Predicting User Mood by Classifying Music Genres from Facebook Shares and Likes

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***Abstract*—Music is part of art when it comes to recreation entertainment or it can be considered as the source of therapeutic medium. The music is grouped in different genres, the most common way to differentiate among these genres is to label an artist or song as belonging to a specific genre, like classical, pop, folk, ghazal, bhangra, rock, Noha, Naat/Hamd and many others. However, prediction of user mood such as positive, negative, energetic, sleepy by analyzing their music genres specifically for Indian and Pakistani songs is still a key issue. One of the most common way to get peoples likes about their music, movies, books etc is Social Networking Sites. Thus, the music related data were collected from Facebook Social Network Users. The collected data holds many issues such as duplication of the data, missing data, noise and intentional errors. After performing the data cleaning process, mid-level features were extracted from each instance and data set was prepared for music genre classification. The training and testing set was prepared using 10-cross fold options. J48 classifier, Decision tree and ROC plot are used for prediction model. For the classification of music genres, the results indicated 0.894 True positive rates for the entire genre whereas the average False Positive rate for different genres is close to zero. For prediction of the mood prediction True Positive rate is close to or equal to 1 for almost all the identified moods. Recall values for all the mood is also significant except the mood EXCITED.**

***Index Terms*—Social Networks, Classification, prediction, Data Mining, User Behavior.**

I. Introduction

Data mining is the method of discovering connection or data patterns amongst thousands of fields in databases. It is a machine learning discipline used for simulation of likelihood patterns and categorization the objects into many groups that denoted as a single class. It is an influential new technology, which provides the many operations, includes:

Prediction: Prediction model used to predict specific result that is supposed to be occurring in the future. Based on group of inputs, a prediction can be made on prediction result; in alternative ways, if the prediction model is once modeled it would be helpful to predict future outcomes more accurately. The techniques for prediction include neural networks, linear and multiple regression, decision trees, and k-Nearest Neighbor methods[15].

Classifications: It is type of supervised learning. For classification two types of attributes are used i.e. multiple features and single class label attribute. The training data is used to model the association among feature attributes. This model is also helpful to predict the class label of any data set where only the feature attributes are given [1][15]. Classification can be achieved by many techniques such as multidimensional plots to visualize, neural networks, decision trees, and k-Nearest Neighbor methods.

Clustering: It is type of unsupervised learning. In the clustering, the class attribute is not known, the similar data are group together based on some parameters. The groups having the similarity within their groups create the segments of the data [1][15]. Techniques of clustering includes, hierarchical, k-Means, kModes, k-Prototypes clustering and neural networks or Kohonen networks.

Association: Association rules are very helpful for examining and prediction of the data. Association rules are helpful to find the relationship among different attributes in large databases. The attributes used in the association can be quantitative or qualitative attributes. The rules used in association are created by analyzing frequent patterns in data[12][15]. Different methods are used to achieve the association such as A priori and GRI algorithms. Social Networking Sites (SNSs) are progressively attracting the concentration of educational and industrial researchers. SNSs also enable peoples to communicate with other members via emails, chats, and commenting on each others profile page. Social networking sites such as: MySpace, Orkut, Facebook, Cyworld, Mixi, Tweeter and Bebo have attracted millions of users on regular basis [5].

Because of their public nature, such conversation is interesting for researchers to analyze from different prospective to classify and predict different behaviors of peoples. Some data mining research has already been done on the analysis of these network such as generating musician ranks based on opinion mined from public comments on MySpace SNSs [7] and a league table system have been developed by Microsoft for movies from profiles extracted from MySpace SNSs. However, there is dearth of research on the sentiment analysis of Social Network users [16].

Facebook is most well liked free social networking website that is available in 37 different languages and through these website users sends messages, upload videos/photos to stay in contact with friends, family and colleagues to be thinkable media to analyze the user behavior from such enlarge social network sites [3]. Even though the speedy progression in SNS and in the techniques of Data Mining for prediction

of Behavior, emotions, sentiment, modes, interest and so on have been done, little research has tangled these both together.

II. RELATED WORK

Liu [11] investigated that how to predict the behavior on social network. The author performed the experiment on information collected from individuals of social networking website. Since social link symbolize for different category of relations based on mining social scope was useful for behavior prediction. Data mining techniques are helpful many areas such as in the field of healthcare and medicine the prediction analysis is helpful in order to identify the kind of diseases and their suitable medicine[13]. Centola [4] examined that how social networks effect the user behavior. Golbeck[6] revealed the predicting personality of users by analyzing various categories of communication exposed personality of users, the users character was predicated through the publicly accessible information on their Facebook profile. Bond[2] showed that the user behavior is consideration to increase during social networks but it was too complicated to recognize social power effects in inspectional learning. Taylor[17] examined that the role of music in emotions, 170 participants was performing extract of orchestral music and initiated to move a mouse cursor quickly as probable to one of six faces to matching emotions showing expressions.

III. METHODOLOGY

Facebook as social networking software repository was taken in account for the analysis of the users mood based on their likes and posts related to the music. The general way to differentiate among the music genre is to tag an artist or song as thats belong to exact genre of music, like classical, popular, folk, or hip-hop and so far, in addition, certainly so, as user become more acquainted with several types of music; some of them have their own preferences and selection about the music mode. There are many reason for the preferences about music genres, some may have preferences per song tempo, singer, genre etc.

The whole experiment was conducted in three phases, in the first phase the analysis of different user mood was observed through literature survey, second phase is about the classification of Identified Music Genre using the J48 classifier and in the later phase the classified music genres was used as a prediction model to predict user mood. Decision Trees was used as a prediction model for observing user mood.

A. DATA COLLECTION

Data collection is concerned with the personal music collection of Pakistani and Indian songs. The 80 Facebook accounts were taken for the experiment; their 6 months archives related to the Music likes and shares were downloaded. Total 1500 songs data were collected from different accounts. The dataset was maintained in arff file format manually. Initially, only two attributes were available for some tracks which was song title and Artist name and for many cases just song title was given, even in some cases the song title was not rightly labelled.

1) Data Cleaning: The collected data contain many issues such as duplication of the data, missing data, noise and intentional errors. Data cleaning is useful to get rid noise and accurate the discrepancy in data. More specifically data problems in the archives reported were duplicate songs on one users wall with different artist name, misspelling in song titles, and the missing entries. After data cleaning 1033 song instances was ready for feature extraction.

B. Feature Extraction

Feature extraction is very hectic process of classifying the set of features. It is one of the dimensionality decrease techniques that are frequently used to defy beside the troubles caused by several classification problems.

Data mining concerns the data analysis and detection algorithms to find out information from vast quantity of data. Feature extraction is extract the subset of new features from the original features [14]. Generally, every song possesses three types of features, which are;

- Top-Level Features: Genre, Mood, Instrument, Artist, Style, Other
- Mid-level features: Pitch, Rhythm, Harmony, and Tempo
- Low-level features: Timbre, Temporal

It has been observed that mid-Level features have strong relationship with user mood. The sonic visualizer having MELODIA plug-in were used to automatically extract the mid-level features from each instance downloaded from random websites

1) Datasets: Data set (.arff) was prepared for automatically analyze the user mood on the basis of music likes. In the dataset five nominal attributes i.e. Song Title, Artist, Melody, Rhythm and Harmony are used to classify the class Genre. The selected genres include: Ghazal, Bhangra, Pop, Remix, Qawali, Naat, Hamad and Noha. The Identified music genres and their related attributes are listed in Table 1. The Data set were further divided into the training and test set.

C. Prediction Model:

Predictive analytics is the region of data mining concerned with estimate probabilities and trends. Supervised machine learning approach is used with several classes of features to predict the genre of music from each like and share. For prediction modeling the Training set were created using cross validation at 10-folds.

TABLE 1. Identified Music Genres and their attributes

Genres	Tempo	Rhythm	Harmony
Ghazal	Slow	Calm, Peaceful, Cool, Serene, Soft, Gentle, Slow, Medium, Tempo	Major
Bhangra, Pop, Rock, Remix	Fast	Consistent, Strong, Loud, Shrill, Fast, vibrant	Major
Qawali	Fast	Energetic, Active, Fast, Speedy	Power Chord
Naat/ Hamd	Slow	Clam	No
Noha	Fast	Strong, Powerful	Power Chord

1) Stratified 10-fold cross validation: It was necessary to reduce the unfairness that connected with the random sampling of the data set of training and testing set samples. For best possible accuracy opinion, the 10-fold cross validation is mainly used [20]. In the standard, the whole dataset like (D), randomly select 4 sets like (D1, D2, Dn). This testing will be keep continue till the stratification was accepted to decrease the difference of the folds. An empirical study has established that stratified cross validation be inclined to produce the results with lower bias and lower variance to evaluated to common cross validation [8][10] even though it could be computationally concentrated. Fig. 1 demonstrates this diagram:

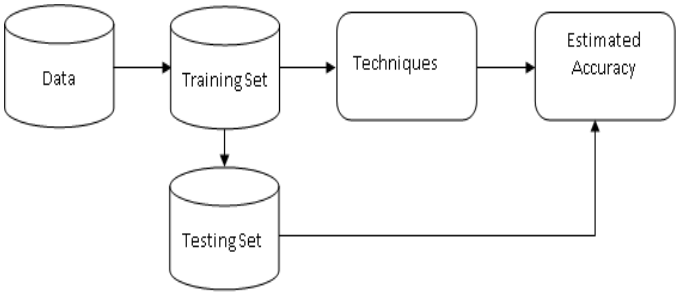


Fig. 1: Model for performance estimation

D. Training and Test Sets

In each phase of dataset were focused to a range of different existing classification algorithms in many runs and folds. Those algorithms presenting a bias near simply the exact class labels or executing extremely low were discarded thereby subjecting the dataset to a 60%-40% training-testing split learning and opinion for all the algorithms.

E. Classification

The classification was done to easily identify which audio file belongs to exact category of mood. In addition, as witnessed in most of the literature survey, classification algorithms have always proved to be quite effective as compared to others in analyzing the mood or genre aspect of music data sets so far. Hence, we choose the classification techniques of mining music feature data set with a supervised learning approach. The Fig. 2 and 3 shows a general process of classification. It is a two-step process.

First Step: This is also called as a learning step" or training phase" which occupies knowledge of a mapping or a function y = f(X), that also predict the connected class label Y of a given tuple X. In this analysis, we desired to learn a mapping or function that divides the data classes. This mapping or function is generally termed as the Classification Model". As seen in the step 1 of Fig. 4 each row of the table represents the tuple X. The function f(X) is learnt as a process of training by using classification algorithms, and corresponding rule is stored in the classifier model. This rule helps in predicting if the song represented in the tuple X is Ghazal (yes) or not (no) depending upon the values of various attributes of the tuple.

Second Step: The model is evaluated against the test data-set to predict the class label of each data instance as has been learned from the model. The results are compared with actual classes of the test data and accordingly decided whether the model is exact enough to classify the test data. If the model is acceptable, it can be used further for classifying data with unknown classes. As seen in the step 2 of Fig. 3, the classifier model evaluates over an unknown tuple X by applying the function f(X) learnt to predict its outcome.

F. Classification of Music Genres:

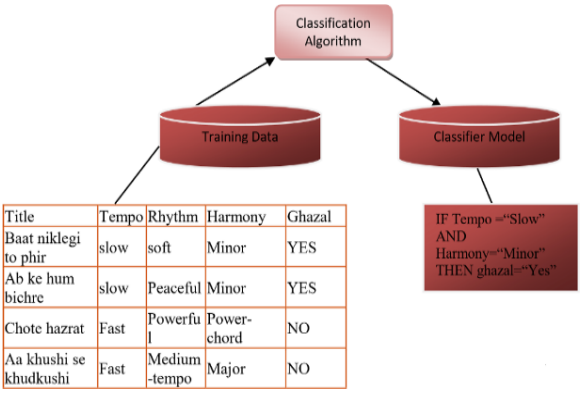
Music genre is conservative part that recognizes portion of music as part of the set of rules and conservatives. Music can be divided in many different genres. There are several types of music genres like classical, rock, pop, and disco etc. It establishes that a lot of element that fit in to an audio signal can be utilized as features that are required music classification.

Decision tree is used to explain and find the answer to a complex problem. Decision trees allows users to take a where each inner node (non-leaf node) identify an examination on an attribute, each branch signify an outcome of the test, and every leaf node (or terminal node) holds a class label. The uppermost node in a tree is the parent node.

G. Mood Identification System

It is method to classify the user mood from audio file. This module has two major roles to perform as mentioned below:-

1) Mood Learner:: In this case, the input received is a training data-set of music features with the "Mood" attribute manually updated by the domain experts, from the opinion of training. The Mood learner can make use of the existing mining algorithms or newly written algorithms, provided they follow the convention and framework laid down by Weka



Title	Tempo	Rhythm	Harmony	Ghazal
Baat niklegi to phir	slow	soft	Minor	YES
Ab ke hum bichre	slow	Peaceful	Minor	YES
Chote hazrat	Fast	Powerfu l	Power-chord	NO
Aa khushi se khudkushi	Fast	Medium -tempo	Major	NO

Fig. 2: Classification model step 1

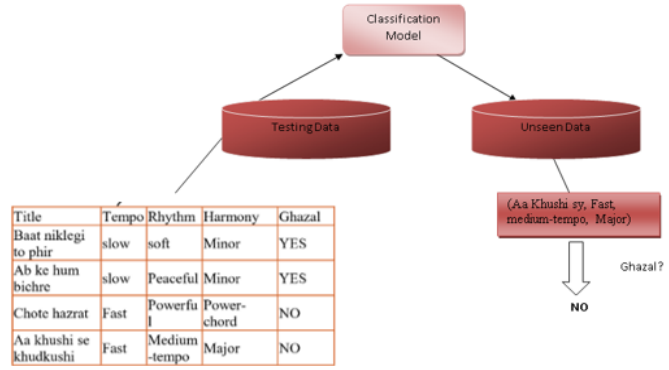


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Fig. 3: Classification model step 2

tool. Thus, this module can serve as the experimenter so that user - analyst or researcher - can utilize it to try various algorithms to mine mood aspect of the underlying music data-set. Using this model, the classifier model for bagging of Random forest approach was trained and store after careful evaluation and comparisons with other comparable models. Mood learning is generally one-time activity. Once done, the model is saved and can be re-used for evaluations any number of times. However, depending upon the user preference, the learning can be made iterative to improve accuracy with the most updated music data which evolves over time. This change, however, might require few code changes which is out of the scope of this project currently.

2) Mood Detector:: In this case, the music data-set received as input will have some dummy data in the "Mood" attribute as this feature is not known and is expected to be predicted by this module. The Mood detector then evaluates the data-set under thought against the mood classifier model that has been saved. The estimation results in predicting the mood for every music clip that was fed to the system by the user. In case a whole song was supply instead by the user, the system returns the maximum chosen mood from the moods predicted for all the clips derived from that song. The result of this module is usually used by the user request such as a mood-annotator or any Music information recovery application or even the end-user himself/ herself. Although the module helps in detecting the mood of the music under consideration, the whole and sole control of accepting or rejecting this decision can be always given to the end-user with some minor enhancements to the code.

H. Prediction of User Mood

- The extracted features into three categories: Tempo, rhythm and harmony. The first two attributes can explain mood information to some quantity and very essential part for mood detection
- Generally happy songs sound bright and vibrant, while sorrows ones sound pensive and gloomy. The features of rhythm can be used to judge whether the emotion is negative or positive. Tempo feature is also used to determine the users mood is calm, relaxed or depressed.
- Russels Mode Model was used for the prediction of the user mood.

IV. RESULTS

The results of this research study suggested the fluctuations of user moods on social networking sites. In this study, total 80 accounts of Facebook were selected for observation their public conversation such as: comments, likes, tags and posts and archives of their data were got to analyze the user mood. Whole experiment was conducted in these phases such as:

- Data source public conversations of Facebook users.
- Feature extraction from collected data.
- Design and develop training and test set.
- Classification of music genres.
- Selection of user mood from literature survey.
- Music classifier as input for user mood prediction.
- Analyses of different user mood were observed.
- Classified music genres were used as prediction model for observing user mood.

The results from the classification model were achieved by using the J48 classifier the output is shown in the form of Decision Tree, Confusion matrix and ROC plots of the weka mining tool.

A. Classification of music genres:

The estimation results for the classification of the music genre are shown in Table 2. The results indicated 0.894 True positive rates for the entire genre while using the modified classification model. The average FP rate for different genres is close to zero.

The Table 3 shows the confusion matrix for the test set of 1033 songs. The diagonal elements represent the true positive or correctly identified songs genres.

TABLE 2. Test Set Experimental Results for Music Genre

TP Rate	FP Rate	Precession	Recall	F-Measure	ROC Area	Class
0.893	0	1	0.893	0.944	0.986	Ghazals
0.872	0.026	0.907	0.872	0.889	0.986	POP
0.933	0.007	0.962	0.933	0.947	0.983	NOHA
0.931	0.035	0.663	0.931	0.775	0.961	Naat
0.867	0.055	0.726	0.867	0.79	0.939	Qawali
0.894	0.018	0.91	0.894	0.898	0.973	Avg

TABLE 3. Test Set Confusion Matrix for Music Genre

A	B	C	D	E	Classified As
368	1	1	34	8	Ghazal
0	205	0	0	30	POP
0	0	153	0	11	NOHA
0	0	5	67	0	NAAT
0	20	0	0	130	QAWALI

The summary of the correctly and incorrectly identified genres are as under:

- Total number of instances: 1033
- Number of correctly classified instances: 923 (89.3514 %)
- Number of incorrectly classified instances: 110 (10.648 %)

B. Prediction of the user mood:

Once the classifaction for the different music generes are identified, the prediction of the user mood are done by using the decision tree. The categarization of different user moods are shown in fig. 4.

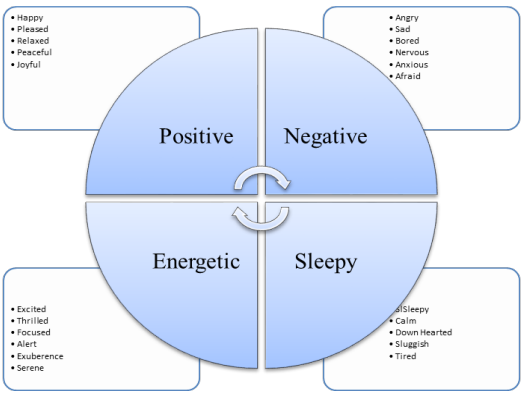

Fig. 4: Categorization of different user Moods

The classified music genre was used for predicting the user mood. The training set was split in 60-40% for training and Test Set. The split of the training and test is unbiased to any selection.

Once the dataset was split into the training and test set the J48 classification algorithm was applied to predict the user mood depending on the music genre and other related characteristics of songs. The results of the classifier are shown in Table 4. TP rate is close to or equal to 1 for almost all the identified moods. Recall values for all the mood is also significant except the mood EXCITED. F-Measure the user's mood prediction shows the significant results.

TABLE 4. Test Set Experimental Results for User mood

TP Rate	FP Rate	Precession	Recall	F-Measure	ROC Area	Class
1	0.054	0.897	1	0.946	0.968	Relaxed
0.898	0.041	0.797	0.89	0.844	0.953	Excited
0.865	0.043	0.846	0.86	0.855	0.95	Happy
0.785	0.011	0.943	0.78	0.857	0.938	Depressed
0.602	0.024	0.784	0.602	0.681	0.867	Calm
0.864	0.038	0.865	0.864	0.86	0.943	Avg

Table 5 shows the confusion matrix for the prediction of the user mood. The diagonal elements represent the true positive or correctly identified class labels for user mood

TABLE 5. Test Set Confusion Matrix for User mood

A	B	C	D	E	Classified As
330	0	0	0	0	Relaxed
0	141	12	0	4	Excited
0	15	192	0	15	Happy
38	0	0	150	3	Depressed
0	21	23	9	80	Calm

The summary of the correctly and incorrectly identified genres are as under:

- Total number of instances: 1033
- Number of correctly classified instances: 893 (86.4472 %)
- Number of incorrectly classified instances: 140 (13.5528 %)

1) Receiver Operating Characteristic:: The area below the ROC curve is a calculation of the accuracy of the model. Analysis of the trade-of between the true positive rate and the false positive rate. It is a two-dimensional plot with vertical axis representing the true positive rate and horizontal axis representing the false positive rate. A model with ideal accuracy will have a region of 1. The closer to the diagonal line (i.e., the closer the area is to 0.5), the less perfect is the model. For each of the five classes of mood model, area

under ROC is calculated and more the value nears 1, more accurate the classification is. The best accuracy with respect to area under ROC was observed in the range 0.832 to 0.97 which seems quite satisfactory. The results for the ROC curve for all classes are shown in figure 5-9.

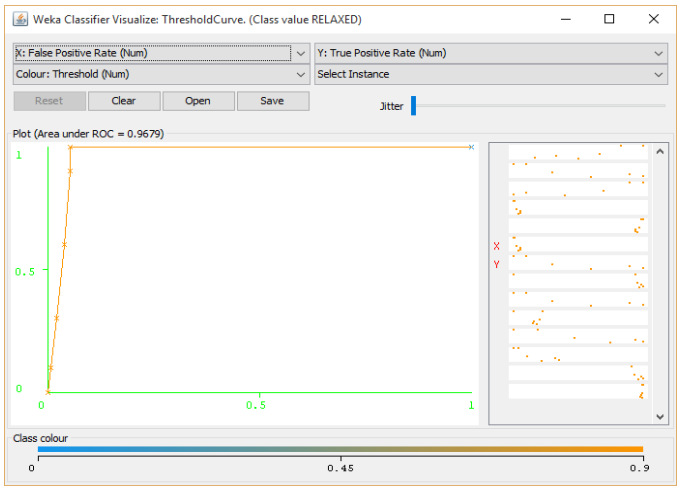

Fig. 5: ROC Curve for Class Relaxed

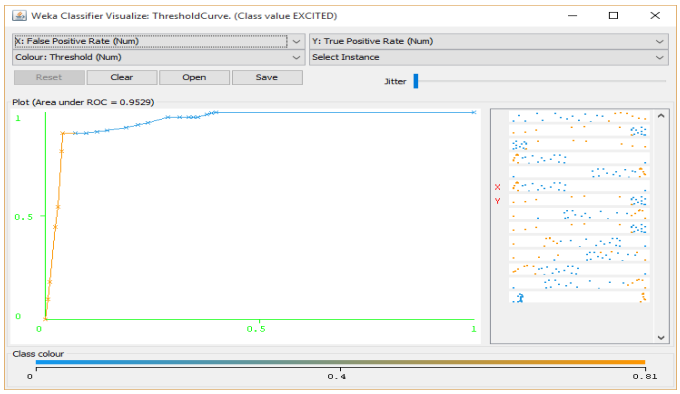

Fig. 6: ROC Curve for Class Excited

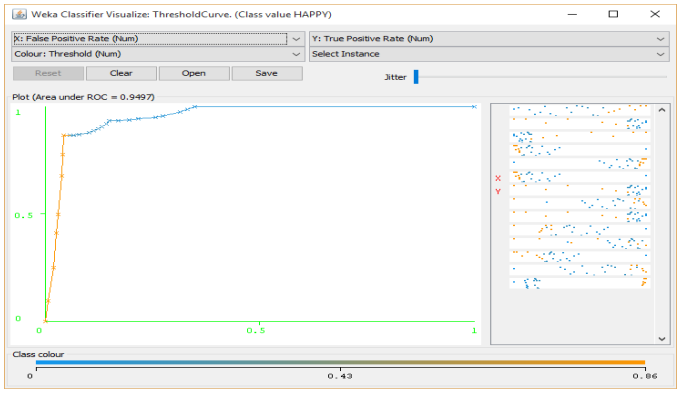

Fig. 7: ROC Curve for Class Happy

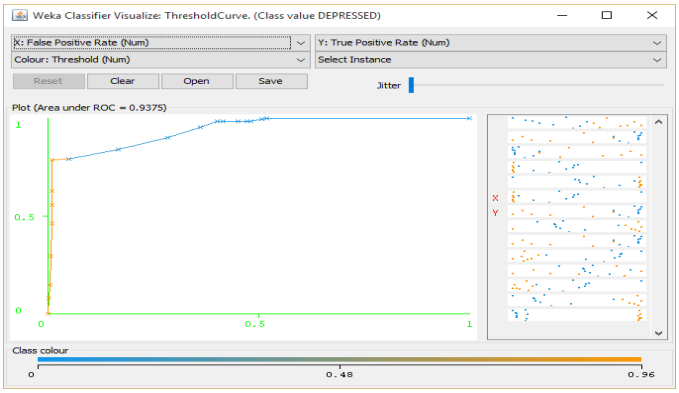

Fig. 8: ROC Curve for Class Happy

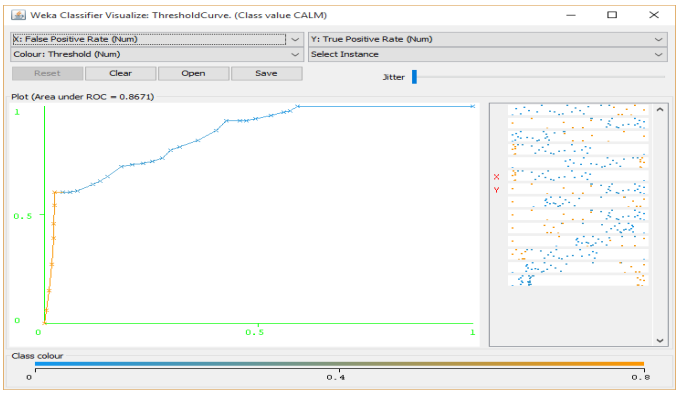

Fig. 9: ROC Curve for Class Calm

Predicting user mood by analysing their social networking profile is really an admirable effort. The decision tree results show that users moods are highly affected by the music genre. The music having slow tempo and minor harmony is predicted Calm and relaxed moods where as Fast tempo and major or power chords as harmony are prediction of Energetic user mood. The results of the decision tree are shown in fig 10.

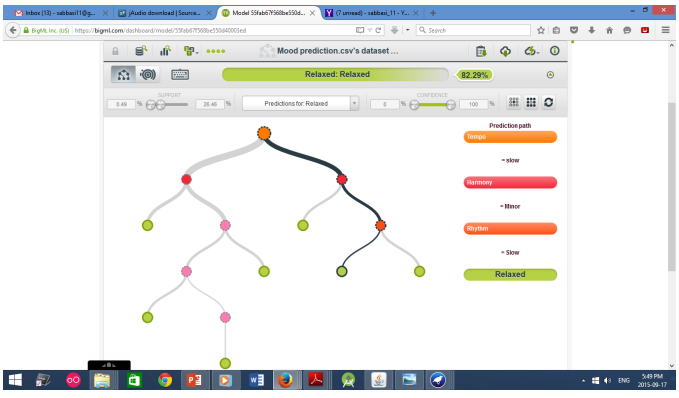

Fig. 10: Decision Tree for User Mood Prediction

V. DISCUSSION

In this study, research was focused on use of social networks and their effects on user moods. The data source was obtained from public conversations of Facebook users. The archive was downloaded to classify the user moods through their likes and shares related to music. It was observed, if the user is in sad mood, he/she used to listen the sad/happy songs and like the tragic and peaceful poetry.

The results were supported that user behaviors were an essential part of research in computer visualization, multi view behavior database was expressed the heftiness and helpfulness in this process [9]. It has also revealed that music has the power to change the users mood positive and negative.

The results were also supported by Liu [11] that how online music is helpful to predict the behavior on social network. Trohidis [18] Music have ability to suggests more than one dissimilar feelings at the similar time.

In this study the most commonly observed behaviors were sad, angry, this is due to the environmental, government, political, social and domestic pressures/issues on people in Pakistan as compared to that of other developed countries.

VI. CONCLUSION

It was completed from the outcome that by using social networking site like: Facebook to classify the user mood through the classification of music genres. For classification of music genres, the social networking sites are better resource to identify the users mood. However, the Corpora used for classification and prediction should be cleaned for better precision and accuracy. Indian and Pakistani music can be best classified based on lyrics and harmony of the songs. Prediction of Facebook users mood based on their music likes and shares would be helpful for many areas such as fraud detection, sentiment analysis, and business promotion and for depressive syndromes.

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