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Mood Aware Music Player Using Neural Networks

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Abstract

Music has long been a way for people to express their emotions. And because we all have a wide variety of emotions, music comes in all types of styles. Mood is an effective state that plays a significant role in our lives, influencing our behavior, driving social communication, and shifting our consumer preferences. Music can be used to elevate the mood of a person. The tempo, rhythm and pitch of music are managed in areas of the brain that deal with emotions and mood. Even though we are living in an age of digital devices which have many sensors to understand the physical world around them, they are unable to develop insight about the object that matters the most, the user. In our project, this ability of music can be used to develop a mood aware music player which automatically senses the mood of user and uses this prediction to recommend songs in his/her library according to current mood. Our application classifies the user's mood into one of the following: happy, sad, angry, fear and disgust. We use the rhythmic features of the songs to classify them into following moods: happy, feel good and sad. The mood sensor that we implement is a system that recognizes user's mood from their smartphone usage patterns. Personalized training can be used to learn the user's mood along with smart phone usage patterns for a specified time period. After the system is trained for this duration, it can then predict the mood of the user and suggest songs to match his/her mood or to elevate the mood of user if he/she is feeling upset or stressed.

Keywords: *Mood detection, machine learning*

I. INTRODUCTION

Mood is an affective state that plays a significant role in our lives, influencing our behavior, driving social communication, and shifting our consumer preferences. But in the digital realm of mobile devices, there is a distinct lack of knowledge about mood unless manually provided. While devices have many sensors to understand the physical world around them, they are unable to develop insight about the object that matters the most: the user. We consider the implementation of a mood sensor as a vital next step in enhancing the context-awareness of mobile devices.

Mood sensing can build an interesting digital social ecosystem as users' devices automatically share their moods with close friends and family. Privacy concerns aside, these moods would enhance social networks by allowing users to share mood states automatically. Users would be able to know better how and when to communicate with others.

Music and mood are inherently linked. Scientists have found that listening to particularly happy or sad music changes the way we perceive the world. You can dial up a mood, mindset or perception on demand by choosing music that elicits a specific emotional response in you. Scientists continue to uncover how these influences occur at a neural level. Studies prove that the music we listen to engages a wide range of neurobiological systems that affect our psychology. A recent study by researcher Jacob Jolij and student Maaike Meurs of the Psychology Department of the University of Groningen in the Netherlands [1] shows that music has a dramatic effect on explanatory style and perception.

The American Music Therapy Association (AMTA) [7] reports that music therapy programs can be designed to achieve goals such as managing stress, enhancing memory, and alleviating pain. A recent review in the World Journal of Psychiatry found that music therapy can be an effective treatment for mood disorders related to neurological conditions, including Parkinson's disease, dementia, stroke, and multiple sclerosis. After reviewing 25 trials, the researchers concluded that music is a valid therapy to potentially reduce depression and anxiety, as well as to improve mood, self-esteem, and quality of life. They also noted that no negative side effects were reported in any of the trials, making music a low-risk treatment.

Music unquestionably affects our emotions. We tend to listen to music that reflects our mood. When we're happy we may listen to upbeat music; when we're sad we may listen to slower, moving songs; when we're angry we may listen to darker music with heavy guitar, drums, and vocals that reflect our level of anger.

This paper proposes a system to create music player that is aware of mood of the user. The player plays music according to current mood of the user. The project uses machine learning to predict the user's mood as well as to classify music using rhythm of the songs. The system is first trained to diff erentiate user's mood using his/her smart phone usage patterns. The system is also trained to classify songs to diff erent moods. The player then predicts the user's mood using this training data and recommends songs that suits his/her current mood.

II. RELATED WORK

In this section we survey existing automated approaches for affect recognition. These methods are mostly sensor-based techniques, often relying on mining speech or facial expressions.

Recognizing emotions from voice and video.

Existing work in affect recognition focuses primarily on the recognition of emotions [1], and does so largely by leveraging the visual [2] and acoustic [3] signals found in the speech, actions, and faces of people. While the authors sometimes use emotion and mood interchangeably, they almost always measure transient 2 affective states, not moods. For example, Mood Meter [4] detects smiles using campus video cameras. But momentary smiles tell us little about long-term mood states unless the larger temporal dynamics of such signals are considered. Moreover, the facial or spoken expressions of people may not reflect their true feelings due to professional or social reasons.

Alternative physiological signals

Physiological indicators offer a more direct signal of how we feel. For example, skin conductance, heart rate, breath rate, blood pressure, and skin temperature all offer difficult-to-fake indications of our affective states. A variety of prototypes have been developed that leverage such signals, e.g., [5]. The key limitation in this approach is that it requires additional hardware. This limits the range of applications to only those that users believe are high utility, such as medical applications, to compensate for the burden.

Our smartphones have rich information about us: where we have been, with whom we communicate, what applications we use, and even more. Furthermore, people use their smartphone differently when they are in different mood states. Our proposed system attempts to leverage these patterns by learning about its user and associating smartphone usage patterns with certain moods.

This approach is not invasive to users; it does not require users to carry any extra hardware sensors or rely on the use of the microphone or camera. Instead, it passively runs in the background, monitoring traces of users' smartphone usage. Because of this, it is also lightweight and power efficient; it does not rely on computationally intensive or power expensive data processing of video, audio or physiological signals. Furthermore, the application works with the general patterns of smartphone usage, making it application-independent.

III. SYSTEM DESIGN

The function of the application is to collect data such as messages from Twitter, SMS, browsing history, recently used applications, current location and use it to predict current mood of user. It will have two major phases: In the training phase, the system learns by collecting the previously mentioned data and the mood of user to create a user profile using machine learning. The mood of the user is classified into one of the following five moods: happy, sad, angry, fear and disgust.

We also train a mood model for songs using machine learning and stores it in the cloud. The system can then classify music in the user's library into various moods using the model in the cloud. The system at last predicts the current mood of the user using previously mentioned data collected for the current time period and the user profile created in the first phase. This prediction is then used to create a playlist of songs from the library that suits current mood of user.

The system consists of five independent software products:

- A module that plays music.

- A module to predict mood of songs in the media library using features extracted from it. This is implemented at the smartphone end.
- A module that predicts the mood of a song using the features that it receives. This is implemented at the server.

- A module to collect data such as messages from Twitter, SMS, browsing history, recently used applications and current location and predict current mood of the user.
- A module that uses current mood of user to create a playlist. The communication between all these software is critical in the working of the entire system.

Machine learning is implemented using neuroph library for java. Neuroph is selected because of the simplicity and easiness to implement neural networks. We have implemented a multilayer perceptron network with momentum back propagation learning rule. The structure of neural network is shown in Table 1.

Table 1: Structure of neural network

Layer	Remarks
Input Layer	5 neurons
Hidden Layer 1	100 neurons, Sigmoid activation function
Hidden Layer 2	100 neurons, Sigmoid activation function
Output Layer	5 neurons

A. Input System

The Android operating system has the ability to run a variety of applications that can be downloaded via Play Store. Using these applications, our smart phones have rich information about us: where we have been, with whom we communicate, and even more. Most Android-powered devices have built-in sensors that measure motion, orientation, and various environmental conditions. These sensors are capable of providing raw data with high precision and accuracy. In our application, we use data available in smart phone such as messages from Twitter, SMS, browsing history, recently used applications and current location for mood prediction, and also for creating and updating user mood model.

B. Training

The application trains and revamps user mood model so as to improve efficiency, by collecting sensor data.

The mood of the user is classified into one of the following: happy, sad, angry, fear and disgust as shown in figure 3. The user mood model is updated by training the data collected as well as the current mood as input from the user. For training the model using accumulated data, we use Neuroph framework. The distinction between various moods of user is done using the neural network. The data is first gathered from messages from Twitter, SMS, browsing history, recently used applications and current location, then classified and tested by Neuroph framework. Similarly, a model for mood classification of songs is created at the server by training using songs in three different classes: happy, sad and feel good by extracting rhythmic features from them. This classification also uses the Neuroph framework.

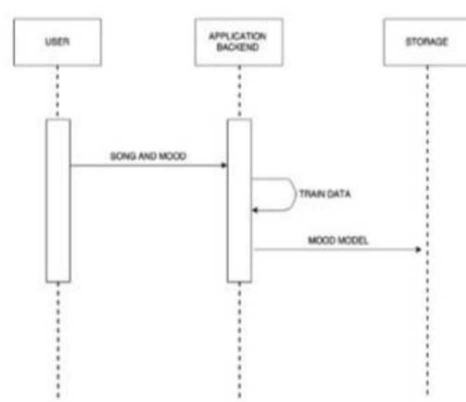

Fig.1Mood classification of songs – Training Phase

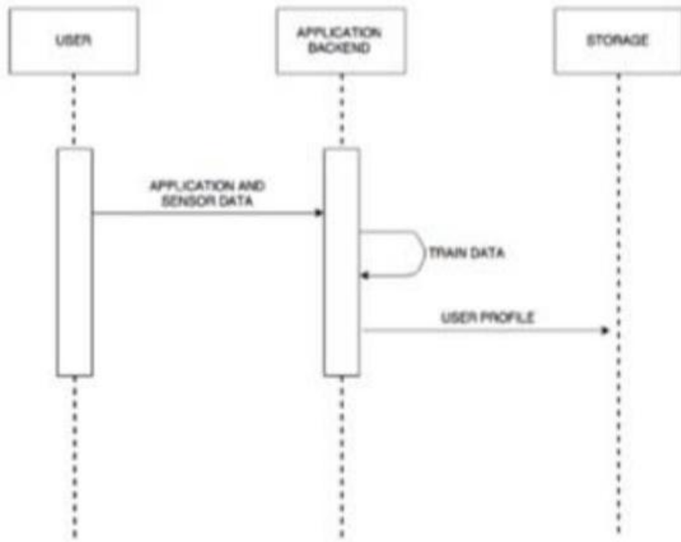

Fig. 2 User Mood model – Training Phase

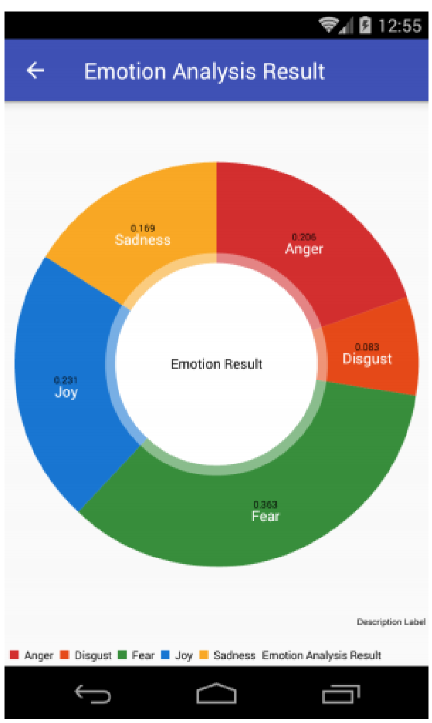

Fig. 3 Emotion Analysis

C. Playlist Generation

The trained mood model is used as a mood sensor that can predict the current mood of the user. The input to this prediction system is the most recent smart phone usage data of the user. The predicted mood is then used by the application to suggest songs to the user. To suggest songs to the user based on his/her current mood, we need to perform mood classification of songs in the user's music library. The application uses a cloud server for this classification. The rhythmic features are first extracted from the songs. This data is then sent to the server which classifies the song into one of the three moods: happy, sad, feel good. This mood is then stored in a local database present in the smart phone. We can then create a list of songs that matches the current mood of the user. The list is created in such a way that it elevates the mood of the user. This helps to change the mental state of the user, that is, when he/she is upset or tensed. The application then starts playing the suggested playlist.

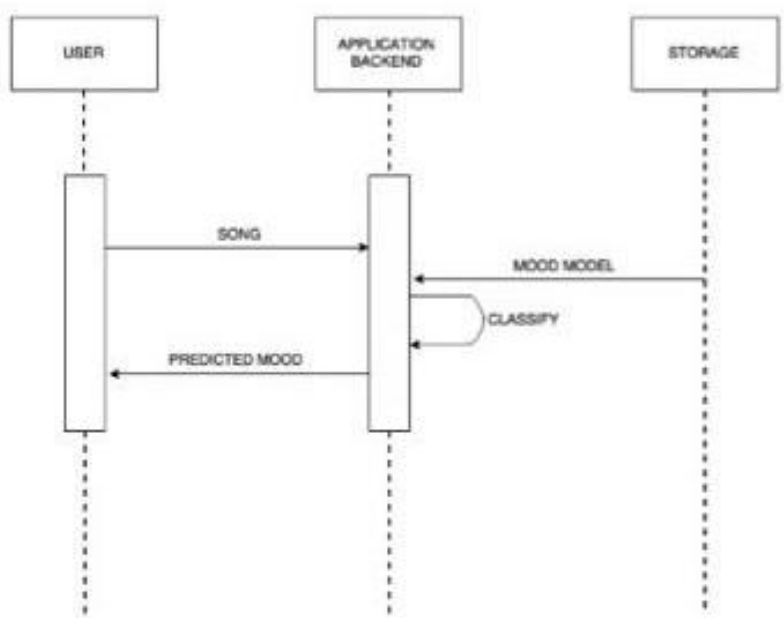

Fig. 4 Song Mood Prediction

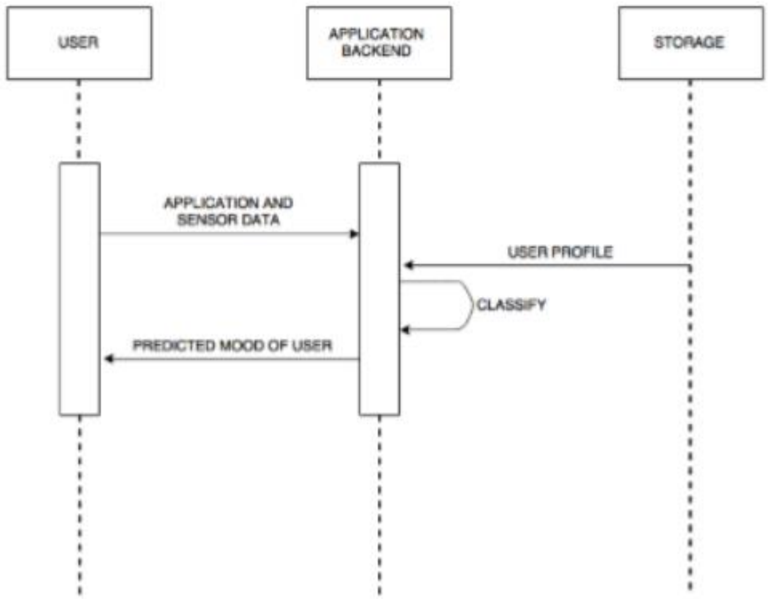

Fig. 5 User Mood Prediction

CONCLUSION

We foresee mood inference as a vital next step for application context-awareness. To approach this goal, we study the possibility of mood inference from smart phone usage analysis. Based on our findings, we build a Mood Inference Engine that can apply mood models to smartphone user data in real time.

The engine leverages the cloud as needed to create the model efficiently, while the smartphone tracks and processes usage data to accurately and efficiently determine the mood. The smart phone component runs silently as a background service, consuming minimal power and does not impact other smart phone applications.

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