# ANALYSIS OF MUSICAL DATA WITH PYTHON

*Submitted in partial fulfillment of the requirements for the course*

# CSE3020 - Data Visualization

In

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# Problem Statement

Music is a powerful language to express our feelings and in many cases is used as a therapy to deal with tough moments in our lives. Emotions and moods can be easily reflected in music; when we are doing sports, we tend to listen to energetic music, similarly when we are anxious or tired a nice relaxed song can help us to calm down. Music plays an important part in our lives and what music we are listening to depends on the mood we are in at that time, which is why segregating our music by moods will be helpful for listeners all around the globe. That's why we are trying to figure out how we can determine which is the mood of a specific track.

# Introduction

## Motivation

The aim is to develop a method for automatically classifying music by mood. Everyone feels the effect of music. It is seen that young adults are more exposed to music by Micheal Jackson, Pink Floyd, Eminem, Rihanna, Taylor Swift, Shakira as well as Bollywood numbers along with Sufi songs and romantic songs. Listening to music sometimes makes some people leave their seats and start dancing, on the other hand, some music may even make some people cry out their hearts. Some music pieces make a person happy, gushy, and think about their romantic partners. Some music pieces provide a feeling of calmness and peace. Not everyone takes the music the same way. For some people, a song may generate happy feelings whereas for some it may evoke negative feelings. The lyrics of the song have the ability to influence the behavior of the person. By peeping in history, we can see that at times music was composed to inspire and motivate people to do some specific activities like dance, sing, march, or fight. So we can conclude that music plays an important role in our lives.

## Significance

Art and music are basic human functions. Humankind and art cannot function without one another. We have the burning desire to create, whatever it may be and however tiny or grand. The interaction with sound is unavoidable, either to make it or take pleasure in it. People have always found music significant in their lives, whether for enjoyment in listening, the emotional response, performing, or creating. Music has immense worth in our society.

Many researchers have done various surveys on young adults (ages ranging between 18 to 30 years) and the result has come out that music affects the thought, feelings, and actions of the person. Psychologists use various tools like the Big five inventory and CAC scale to measure the effect of the music of different genres on different personality traits.

## Scope and Applications

Music is an important entertainment medium. With the advancement of technology, the optimization of manual work has gained a lot of attention. Currently, there are many traditional music players that require songs to be manually selected and organized. Users have to create and update playlists for each mood, which is time-consuming. Some of the music players have advanced features like providing lyrics and recommending similar songs based on the singer or genre. Although some of these features are enjoyable for users, there is room to improve in the field of automation when it comes to music players. Selecting songs automatically and organizing these based on the user's mood gives users a better experience.

# Literature Survey

### Integration of Text and Audio Features for Genre Classification in Music Information Retrieval

*Robert Neumayer and Andreas Rauber {neumayer,rauber}@ifs.tuwien.ac.at Vienna University of Technology Institute of Software Technology and Interactive Systems*

The paper explains the nature of the text and audio feature sets which describe the same audio tracks. Proposal for the use of textual data on top of low-level audio features for music genre classification. Also, this shows the impact of different combinations of audio features and textual features based on content words.

Using the results of this paper, we shall be trying to incorporate changes in the retrieval of lyrical data of music in a more efficient manner.

### Interactive Music Rankings Visualization

*Leandro S. Guedes∗ Carla M. D. S. Freitas† Instituto de Informaa tica - Universidade Federal do Rio Grande do Sul Porto Alegre, Brazil*

This work presents a new interactive way to show and compare music rankings using the Sunburst technique. This reports a remote user survey that we performed to gather information about people's behavior regarding music. Their visualization makes it easier to collect information about artists and tracks, and also to compare the data obtained from the two major music rankings: Billboard and Spotify.

Using the various techniques mentioned in the paper, we will be incorporating various different methods to retrieve data and display them in an interactive manner.

**Analysis of a Social Data Visualization**

*Najla Aljabr, Ghadeer Alkalthm, Rawya bin Abdulrahman and Muneera Alhabdan*

The work analyses and discusses the characteristics of Youtube videos using tools like Tableau and Rapid miner. It uses the most famous youtube channels as the dataset. The result will help the many companies and businesses to select the right target and the segment for advertisements in order to increase the profit and the impact of the ads. K-means algorithm is used for the analysis of the cluster groups and the correlation coefficient is used to determine the results.

This paper focuses on the research of the platform Youtube in specific. However, our project revolves around the visualization of data from music charts sources such as Billboard. Unlike this paper, our complete focus would be upon the analysis via certain APIs from the music chart Billboard itself using Python.

**2018 IJERCSE 60: Classification of YouTube Data based on Sentiment Analysis**

*Shaila S.G, Prasanna MSM, Kishore Mohit Dayananda Sagar University, Bangalore, India.*

The paper deals with the analysis of the data on YouTube Videos. The user sentiments feature in the form of likes, dislikes, views, and comments were used for analysis. The study uses the linear regression classification approach in order to classify the data. The experiment has given accurate results which indicates that it is an influential practice and a key enabler for the social business.

Just like this paper, we shall be incorporating sentiment analysis in our project ourselves, by analyzing the leaps and drops in rankings accordingly and so on, as we progress in our attempt.

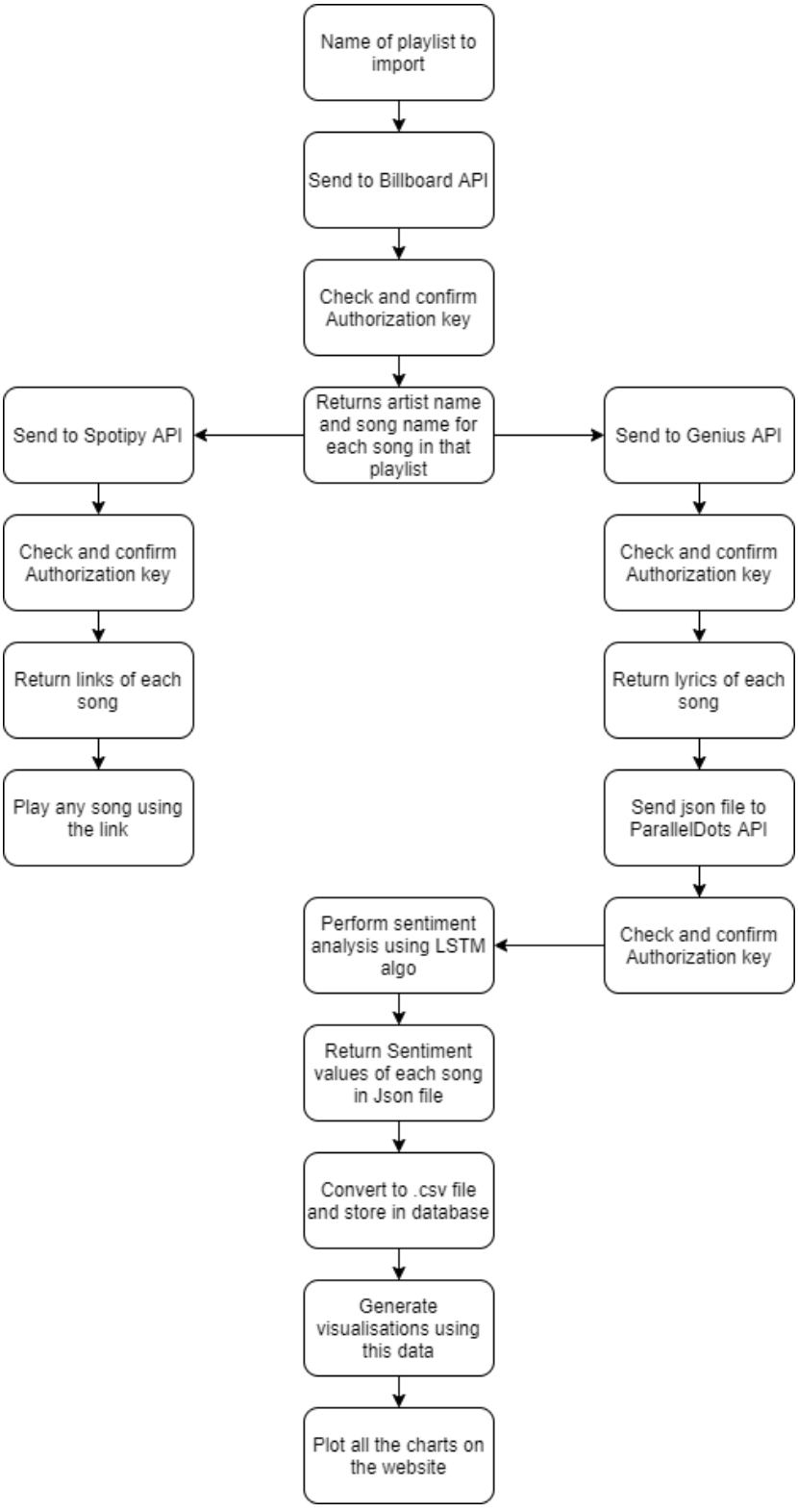
**The Streams of Our Lives: Visualizing Listening Histories in Context**

*Dominikus Baur, Student Member, IEEE, Frederik Seif ert, Michael Sedlmair, and Sebastian Boring*

In this design study paper, an overview of the field of music listening histories and their unique characteristics are shown as a type of personal data. It is describing the design rationale, data, and view transformations of LastHistory and is clearly presenting the results from both a lab and a large-scale online study. In our paper, we are using a data set of the music chart from a time period of approximately 20 years. Throughout the years, the taste in music of people has changed and by using the information from the given paper we shall try to achieve the trends especially related to this time.

# Implementation

## Architecture Diagram



## Algorithm

- START
- User selects name of playlist to import
- Name of playlist is sent to Billboard API
- Billboard API checks and confirms authorization key
- Billboard API returns artist name and song name for each song in that playlist
- The artist name and song name are sent to Genius and Spotify APIs
- Genius API checks and confirms authorization key
- Genius API returns lyrics of each song
- Genius API sends json file to ParallelDots API
- ParallelDots API checks and confirms authorization key
- ParallelDots API performs sentiment analysis using LSTM algorithm
- ParallelDots API returns sentiment values of each song in json file
- Json is converted to CSV file and stored in database
- Visualizations using this data are generated
- All the charts on the website are plotted
- Spotify API checks and confirms authorization key
- Spotify API returns links of each song
- Any song can be played using these links
- END

Emotion Detection API can accurately detect the emotion from any textual data. People voice their opinion, feedback, and reviews on social media, blogs, and forums. Marketers and customer support can leverage the power of Emotion Detection to read and analyze emotions attached with the textual data.

It uses Deep Learning powered algorithms to extract features from the textual data. These features are used to classify the emotion attached to the data. The API trains the classifier using Convolutional Neural Networks (Convnets) on a tagged dataset.

We have used the ParallelDots API which uses Long Short-Term Memory (LSTM) to perform sentiment analysis on each song in our playlists. LSTM can solve numerous tasks not solvable by previous learning algorithms for recurrent neural networks (RNNs). LSTM holds promise for any sequential processing task in which we suspect that a hierarchical decomposition may exist, but do not know in advance what this decomposition is.

Since LSTMs are effective at capturing long-term temporal dependencies without suffering from the optimization hurdles that plague simple recurrent networks (SRNs), they have been used to advance the state of the art for many difficult problems. This includes handwriting recognition and generation, language modeling and translation, acoustic modeling of speech, speech synthesis, protein secondary structure prediction, analysis of audio, and video data among others.

The Long Short-Term Memory architecture was motivated by an analysis of error flow in existing RNNs which found that long time lags were inaccessible to existing architectures because backpropagated error either blows up or decays exponentially.

An LSTM layer consists of a set of recurrently connected blocks, known as memory blocks. These blocks can be thought of as a differentiable version of the memory chips in a digital computer. Each one contains one or more recurrently connected memory cells and three multiplicative units – the input, output, and forget gates – that provide continuous analogues of write, read and reset operations for the cells. The net can only interact with the cells via the gates.

### Complexity Analysis

For LSTM, the computational complexity is **O(W),**

Where,

$$W = 4IH + 4H2 + 3H + HK ;$$

*I - Number of Inputs*

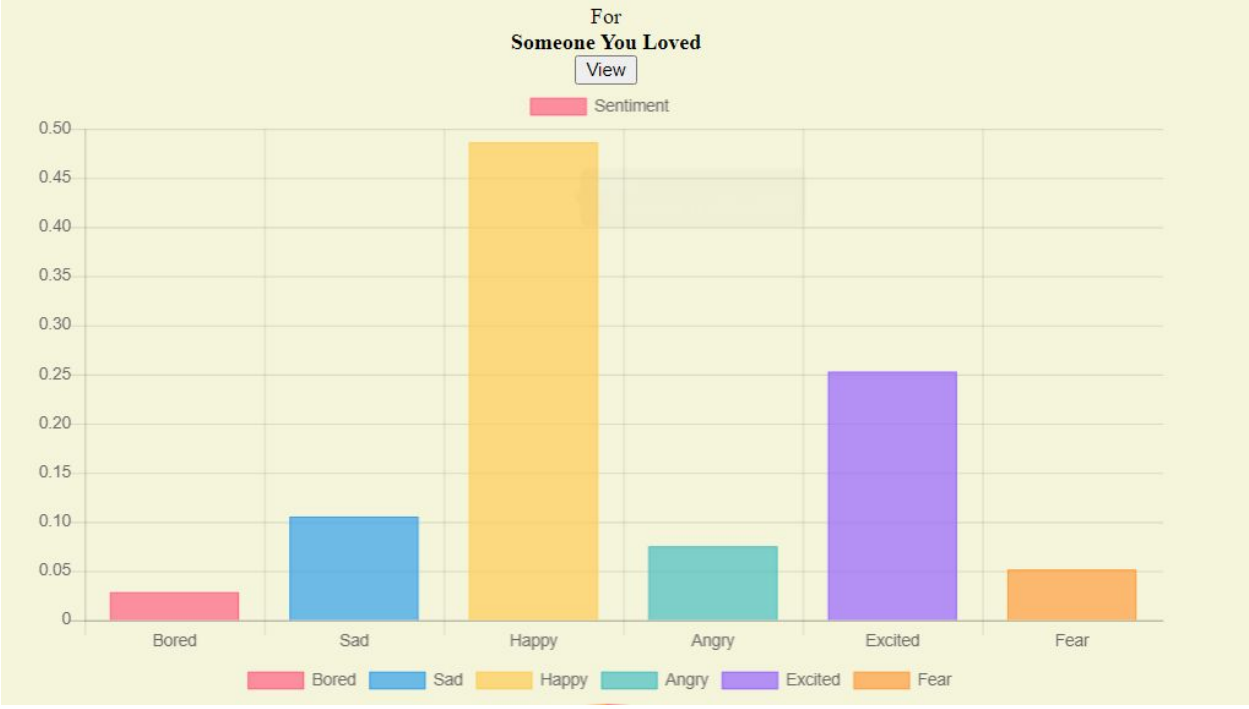
*K - Number of Outputs*

*H - Number of cells in Hidden Layer*

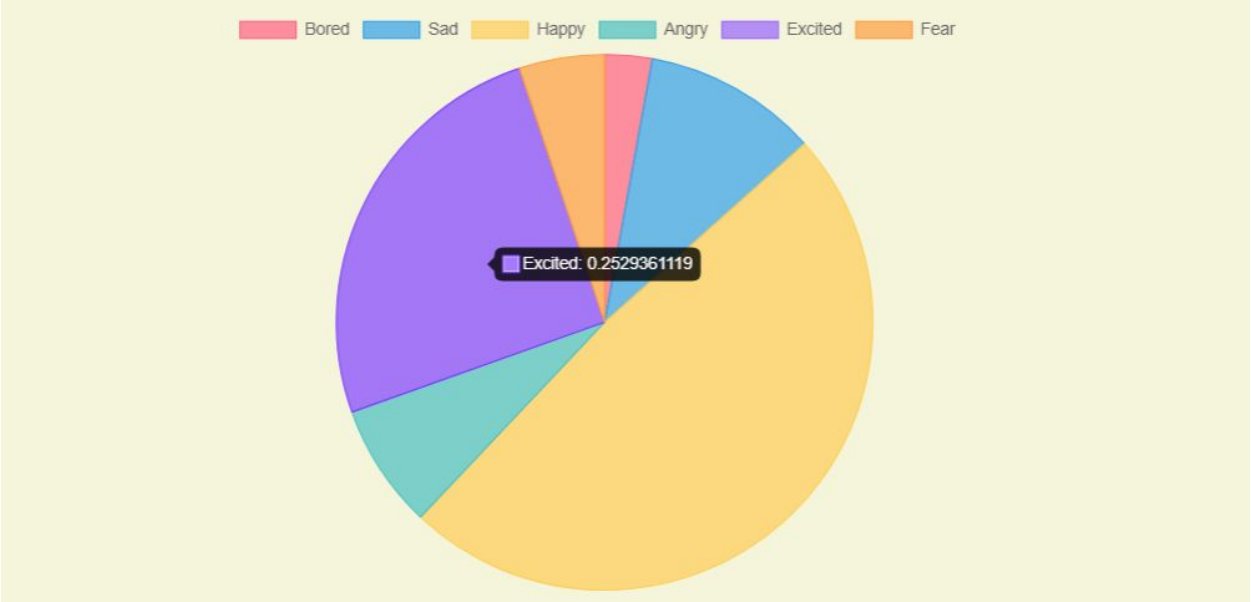
## Result Analysis

Below, we have shown the visualizations and analysis of one song - Someone You Loved

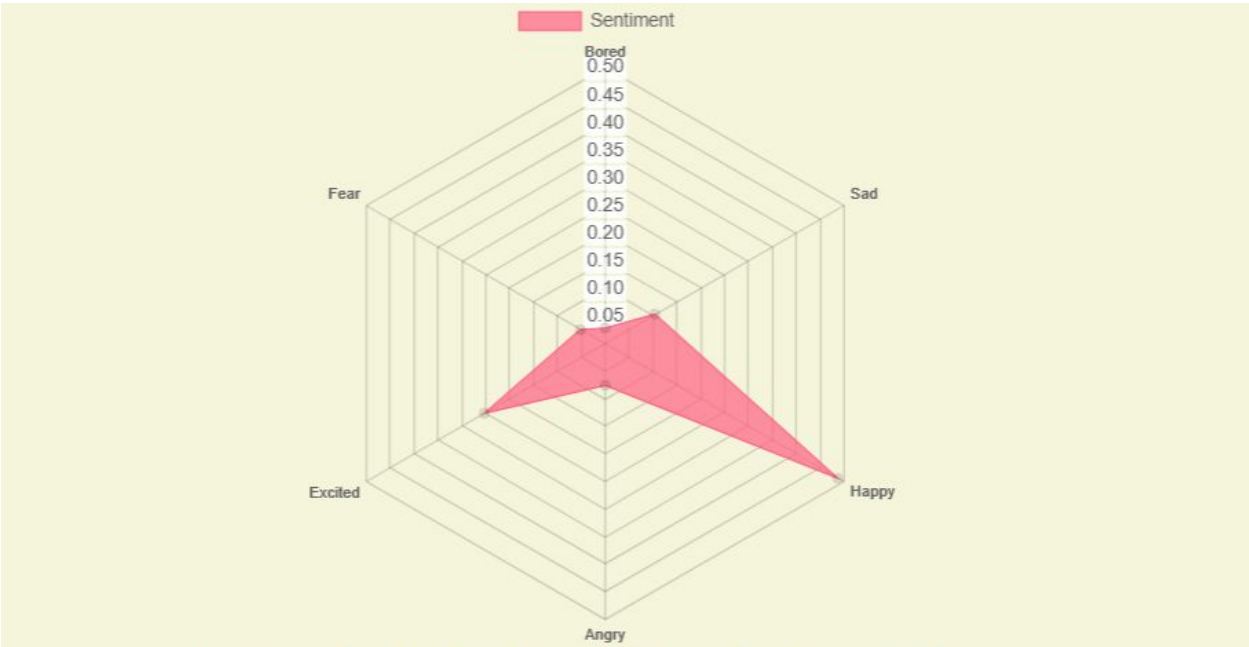
1) **Bar Plot**



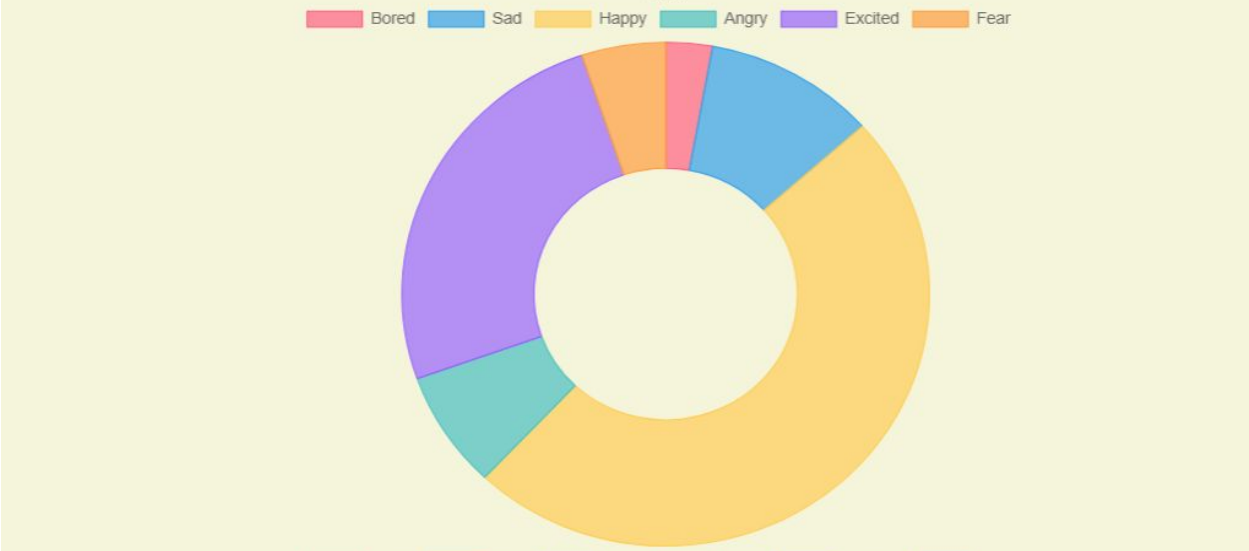
## 2) Pie Chart



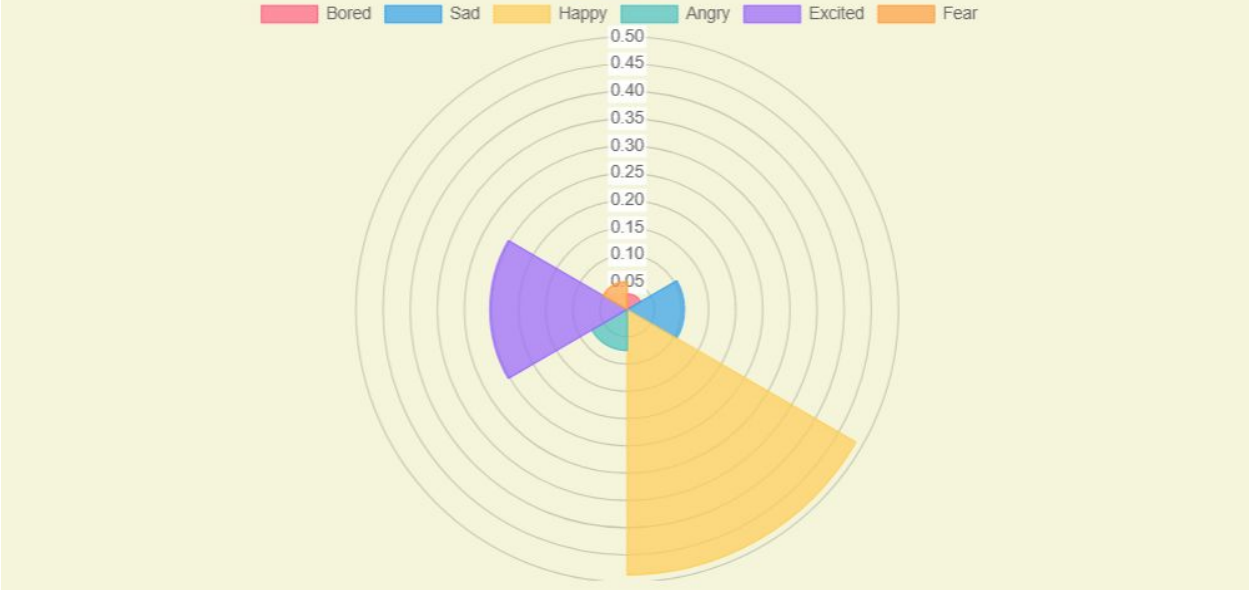

## 3) Radar Plot



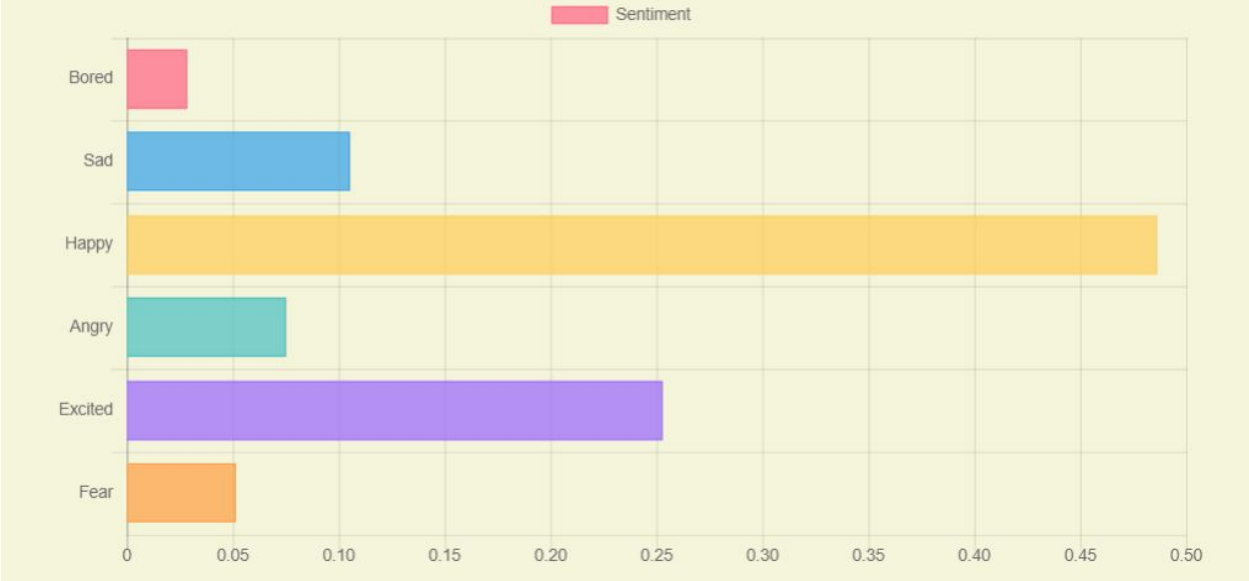
## 4) Doughnut Chart




## 5) Polar Plot



## 6) Horizontal Bar Plot




## 7) Line Chart

# Future Work

In our future work, we may review different methods for classification of musical mood on the basis of genres, social tags, and audio. We can also add more visualizations to our project such as making a graph of all songs with the same dominant mood comparing the extent of the emotion in these songs. We can also create various playlists containing songs with the same dominant mood. Since we have also included playlists of the most popular songs, we can visualize them according to the mood which will let the user see songs of which mood is trending at that time.

We can analyze and plot other features of the songs such as lyricality, flow, rhyming scheme, distribution of verses and chorus, etc, which can help young, upcoming artists to study the industry better and understand what makes a song popular among the common folks, so they can work on improving their songwriting skills to produce better music for their target audience.

# References


**[1]** Foote, J. (1999), *An overview of audio information retrieval*, Volume 7(1), Singapore: Multimedia Systems

**[2]** Lidy, T., and Rauber, A., 2005, September. *Evaluation of feature extractors and psycho-acoustic transformations for music genre classification*. In *ISMIR* (pp. 34-41).

**[3]** Logan, B., Kositsky, A., and Moreno, P., 2004, June. *Semantic analysis of song lyrics*. In 2004 IEEE International Conference on Multimedia and Expo (ICME)(IEEE Cat. No. 04TH8763) (Vol. 2, pp. 827-830). IEEE.

**[4]** Mahedero, J.P., MartÍnez, Á., Cano, P., Koppenberger, M. and Gouyon, F., 2005, November. *Natural language processing of lyrics.* In Proceedings of the 13th annual ACM international conference on Multimedia (pp. 475-478).

**[5]** Rauber, A., Pampalk, E., and Merkl, D., 2002. *Using psycho-acoustic models and self-organizing maps to create a hierarchical structuring of music by sound similarity*. na.

**[6]** Tzanetakis, G., and Cook, P., *Marsyas: A framework for audio analysis. Organized Sound* 4 (3), 169–175 (2000).