marks below 0.5 indicating low energy and a negative sound and above 0.5 - high energy and a positive sound. After applying mood labels there are 4464 happy, 4499 angry, 1248 sad and 463 relaxed songs. This dataset will be used for training, evaluating and choosing the best mood classification model.

The second dataset is from Billboard Hot 100 and it holds data of around 5 thousand songs that have charted from 1999 to 2019. Apart from lyrics it also consists of songs’ peak positions and the number of weeks they have been on the chart. Track popularity is calculated based on those two metrics. The exact equation is as follows:

where 87 is the highest number of weeks a song has been on the chart. The sum is multiplied by 50, so that popularity can take values between 0 and 100 (from least to most popular). On this dataset, after mood labels are applied to songs by the best mood classification model, analysis will be performed to determine which type of song is the most popular.

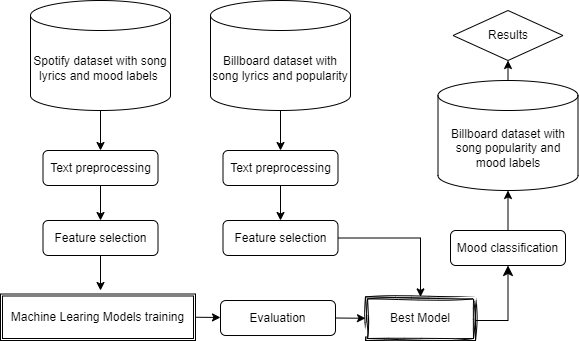
Additional data preparation on both datasets included text preprocessing: removing special characters, changing contraction to their multi-word forms, replacing informal writing with known semantic replacements and reducing whitespace. After that, stop words were removed and Porter Stemming Algorithm was applied to reduce words to their root form. Figure 2 shows the most common terms used in each mood category. A lot of words are common across all categories, for example: “like”, “know”, “love”, “just”, ”get” or “can”. However, words like “never” and “feel’ are more common in negative groups. Also “but” is present more frequently in categories associated with low energy.

Fig. 2. The top 10 of the most common terms in each mood category

*Source:* Own study, based on data from Spotify

**CHAPTER III. MODELING**

After text preprocessing, lyrics data was converted into a Document Term Matrix, where scores were assigned using Term Frequency - Inverse Document (TF-IDF) technique. This gives terms a higher score if they appear frequently in a particular document, but rarely across the entire corpus and it helps to balance off terms’ frequency and importance. The full workflow of this study can be seen on Figure 3. Before applying any machine learning models an additional feature selection was performed. Later, several traditional machine learning algorithms such as Naive Bayes, Decision tree and Random forest were used for text classification with varying results.

Fig.3. The overall process of the proposed research

*Source:* Own study

**CHAPTER IV. results**

**conclusion**

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