Personalized Recommendation Method of Online Music Teaching Resources Based on Mobile Terminal

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Abstract. Due to the large number of users of the mobile teaching terminal and the many types of music teaching resources, the recommendation accuracy is low. To this end, this paper proposes a personalized recommendation method for online music teaching resources based on mobile terminals. This paper identifies the characteristics of online music teaching resources, connects the resources through knowledge points, and optimizes the streaming media storage format using mobile terminals. The time continuous signal is converted into discrete time signal, and the user interest model is constructed by collaborative filtering, and the favorite resources of neighbor users are recommended to the current user. The experimental results show that the accuracy of this method is 75.694%, 66.669% and 66.350%, respectively, which shows that the performance of this method is better than the other two methods.

Keywords: Mobile terminal · Online music teaching · Teaching resources · Personalized recommendation · Audio materials · Information age

1 Introduction

Personalized recommendation method of online music teaching resources based on mobile terminalThe huge demand of online education promotes the development of education informationization. Compared with the traditional teaching mode, the network teaching has gradually become a new and widely used mode. The existing music teaching resources present the characteristics of huge quantity, numerous types, wide distribution, repeated development and strong dynamic change. Teachers can obtain rich teaching resources through network teaching, students also effectively reduce the burden of books, is a useful complement to the traditional teaching mode. In order to solve the contradiction between the massive teaching resources and the user's individualized needs, and further improve the utilization of educational information resources, so that learners become passive in the learning process. However, with the rapid increase in

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the number of teaching resources, users find it more and more difficult to find the real need of teaching resources, and spend more and more time, that is, the so-called "teaching resources overload", "information lost" phenomenon [1, 2]. Based on the idea of personalized service, this paper adds the function of personalized recommendation to the traditional network teaching resources, so as to solve the problem of users' finding teaching resources and the low utilization of teaching resources. Using traditional information search technology to obtain resources has some problems, such as low accuracy, more redundant information, and there must be a general direction of information search. However, in many cases, it is difficult for users to express their needs clearly or do not know their specific needs, so the traditional search technology has become increasingly difficult to help users find their true useful information. In order to solve this problem, personalized recommendation is applied to the teaching resources platform to provide personalized services for users.

In order to realize personalized recommendation service, user interest model is established by collecting and analyzing user registration information and behavior history data. Based on the user's interest, the teaching resources are pushed to the user actively, so that the teaching resources are more pertinent, personalized learning is realized, and the learning interest, quality and efficiency are improved. This undoubtedly has a certain promoting significance to the development of distance education. Personalized recommending service of teaching resources is to provide users with teaching resources that they may be interested in automatically by analyzing their personalized information. Different from the "one to many" mode of resource search service, the resource personalized recommendation service can meet the user's personalized needs better, and the system users don't need to participate in it too much, which greatly reduces the cost of resource search and makes the user more convenient to use. In addition, it also has rich academic value and practical significance for the research and practice of developing network teaching resource system. Personalized recommendation service changes the mode of "people looking for resources" into the intelligent mode of "people looking for resources, resources looking for people". In order to improve the accuracy of online music resource recommendation, this paper proposes a mobile terminal-based personalized recommendation method for online music teaching resources. This paper clarifies the characteristics of online music teaching resources, and optimizes the streaming media storage format by using mobile terminals. Convert a time continuous signal to a discrete time signal. The user interest model is constructed through collaborative filtering, and the resources of neighbor users are recommended for users.

2 Personalized Recommendation Method of Online Music Teaching Resources Based on Mobile Terminal

2.1 Identify the Characteristics of Online Music Teaching Resources

The network music education resources are opposite to the traditional music education resources. Generally speaking, the traditional music education resources include books, newspapers, magazines, CD, tapes and other physical material carriers, or radio and television carriers, which carry and spread music education resources. With the development

of information technology in education, teaching resources platform is also increasing, promoting the wide dissemination and sharing of high-quality resources [3, 4]. Different from the merchandise in E-commerce, the digital teaching resources in the platform have their own characteristics. Network music education resource is a new type of music education resource based on virtual digital technology and Internet. It is the combination of music education, modern digital technology and network technology. Although there are a variety of resources classification: according to the level of teaching, can be divided into basic teaching resources and higher teaching resources. According to specialty, it can be divided into modern teaching resources and classical teaching resources. Generally speaking, the network music education resources have two kinds of broad and narrow sense. In a narrow sense, network music education resources refer to the resources that specially serve music teaching in schools at all levels. But the broad sense network music education resources are then refers to all and music education related but can serve in each kind of type music education resources. The characteristics of online music teaching resources are shown in Fig. 1:

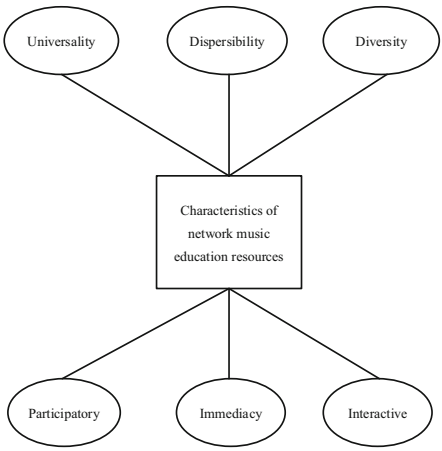

Fig. 1. Characteristics of network music teaching resources

From the Fig. 1, we can see that online music education resources include universality, decentralization, diversity, sharing, immediacy and interaction. Network music education resources generally exist in the following forms: network music education curriculum. However, no matter what the classification of teaching resources is used to teach knowledge, each teaching resources have their own knowledge and skills points, these knowledge and skills points constitute the core of this resource, representing the essential nature of teaching resources [5]. Network Music Education Resource Base and various resource sites based on Network Music Education Resource Base. Scattered personalized network music resources, such as personal music blog, blog, etc. Moreover each teaching resources knowledge point information is carries on the annotation by the expert scholar, has certain authority. Among them, the resource sites based on the online music education resource database can often act as the resource center within a region

(such as a prefecture-level city) and effectively consolidate and connect the online education resource database of the subordinate regions (such as the districts under the city, counties and cities), thus playing the role of an information hub for the transmission of music education resources. The knowledge points of resources may overlap, so we can link the resources by the knowledge points, and the user's preference for the resources also represents the user's preference for the knowledge points.

Because the Internet is distributed all over the world and there is no entity boundary, all kinds of music education resources are widely distributed. Music learners and music teaching researchers can search for their own resources across cities, provinces and even across countries. Users share digital resources through the teaching platform, learning related knowledge, is the user of teaching resources. Users generally have some pertinence in learning, and the classification is clearer, that is, the user's own characteristic information and the selected resources have a certain relationship. On the other hand, it is difficult to establish an overall index catalogue of online music education resources because of the loose distribution of independent education resources. Therefore, the similarity of users who choose the same resource is much higher than that of users who choose different resource. Because a static web page of music education resources can be browsed by thousands of learners, the network music education information resources break the limitation of entity music resources. Because of the high speed of network transmission, learners can easily and quickly browse, access, download, real-time access to online music education resources.

2.2 Mobile Terminal Optimized Streaming Media Storage Format

Traditional teaching resources, such as video and audio tapes and videotapes, are simply preserved in their form. Analog signals in the form of audio and video tapes are used to record information. Therefore, the establishment of video and audio analog signals in the first version library records this information into the digital information of the computer, namely, video and audio data collection and storage. Mobile terminals, also known as mobile communication terminals, refer to computer equipment that can be used in mobility, including mobile terminals, notebook computers, multifunctional terminals and even on-board computers [6, 7]. One classification can decompose the implementation of a functional method into a series of scattered files. Program developers should put a series of related methods into a category to make the code more readable. But most refer to smart mobile terminals or have a variety of applications.

With the development of network technology for broadband capacitance enhancement, the mobile communication industry will move towards the real information age. The collection of video and audio materials is a complex work process. The whole process can be divided into three main steps. One is sampling, the other is quantification, and the third is coding. It is wrong to think that the data collection is divided into three steps. The principle of the whole process is simple, and it is very complicated to realize on the network. For example, you could add a category called "spell checker" to the string class and then put the code associated with the spell checker into the category. In addition, with the development of electronic technology, mobile terminals are becoming more and more powerful, and mobile terminals are changing from a simple call tool to an integrated information processing platform. Sampling, also known as sampling, refers to

the periodic scanning of a certain time interval of analog signals, time continuous signals into discrete time signals of continuous and amplitude pulse modulation information, which also gives mobile terminals to add a broader space for development.

Mobile terminal communication mode is very rich, can be through GSM, CDMA, edge, 3G wireless network communication, can also be through WLAN, Bluetooth and infrared. The size of the sampling frequency is a key parameter in sampling, which means that the sampling frequency of the analog signal, noise, and will not produce a second overlapping fold. The sampling frequency generally requires the highest frequency of the analog signal, although the value of the sampling frequency may not be too high, because the total data rate after sampling increases exponentially with the increase of the sampling frequency, thereby increasing the requirements for data processing, transmission bandwidth, and memory capacity. For example, if the system's original string class implementation method does not have spell checking settings, the programmer can add such methods without changing the original string class code. Digital video and audio need to be further compressed and edited in order to adapt to network operations.

According to the different broadcast quality, there are different editing schemes for digital video and audio. Modern mobile terminals, like our personal computers, have a stable miniaturized operating system with powerful information processing capabilities, memory and memory cards, can complete complex processing tasks. Audio for the sound of the general participation of Effect Audio, Cool Edit and other tools, especially video editing is more complex, the need for better hardware conditions. The simplest is to use audio and video editing, more professional there are professional video editing software such as Primier. Based on the principles of mobile terminals, four main modes of mobile learning are presented, as shown in Fig. 2:

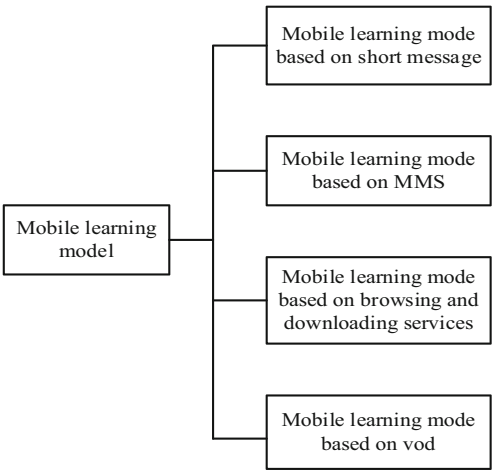

Fig. 2. Schematic diagram of mobile learning mode

According to Fig. 2, the main modes of mobile learning are short message-based, multimedia message-based, browse-based, download-based, and video-on-demand. When the program runs, the method in the class is the same as the original method

in the class. The code in the class can access all the member variables, including the private member variables. For image processing in general sampling photoshop for processing, if it is batch compression can be used, such as optical magician processing tools. Through the use and disposal of these tools, the collected materials can be stored in the original ecological teaching resource management system to ensure quality, improve resource storage efficiency and save system space. If a class declares a function with the same name as the original method in the class, the system chooses to call the method in the class. Therefore, classification can not only add class methods, can replace the existing methods. Streaming media (streaming media) is a multimedia format used for transmission on the network, mainly including streaming media video, audio, or animation, etc. Streaming media is the main multimedia technology used on the Internet. If the methods in both categories have the same name, then it is unpredictable which method is invoked at runtime.

2.3 Collaborative Filtering Build User Interest Model

The most common method of log mining tracking is to evaluate the user's interest in the page according to the number of clicks. Implicit tracking is a practical and effective way of tracking, which is automatically completed by the system, reducing the burden of users. Because the teaching and learning of online music courses are often not in the same place, online music courses must build effective communication, exchange and interaction mechanisms between teaching and learning in various ways with the help of rich and diverse man-machine interfaces and webpage (website) functions. The process of a user's interest tracking is the process of obtaining the user's interest, which generally includes two ways: display tracking and implicit tracking. The core idea of user-based collaborative filtering is that human behavior is similar to human behavior, and users with similar behavior will make similar choices, and user behavior contains user interest information. The algorithm finds the neighboring users through the user's preference for resources, and then recommends the resources that the neighboring users like to the current user. The expression of the user evaluation matrix is as follows:

$$L(p, q) = \begin{bmatrix} L_{1,1} & L_{1,2} & \cdots & L_{1,q} \\ L_{2,1} & L_{2,2} & \cdots & L_{2,1} \\ \vdots & \vdots & \vdots & \vdots \\ L_{p,1} & L_{p,2} & \cdots & L_{p,q} \end{bmatrix} \tag{1}$$

In the formula (1), rows represent users, p in total, columns represent items, and q in total. Display tracking is a process in which users fill in personal information or answer questions raised by the system by filling in forms, such as personal information and user's evaluation of resources. Consider the user rating as a vector in the multidimensional item space, and set the rating to 0 if the user does not rate an item. The similarity between user a and user b is obtained by calculating the cosine angle between vectors. The higher the cosine value is, the higher the similarity is. Given that the scoring vectors for user a

and user b are a and b respectively, the similarity between users is:

$$sim(a,b) = \begin{cases} \cos\left(\overline{a},\overline{b}\right) \\ \dfrac{\overline{a} \times \overline{b}}{\|a\| \times \|b\|} \end{cases} \tag{2}$$

Since the VCC does not consider the different user's rating scale in computing the user's neighborhood, the modified VCC algorithm improves the problem by subtracting the average user's rating. Based on the calculation results of formulas (1) and (2), the nearest neighbor set of the target user can be obtained, and then the user's scoring on the item can be predicted. The specific formula is as follows:

$$G = \overline{\delta} + \frac{sim(a,b)}{\phi} \tag{3}$$

In formula (3), ϕ represents the number of users, and $\overline{\delta}$ represents the average user rating of the project. Through the support of rich media technology, the network music education not only achieves, but also surpasses the teaching interaction effect of the entity music course in some aspects. Display tracking is completely dependent on the user, and is likely to reduce the user's enthusiasm to use the system. Even if the user is willing to enter the user model by hand, it is difficult for the user to list all the keywords he is interested in, which leads to the inaccuracy of the user model. For online music learners, online courses provide them with a technical platform that can maximize their learning initiative, rather than a simple music teaching video. The user model built using the display trace is static and will not change once the user model is completed. Therefore, in the design of the webpage (website) of the online music course, the function of prompting learning objectives, disaggregating and displaying learning content and navigating learning paths must be added. The longer the time elapsed, the greater the difference between the displayed tracked user model and the real user interest. Implicit tracing does not require information from the user, and all tracing is done automatically by the recommended method. User behavior records such as browsing the Web, clicking a mouse, marking a bookmark, and dragging a scroll bar can all indicate a user's potential interest. The aim is to enable music learners to get a clear understanding of the objectives, contents and learning strategies of online music courses, and to arrange the preparation of music learning materials and the process and steps of music learning. Implicit tracing can be divided into two ways: behavior record tracing and log mining. Among them, the former one is that the system reveals the user's interest effectively by recording the user's behavior. In order to optimize the allocation of curriculum resources to the greatest extent, we can effectively grasp the key points of knowledge taught by teachers in the limited and centralized network music teaching time, and interact with music teachers in a targeted manner, thus achieving twice the result with half the effort. The latter method of tracing is to extrapolate user interest from server log information statistics.

Log mining tracking method can be used to create and update the user's interest model by obtaining the number of page clicks, page stay time and page visit order. In order to determine the overall teaching style of online music course, it is necessary to

select representative specific "teaching units", determine the elements such as knowledge system construction, interface style and navigation strategy, and solicit the opinions of music learners through activities such as "trial teaching" and "trial listening" within a certain scope. But the data collected by implicit tracking may contain too much redundant and irrelevant information, which will increase the computational cost and complexity in the model learning process. For example, "syncopation" can be selected as a specific "teaching unit", first clear this "teaching unit" goal is to master the basic form of syncopation, singing and its role. In order to grasp user's interest better, display tracking and implicit tracking can be combined to obtain static user's interest and dynamic user's interest by implicit tracking. Then cut into the specific teaching process, we can first explain the concept of syncopation, pointing out that its role is to change the rhythm of the intensity of the law. However, the concept is far from enough. Three basic forms of syncopation, such as "within one bar", "between two bars" and "with body stop", must be enumerated, and the relevant notation examples must be attached.

2.4 Design Personalization Recommendation Pattern

Choose specific songs and instrumental music fragments containing syncopation as teaching cases, and choose different vocal and instrumental music types, such as art songs, melodic music, popular music and other vocal music types, as well as piano music, guzheng music and other different instrumental music types, so as to help students understand the different forms of syncopation in various music concretely and vividly, so as to understand the role of syncopation in a more comprehensive and profound way. There are not only registered users but also unregistered users in the personalized recommending method of teaching resources, which can be searched, browsed and non-personalized. This paper introduces the singing method of syncopation, that is, beginners can break the syncopation of the quarter note into two octaves, or break the syncopation of the quarter note into two sixteenth notes, and then unify the syncopation after being skilled, so as to enable students to freely master the singing method of syncopation. For the registered users, in addition to the rights of unlogged users, we can also evaluate the resources and personal information management. At the same time, the recommendation policy for new registered users is different from that for graded users. After introducing the three basic forms of syncopation and showing the relevant notation examples, you can also add a personalized teaching link, for example, can guide students to imagine the kind of "Ouch Hey" chant shouted when the two sides compete in a tug-of-war game, which is a similar form of syncopation rhythm in daily activities. There are many kinds of teaching resources in the network, and it is difficult to recommend the unstructured resources such as audio and video based on the content. The recommendation based on association rules has low personalization degree, and it is difficult to get good personalized recommendation results. By citing examples from daily life, it is easy to bridge the gap between students and the boring knowledge of music theory. The recommendation method inputs the basic information of users and resources and scores, and outputs the recommendation results. Personalized recommendation can be divided into three steps: data processing, recommendation calculation and forecasting recommendation. The architecture of the personalized recommendation model for teaching resources is shown in Fig. 3.

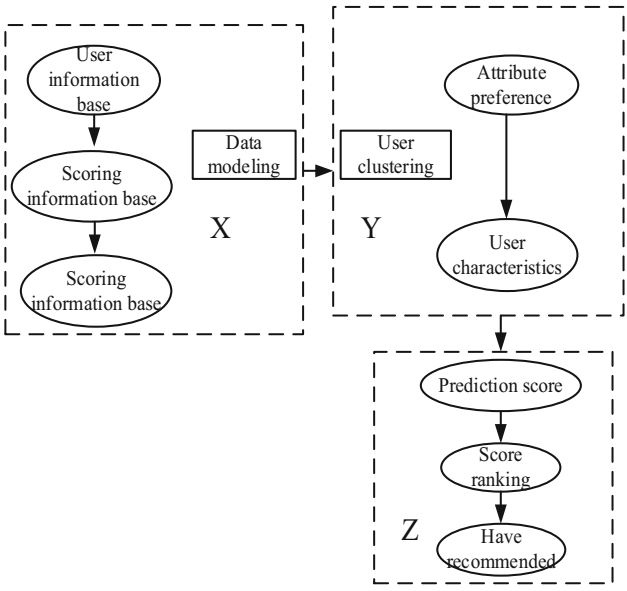

Fig. 3. Personalized recommendation method structure diagram

According to Fig. 3, X part is to preprocess the data in user information database, resource information database and rating information database, and construct data model, namely, to get user feature vector, resource attribute vector, resource attribute preference vector and so on for the subsequent calculation of user similarity. After making this kind of experimental teaching unit, we can check and accept the teaching effect through the activities of "trial teaching" and "trial listening" in a certain scope, and solicit students' opinions so as to determine the overall style of network music course. The Y part calculates the similarity of the recommendation model based on the X part to find the nearest neighbor, in which the new user is based on the user characteristics and information entropy model, and the other user is based on the rating and resource attribute preference model. Z is responsible for the user's forecast score and the final Top-N recommendation. At the same time can also join the tug-of-war when the demonstration audio, and tug-of-war animation video, in order to enhance the visual effect of music teaching. Collaborative filtering can handle complex unstructured objects without considering the form of recommendation resources, and it has high degree of automation, can mine the potential interest of users, and the recommendation quality is high. If the tug-of-war cases and animated video can achieve good teaching results, this teaching method should be retained and carried forward, and the overall style of online music course will tend to be lively, picturesque and interesting.

3 Experimental Test

3.1 Construction of Experimental Environment

This experiment uses B/S structure, B/S refers to the browser/server structure, that is, only one server installed and maintained, while the client uses the browser. B/S structure is with the rise of Internet technology, the C/S structure of a change and improvement. B/S structure adopts three-tier architecture, that is, database system, application server and client browser. After the design of personalized recommendation method of teaching resources is completed, 694 grading data of 300 teaching resources were collected from 80 users, among which the user's grading of resources is 1–5, and the higher the grading is, the more favorable the resource is. Most of the transaction logic is implemented on the server side, and very few of the transaction logic is implemented on the client browser. Meanwhile, the sparsity of the data set is 94.69%. The data set is divided into training set and testing set according to the scale of 3: 1. C #, a new programming language designed specifically for the. NET platform by a development team led by Microsoft's Anders Hejlsberg and Scott Willamette, has many similarities with Java.

3.2 Experimental Results

Different users have different understandings of the same word, which results in different evaluation of the filtering results. At present, the representative evaluation standards adopted take the precision rate as the test standard for testing the personalized recommendation method of online music teaching resources. The calculation formula is as follows:

$$T = \frac{H}{\eta} \times 100\% \tag{4}$$

In formula (4), H represents the number of information items in the filter results that meet the user's interests, and η represents the number of information items in the filter results. Choose the personalized recommendation method of online music teaching resources based on neural network and machine learning, and compare with the personalized recommendation method of online music teaching resources in this paper, and test the accuracy of the three recommendation methods under different number of users. The experimental results are shown in Table 1, 2 and 3:

Table 1. Number of users 100 Recommended method accuracy (%)

Experimental rounds	Personalized recommendation of online music teaching resources based on neural network	Personalized recommendation of online music teaching resources based on machine learning	Personalized recommendation method of online music teaching resources
1	76.615	76.331	82.313
2	77.845	74.205	83.155
3	76.312	76.894	84.619
4	77.948	78.211	85.207
5	75.062	77.302	86.131
6	78.009	77.166	87.449
7	77.315	78.299	86.512
8	76.452	75.416	87.619
9	78.299	75.487	86.233
10	76.154	76.945	85.199

Table 2. Number of users 200 Recommended method accuracy (%)

Experimental rounds	Personalized recommendation of online music teaching resources based on neural network	Personalized recommendation of online music teaching resources based on machine learning	Personalized recommendation method of online music teaching resources
1	69.487	65.288	72.616
2	65.219	66.918	73.198
3	66.177	65.317	75.232
4	69.347	66.203	74.951
5	67.515	67.858	75.129
6	66.974	66.123	76.313
7	65.398	68.544	77.209
8	66.152	69.202	75.114
9	64.399	65.337	76.980
10	63.251	62.130	75.318

Table 3. Number of users 300 Recommended method accuracy (%)

Experimental rounds	Personalized recommendation of online music teaching resources based on neural network	Personalized recommendation of online music teaching resources based on machine learning	Personalized recommendation method of online music teaching resources
1	53.615	56.487	64.317
2	57.818	59.154	66.659
3	56.319	54.198	65.419
4	55.825	55.316	66.286
5	56.322	54.811	67.344
6	55.848	52.319	68.259
7	59.120	56.474	67.188
8	56.487	57.822	65.286
9	59.416	59.316	66.310
10	55.377	55.422	67.251

As can be seen from Table 1, the average accuracy rates of the personalized recommendation method and the other two methods are 85.44%, 77.001% and 76.626% respectively, and from Table 2, the average accuracy rates of the personalized recommendation method and the other two methods are 75.206%, 66.392% and 66.292% respectively. Because this method identifies the characteristics of online music teaching resources. Connect the resources through the knowledge points, and optimize the mobile terminal streaming media storage format. In addition, we converted the temporal continuous signal into the discrete time signal, constructed the user interest model by collaborative filtering, and recommended the favorite resources of the neighbor users to the current users.

4 Conclusion

Designing and developing personalized recommendation method of teaching resources to meet the personalized learning needs of online music users will help the effective use of teaching resources. At the same time, users need to choose more teaching resources to meet the different personalized needs of users, so that each learner can be fully developed in the field. Users are clustered offline based on resource attribute preference, and users with similar preference are partitioned into the same cluster and recommended in several clusters similar to the target user. This not only promotes the perfection of each learner's personality, but also meets the needs of social development for music talents. In the future, we need to do more research on cold start. Although this article has made a suitable summary and construction of classification information for Chinese songs. But the included classes and instances are far from the real ontology of Chinese songs, and there is still a lot of work. We need continuous improvement and timely updates.

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