An Empirical Prediction Methodology for the Emotional Behaviors with the Impact of Musical Features

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Abstract: Music is the combination of melody, linguistic information and singer's mental realm. As popularity of music increases, the choice of songs also varies according to their mental conditions. The mental conditions reach the supreme bliss to melancholy strain based on the musical notes. Majority mostly prefer songs, which satisfy their current state of mind. Pragmatic analysis in music by computer is a difficult task, as emotion is very complex and it camouflages the real situation. Hence, In this paper , trying to classify the songs based on the features of music which helps to classify the emotion more easily. Music feature extraction is done using Music Information Retrieval (MIR) toolbox. The dataset consists of 100 of Hindi songs of 30 seconds clip and later classify the emotion based on Naïve Bayes classification method using Weka API.

Keywords: Data Mining; Naïve Bayes; MIR Toolbox; Weka Tool

I. INTRODUCTION

Music is a language that does not speaks in words but speaks in emotion. Every music has an emotion, which attracts people for listening that song more frequently. Music therapy also have been introduced in today's world, which helps people from stress relief to mental, emotional, and behavior problems. Majority of people prefer song, which satisfy their mental condition. Music is everywhere in the world, irrespective of the language. People love to listen songs, which give them mental relaxation. Every song is different from other songs through their features, which make them attractive to people. Hence, in this paper, we are focusing on songs of Bollywood industry, which linguistically tend to use colloquial dialect of Hindi-Urdu and nowadays even Hindi and English. We are trying to extract features of those songs using the MIR (Music Information Retrieval) Toolbox, which has been used with MATLAB tool. For the Classification purpose, we have chosen a dataset of 100 songs, which consists of 30-second audio clip. The emotions are classified by the model which is a two-dimensional circular space named Russell's Circumflex Model ,

where vertical axis denotes calm or exciting emotion which is also known as arousal and horizontal axis denotes positive or negative affectivity which is also known as valence

II. LITERATURE REVIEW

Research area in music has been introduced decades before; it has become important field in research . There were many researches done, like on music classification and many more. The process of music classification has also introduced many sub areas like classification based on genre, artist, lyrics [9], audio, user ratings and social tags . Each areas have its own pros and cons. Emotional wavelength of Music has spread over into wide area ranges. The interrelationship between human and emotion made a new research topic. For classifying songs based on emotion there were many models developed, like Thayer's model, Russell's Circumplex Model [12]. In Fig 1, it explains The Russell's Circumplex model is a two dimensional diagram which describes the variety of emotions ,which helps to classify the songs based on them.
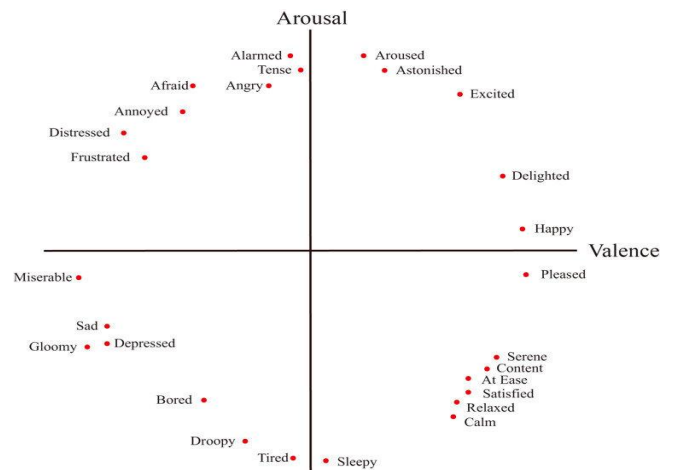

Fig 1. Russell's Circumplex Model

The classifications of emotion need not be based only models, but also the features of songs. For the features of song, we need tools for extracting, like JAudio [8], MIR Toolbox [1], [12].The MIR TOOL BOX contain so many integrated functions and feature extraction commands for extracting the audio features[11]. After these extraction we can do many classification processes using several machine learning algorithms. By using these algorithms we could create many ways to classify music [7].Features of songs we can classify based on listening test also so we get the emotions according to that, and we can grouped in clusters after that classify it[2].

Retrieval Number: F3336049620/2020©BEIESP
DOI: 10.35940/ijitee.F3336.049620
Journal Website: www.ijitee.org

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Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Music has different type of features like timber, intensity[4], rhythm so that each songs are different according to their features. These features affect the human emotions.

The composition of music is different for each song, not only the features but also languages like, Hindi ,Malayalam, English and other languages[5]which also have different lyrics .

These classified song features can be used for other purpose like making a recommendation system or creating for playlist , for that we can store it in excel files[6] which can further be used in Weka tools .The Weka Tool contain many classification algorithms like Naïve Bayes[10], Decision Tree, K-Mean, K-nearest, SVM it is help to classify the songs.

The emotion recognition thus has become a research topic also more and more factors are getting added to this sector which make it stronger, like using singer's voice and detecting emotion [3]. Thus, we tried to do a combination of all this and to secure a result.

III. METHODOLOGY

For predicting the emotion of songs is a complex task, since each song in Bollywood industry has different lyrics and different music. The classification process has done considering all these features.

The dataset, which we considered, had a collection of 100 songs, which are of different styles. Each song had its own features, which makes it difficult for the classification purpose.

As a first procedure, that is before extracting the features of the song we have to consider whether we should classify it based on lyrics or audio.

As Hindi, songs have different lyrics it is difficult to extract features from the songs. Hence, we choose the audio for feature extraction.

The second procedure was to decide the frame length of the song that is whether we should take full audio for extracting features, or select a particular frame of length. Since full audio take time to process, it was decided that would choose 30 second clip for extracting features. Third procedure is to decide the features for extracting from the songs audio clip.

A. Feature Selection

The Bollywood songs have different features, which it helps to differentiate it from other songs. So selecting appropriate features is much important in the process of emotion prediction. Thus selected features like,

1. Intensity

It is the most essential feature in mood detection. And used in many research works. It is approximated by the signal's root mean square (RMS). The Intensity depends upon various factors, those are,The amplitude of the vibration of source: Greater is the amplitude of vibration of the source, larger is the intensity and sound.

2. Timber

It is the perceived sound quality of a musical note, sound or tone. Timbre distinguishes different types of sound production, such as choir voices and musical instruments,

such as string instruments, wind instruments, and percussion instruments.In Fig 2, it shows how a particular musical sound have a different sound from one another.
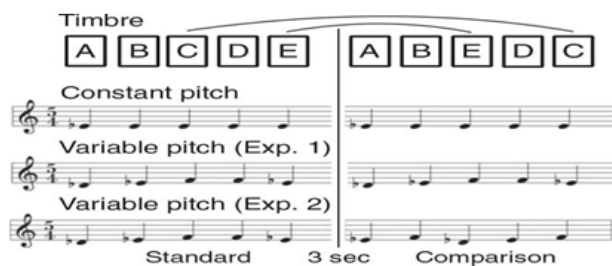

Fig 2.Musical Timber

3. Key

The key of a piece is the group of pitches, or scale that forms the basis of a music composition in classical, Western art, and Western pop music. The key may be in the major or minor mode. The key usually identifies the tonic note and/or chord. In Fig 3, it shows the identified key notes.
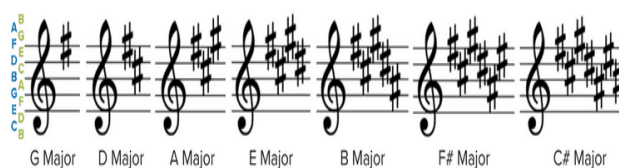

Fig 3.Musical Key

For extracting features the tool used is MIR Toolbox, which can be installed in Matlab. It consists of a set of integrated function written in Matlab for extracting features from the audio files. After extracting features using this toolbox, then will annotate the emotion for each songs. The annotation is done using the listening test in which five college students are asked to hear the song and annotate the emotion which they felt while hearing the song. The emotion is described from the Russell's Circumplex Model. The emotion we choose have been clustered to two clusters as positive and negative as shown in Table. 1 , in which each cluster has three emotions representing the cluster as shown below in the table.

Table 1.Emotion Cluster

POSITIVE	NEGATIVE
Happy	Sad
Calm	Frustrating
Exciting	Annoyed

The listeners will annotate the emotion as positive and negative , considering the feeling they felt while hearing . After annotating the emotions will check whether annotated emotion are matching the predicted result using Weka API tool by classifying using Naïve Bayes method which is described in Fig 4.. Naïve Bayes classifiers are collection of classification algorithm based on Bayes Theorem. The common principle is that every pair of features being classified is independent of each other. Using this method trying to get a appropriate result.
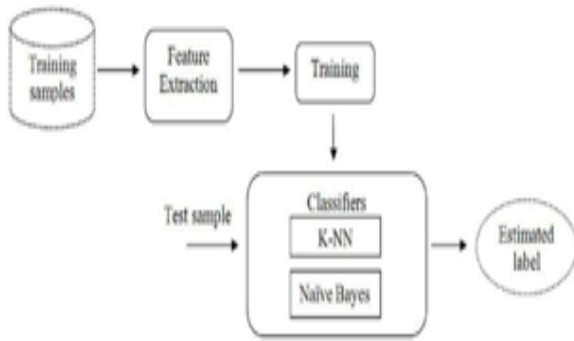
Fig 4.Classification Process

IV. RESULT

According to the methodology and the steps done we were able to extract the features and classify the songs based on the features. Thus, after classifying we got the accuracy in between the range 83%-90% which is shown in the Table 2 which describe the confusion matrix. In other Papers it shows the accuracy less than 80 using the Decision Tree Method, So compared to other paper it is better.
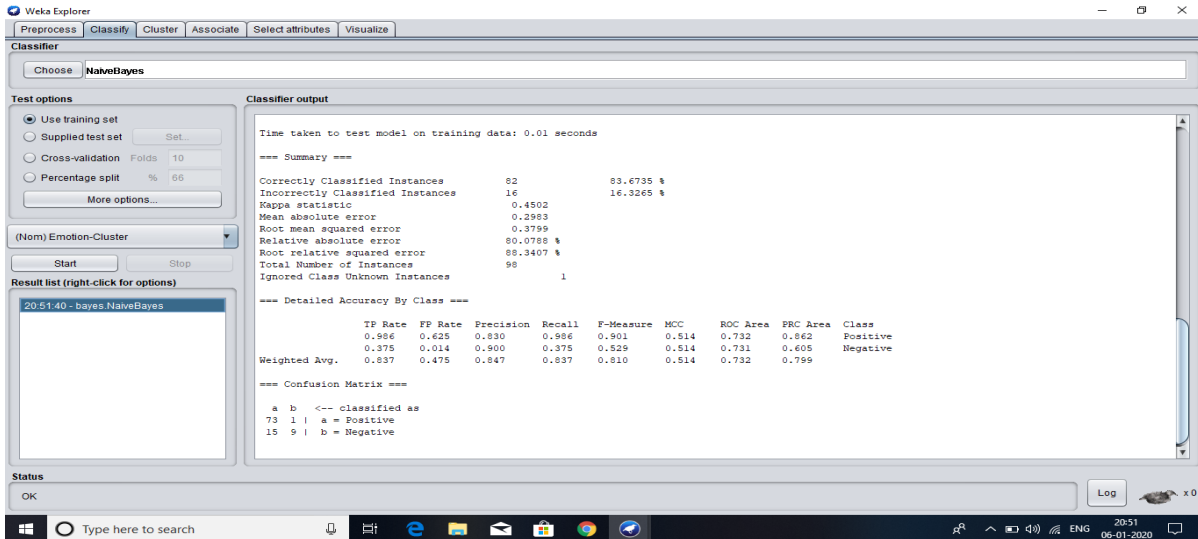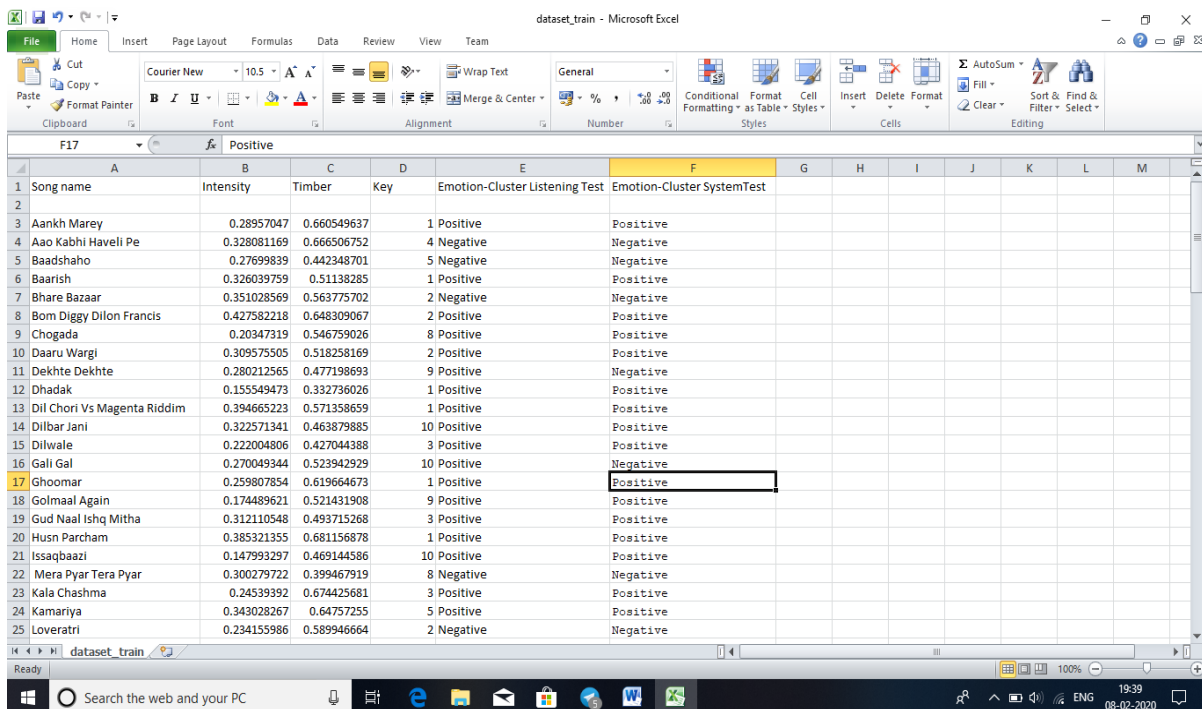

Fig 5. Correctly and Incorrectly classified instances

Fig 6. Predicted and listening test results

Table 2. Confusion Matrix

PARAMETERS	A	B
A	73	1
B	15	9

V. CONCLUSION

Pragmatic analysis is really difficult, we have found some ways of classifying songs based on emotion so that people can select song which satisfy their mental condition . Hence in this work, we tried to classify Bollywood songs based on emotion . The music features are extracted using the toolbox MIR which is used in Matlab. The features and the emotions are annotated by the listeners in the listening test and are classified using Naïve Bayes algorithm and checked whether the listening test matches the predicted result and we got a accuracy of 83%. Hence, our work provided us the classified list of song based on emotions which people mostly feel.

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