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Forward Chaining for Contextual Music Recommendation System

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ABSTRACT

Music is an important aspect of people's daily lives. The reasons people listen to music include to fill their free time and to keep the mood in good condition. Music recommendations are a recommendation system that exists not only because of the many types of music available, but also because people's perceptions of music are still not fully understood. But with so many music choices it makes it difficult for users to find music that fits their context. Examples include considering music based on the current user's location or current activities. A system is required that can recommend music in the context faced by the user. Music Recommendation System Development based on user context is a mobile application that uses the Android operating system. The recommendations provided by this system use expert system methods with forward chaining flow. The system will process inputs obtained from users and provide musical recommendations in accordance with the references provided by experts. The result of this study is a rule that is built to produce an average accuracy between user choice and system recommendations of 72%.

Keywords: Mobile Recommender System, Music, Rule Based DSS, Contextual, Accuracy.

1. INTRODUCTION

Music is an art of arranging rhythm so it's sound harmony [1,2,3]. Music is one of the important aspects of human daily life. The reason people listen to music is to fill some free time, to get rid of tiredness, to avoid something that people don't want to think about, and also to keep the existing mood so that it stays the same. With today's technology development that develops towards mobile devices and the internet that follows it. The activity of listening to music becomes the norm for many people that you can find almost anywhere. Today most of the people that listen to music tune in with streaming services like apple music or Spotify [4,5,6].

The increasing of music content in the form of digital that can be accessed with the internet gives users chances to choose which content that user want. The overflowing of content that user has to choose cause user a difficulty to find new music that fit the user taste, this creates a new problem there is maybe good interesting music that fit the user but it's hard to find [7]. This problem is the base for the scientist to research a system that can recommend music that fits user taste based on digital data, this system is called Music Recommender System. Music Recommender System functions like a tool that helps to sort out digital data that user input to become relevant data for the user [7,8,9,10].

In today's digital environment music recommender system is already being used by companies like Apple and Spotify for their music streaming service platform. The music Recommender System that Spotify used only used a digital data based on user history, for example, a song that user adds to their playlist, a song that user always listens to, and song that user always skips ahead cause the user didn't like the song [11,12,13,14,15]. The recommendation that usually the Music Recommender System gives doesn't consider the context of the user, like user mood, user position, and user activity.

Contextual Music Recommendation System gives a recommendation that fits the context of the user [7], for example, people that're working out. Heart rate is one of the indicators of how effective your workout is]. Some people don't understand what to listen to when working out so that their heart rate can reach the optimal amount of heart rate that fits their age. When listening to high Beats per minute (BPM) it can increase the heart rate and so is the other way around [16,17,18]. With this application, users can choose between increasing or decreasing with music so that it can fit their optimal categories based on their age when working out.

The method that this research used is forward chaining for the music recommendation that fits the user context. Every user inputs different aspects from age and their heart rate. The final recommendation is the target heart rate and music. The lifetrak research [19] also uses forward chaining for the recommendation method.

In this study, contextual music recommendations used were the user's heart rate captured through sensors in the smartphone, time, weather, current location, as well as the mood of the user captured through the smartphone camera. Each of these variables is ruled by music experts and then the results of accuracy tests will be examined in this study.

This research consists of 4 sections, introduction in first section, research methodology in second section, results and analysis in third section and the last section is conclusion and future works.

2. MATERIAL AND METHODS

Forward Chaining is reasoning method using inference engine or decision support machine. Logically, this method presented as repetition of modus ponens (an inference set rule and valid argument) and is common concept of thought which is controlled by data (data-driven) [20].

Algorithm steps to do in forward chaining method is mentioned below:

1. Problem definition
2. Data input system definition, forward chaining needs initial data to start creating reference
3. Structure of controlling data definition
4. Writing the code
5. System testing

In previous research, contextual music recommendations have been carried out using forward chaining and produced the following rules:

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2.1 RULES FOR THE MUSIC RECOMMENDATION SYSTEM BASED ON THE USER'S EMOTIONS

The music recommendation system based on the user's emotions is captured via the camera sensor on the smartphone. This type of recommendation system generates rule [21]:

IF Mood = Happy → THEN Recommend music from the tag "Happiness"
IF Mood=Sad → THEN Recommend music from the tag "Sadness"

2.2 THE RULES FOR THE MUSIC RECOMMENDATION SYSTEM ARE BASED ON THE USER'S LOCATION

The music recommendation system based on the user's location is retrieved via the GPS sensor on the smartphone. This type of recommendation system generates rule [22]:

IF Location = Bekasi Barat
THEN Recommend music from tag " Kecamatan Bekasi Barat"
IF Location = Bekasi Selatan
THEN Recommend music from tag "Kecamatan Bekasi Selatan"
IF Location = Bekasi Timur
THEN Recommend music from tag "Kecamatan Bekasi Timur"
IF Location = Rawalumbu
THEN Recommend music from tag "Kecamatan Rawalumbu"

2.3 RULE FOR MUSIC RECOMMENDATION SYSTEM BASED ON HEART RATE

A music recommendation system based on the user's heart rate is captured via a sensor on the smartphone. This type of recommendation system generates rule [23]:

IF Heart rate >= 220-Age
THEN Recommend music that lowers the heart rate
IF Heart rate <= (220-Age) * 50%
THEN Recommend music that increases heart rate
IF Heart rate <= (220-Age)
AND Heart rate >= (220-Age) * 85%
THEN Recommend music that lowers heart rate
IF Heart rate >= (220-Age) * 50%
AND Heart rate <= (220-Age) * 85%
THEN Recommend music that keeps the heart rate up

2.4 RULES FOR THE MUSIC RECOMMENDATION SYSTEM BASED ON THE WEATHER

The music recommendation system based on the weather is retrieved via Google weather on the smartphone. This type of recommendation system generates the rule [24]:

IF Weather = Rain
THEN Recommend the music from the tag "Rain"

IF Weather = Sunny
THEN Recommend music from the tag "Bright"
IF Weather = Cloudy
THEN Recommend music from the tag "Cloudy"

2.5 THE RULES FOR THE MUSIC RECOMMENDATION SYSTEM ARE TIME BASED

Time-based music recommendation system retrieved through time on the smartphone. This type of recommendation system generates rule [25]:

IF Time Of Day>=06.00 AND Time Of Day <11.00
THEN Recommend genre POP
IF Time Of Day>=11.00 AND Time Of Day <15.00
THEN Recommend genre EDM OR RAP
IF Time Of Day>=15.00 AND Time Of Day <18.00
THEN Recommend genre JAZZ OR POP OR COUNTRY OR DANGDUT
IF Time Of Day>=08.00 AND Time Of Day <00.00
THEN Recommend genre GENRE JAZZ OR BLUES.

After the rules are generated, the final step is to test the accuracy between the recommendations generated by the system and the music choices the user selects. In this study, tests were conducted 5 times for each contextual recommendation system and then calculated the average of that accuracy.

3. RESULTS AND DISCUSSION

In previous research, the implementation of an Android-based music recommendation application has been carried out and blackbox testing resulted in 100% validity, meaning that the application is in accordance with functional needs, which is able to provide music recommendations according to the user's context. One example of a music recommendation application that is used as a sample is a music recommendation application based on heart rate [23].

Figure 1 is the first display when the user has given permission to use the camera. This display prompts the user to stick a curry on the device camera and enter the user's age. Figure 2 displays when the user's heart rate has been detected by the application and the next step is for the user to press the "Recommend Me!" to get recommendations that match the target heart rate. When pressing the "Playlist" button, the user will hear the song played through Spotify as shown in Figure 3.

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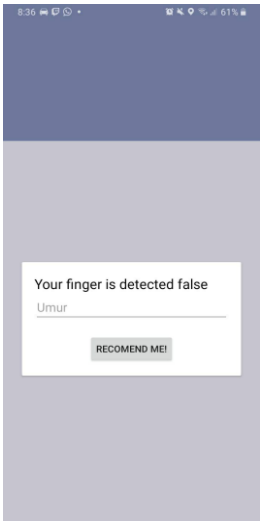

FIGURE 1. First display when the user has given permission to use the camera

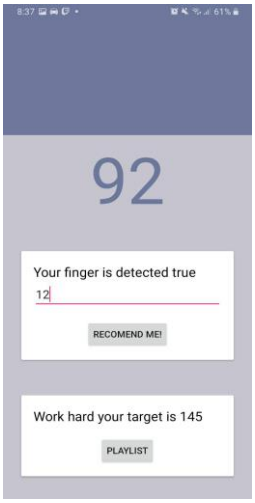

FIGURE 2. Displays when the user's heart rate has been detected by the application

FIGURE 1. Song played through Spotify when pressing the "Playlist" button

In this study, tests were conducted 5 times for each contextual recommendation system and then calculated the average of that accuracy. Table 1 shows the results of testing the system accuracy of 72%.

TABLE 1
Result of Accuracy Testing

No	Contextual Music Recommendation based on:	Size
1	Weather	4 of 5
2	Location	3 of 5
3	Heart Rate	4 of 5
4	Emotion	3 of 5
5	Time	4 of 5
	Total	18/25 = 72 %

4. CONCLUSION

Music Recommendation System Development Based on user context has been done based on weather, location, heart rate, emotion and time. The testing shows that the accuracy of the system is 72%. For the future works, we can modify the recommendation method, for example by means of classification algorithms. The contextual music recommendation system can be used as an alternative in music recommendation systems for diffable that can't use their hands to swipe the smartphone.

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