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Framework for classification of music based on tempo using Naïve Bayes and cloud storage

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ABSTRACT

Music is considered as one the best form of expression of emotions. The music that people hear is governed by what mood they are in. The characteristics of music such as rhythm, melody, harmony, pitch and timbre play a major role in human physiology and psychological functions, thus altering their mood. The Naive Bayes classifier is considered a popular classification technique in machine learning. It's been shown to be very effective on a range of test data sets. However, the strong assumption that each attribute is independent of each other is often violated in real world problems. In this paper we have applied locally weighted naïve Bayes to data stored within cloud to automate the process of classification of music.

Keywords— *Music Emotion, Music Information Retrieval, Music Mood, Attribute Weighting, Class, Local Optimization Naive Bayes, Cloud Storage*

1. INTRODUCTION

The music industry generates millions of dollars every day. All this money hinges on how the people listen to the songs. As mobile is used every day by almost everyone, it is one of the main modes of communication between artists and listeners. Everyone listens to songs on their mobile. As the automation industry grows, the applications in mobile are also trying to provide personalized experiences to users, without much effort from the user side.

People hear music mostly supported their moods. For example, when an individual comes back home from work, he may want to listen to some relaxing soothing music; while when he is at gymnasium, he may want to choose some exciting music with a strong beat and fast tempo. Music is not just a form of entertainment but also the easiest way to speak among people, a medium to share emotions and to make memories. Booming of the Internet technology, there is more and more music on mobiles, in the music libraries and on the Internet. Therefore, automatic music analysis systems such as music classification, music browsing and play list generation systems are urgently required for music management facilities. Because of various listening objectives, music classification and retrieval based on perceived emotion is might be more powerful than other tagging such as artist, album, tempo and genre. Classification of music supported tempo or beats are a theme of research for several years. We have referred to a number of these papers and applied them to classify music supported users preference automatically.

2. LITERATURE SURVEY

As said before there have been various researches on this topic. Some of the papers that we have referred for this paper are listed below:

Jhon Yearwood, Musa Mammadov, Sattar Selfollah [1] proposed an algorithm; attribute weighted Naive Bayes using optimization. Here they first give a brief description of quasisecant method. Then they discuss Discretization methods. The first one Fayyad and Irani's Method and then Sub-Optimal Agglomerative Clustering based Method (SOAC). The proposed algorithm has been tested on 16 data sets where it has higher accuracy than NB (Naive Bayes), TAN (Tree Augmented Naive Bayes), & INB (improved Naive Bayes). However, the author has not given how it performs in multiclass data sets.

Sonal P Sumare M, Mr D G Bhakle [2] has given a brief introduction to the history of different research papers which have worked on classification of music. They then explain about different acoustic features such as intensity, timber, pitch and rhythm and how it is used in mood detection. There are various mood models given which are applied using GMM and also how SVM can be used for risk minimization.

Ardiansyah, Boy Yuliadi, Riad Sahara [3] have classified the training data consisting of 20 data for jazz music and 17 data for dangdut music. While for data testing there are 10 data for rock music, 8 data for pop music, 10 data for jazz music, and 8 data for dangdut music. So, the total music that will be used is 113 music clips. They have used Naïve Bayes classification and got a total success percentage of 41.67%. The very best success is the classification of pop music by 70.5%, followed by dangdut music by 62.5%, then rock music by 30%. For jazz music the success of the classification is considerably small, which is barely 10%.

3. STORAGE

In this paper, we have used cloud storage to store data preferences. The user's preferences of moods for songs are stored in the internal storage of user's device. This storage can be SQL, MySql etc if it is a desktop application. If it is mobile application then SQLite for android can be used.

Cloud storage involves storing data on hardware present in a remote server, which can be accessed from any device via the web. Clients send files or data to a server maintained by a cloud provider instead of storing it on their own drives. We use cloud storage as main storage for data. Here we are storing the tempo of each song. The user's preferences are also stored in cloud. This cloud storage should be updated real time to achieve best results. Cloud services like Firebase, Azure etc. can be used.

4. ATTRIBUTE WEIGHTED NAIVE BAYES CLASSIFIER

Good attribute weighting can eliminate the effects of noisy and irrelevant attributes. The weighting procedure proposed in [1], in which each conditional attribute-class probability has its own power as a weight. The number of weights for each attribute is equal to the number of classes. The idea of the weighting method is similar to the works in, however constructing a proper objective function and utilizing the new weighting procedure are different from the existing methods. Let us consider $D = \{X_i, C_i\}$, $1 \leq i \leq N$, where N is the number of instances and $C_i \in \{C_1,...,C_m\}$. X_i is an n-dimensional vector, $Xi = (Xi_1, Xi_2, ..., Xi_n)$, n is the number of attributes, and C_i is the class label. The considered binary classification and assumption that the two classes are 1 and −1. Then, for each attribute, the defined two weights, one corresponding to the class $C_1 = 1$ and another to the class $C_2 = -1$. By considering two weights for each attribute, the attribute weighted NB classifies an instance X_i by selecting:

$$\arg \max_{1 \leq k \leq 2} P(C_k) \prod_{j=1}^{n} P(X_{ij}|C_k)^{w_{jk}}.$$

5. SYSTEM DESIGN

5.1 Sequence Diagram

A Sequence Diagram in Unified Modelling Language (UML) is a one of the interaction diagrams that shows how processes operate with one another and in the order in which they operate. It's a construct of a Message Sequence Chart. A sequence diagram shows, as parallel vertical lines ("lifelines"), different processes or objects that live simultaneously as horizontal arrows, the messages exchanged between them, in the order in which they occur.

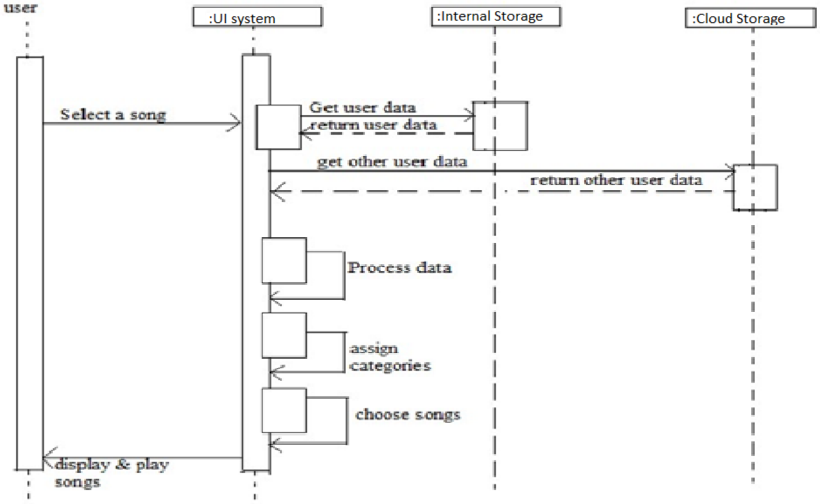

Fig. 1: Sequence diagram

Figure 1 shows the sequence diagram for classifying songs based on mood. In this user gives input by selecting a song. The songs are then classified by preference of the user, and other users of application. Based on this classification, songs are selected to be played next.

5.2 Data Flow Diagram

Data flow diagram (DFD) is a graphical representation of the "flow" of data through information, modeling its process aspects. Often, they are preliminary steps used to create an overview of the system. DFDs can also be used for the visualization of information processing (structured design). Dataflow diagram are constructed from a limited repertoire of shapes, connected with arrows.

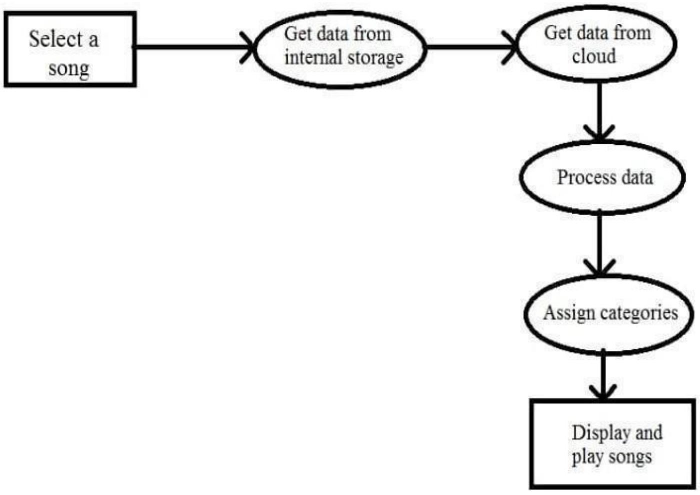

Fig. 2: Data flow diagram

The most important shape types:

- Oval represents start or end pointing.
- Line is a connector that shows relationship between the representative shapes.
- Rectangle represents a process.

Fig 2 represents the Data flow diagram, at first the user selects a song present in his/her device. The system gets data from internal storage which contains the user and other user preferences. Songs present on user device are classified, by applying machine learning algorithms.

6. CONCLUSION

This paper gives a framework for building an application for automated music classification. For this application we've got elements of cloud storage and machine learning to provide the user the most effective personalized experience. We are classifying songs based only on tempo in this paper. In future, we can add other features like pitch and timber to form classification more accurate.

7. REFERENCES

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