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# An Analysis of Music License Purchase Tendency based on the User Profiling

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## Abstract

*In this study, we had analyzed the user's license purchase pattern or tendency on digital music library and predicted a user's next license purchase activity from the user profiling data. A user can play the songs through purchasing the music licenses that can provide as a kind of temporal, limited and combined form on streaming service or download service for one or bunch of songs. A digital music library user should purchase appropriate license for songs they want to listen in accordance with the terms of service of the music library service company. If there is somewhat closed relation between the user's license purchase tendency and the user's profiling data in the music library service company, we can provide a nice suggestion on the next license purchase to a specific user and enhance the license purchase frequency of the user. To make it sense, we extracted the metadata related on the user's license purchase from the user profiling data in existing music library service company and analyzed the metadata with history based tracking method to predict the user's next license purchase activity. The analysis results show over 80% of matching between prediction and real activities of the users' license purchases. Therefore, a user profiling data can be used as a useful source on the license purchase suggestion service that can give effective license purchase activities for users.*

Keywords: *License purchase, User profiling data, Aged-MRU, Recommendation service*

## 1. Introduction

A copyright on a work can make the author's authorship and economic effect through a kind of license from the user of work such as a book, music, paint and so on. If someone wants to have a copyright on one's work, He/she has to register one's work as an original and can get reward as royalties on a copyright [1]. The license can be distributed anyone who wants to use it

within a copyright law. Therefore the main issue on a license can be categorized in two aspects, the kind of license and the purchase type of license. The purchase type of license would be concerned with the user's license purchase intention and utilizing type. The consecutive license purchase also concerned with the user's utilizing type. These kinds of utilizing type can be caught though the analysis on the user profiling data [2]. If we can predict user's license utilization activities through the user profiling data, we also can enlarge the legal license purchase to general users by recommending appropriate license [3]. To make it over all, we need to make some high confident recommendation technique, and need some effective recommendation method also.

User profiling is a kind of log data preserving technique on data writing for each user's actions, accesses and updates on the specific objects those use authority related resources such as license. It could be effectively used on various history managements for each user. Since most of the user profiling data can reflect user's activity characteristics, types and environment, some appropriate recommendation can enhance user's purchase for legal license.

In existing researches, many researchers has been studied on user's search query based semantic analysis and recommendation services based on the search results as a recommendation method for users. This method can provide recommendation search query fit to the user by using user profiling data on web search and reference information search. It has been adopted on most of the recommendation methods [4, 5, 6].

Knowledge management method based on the user data utilization activities is another recommendation method. This method can find out the user's action through analyzing the user data utilizing pattern that concentrates on the user data tracking analysis [7, 8, 9]. Although this method has not been researched as much as semantic analysis method, it is very efficient on user action analysis on history concentrated data such as user's license. Therefore, we decided to target on the user license data utilization analysis include license purchase action.

## 2. Material and methods

In this work, we predicted user's next license purchase action through tracking user's license purchase and utilization history by using user profiling data for music. We also compared the prediction and the real license purchase actions how they closed each other through the real license purchase activities. The more prediction closes to real license purchase action, accept possibility of recommendation service also higher. But user's next license purchase action could be decided depend on various aspects. Thus, what kind of data in user profiling data should be applied or how the relation between user profiling data and license purchase action has to be set is very complicate problem. In this work, we thought the license purchase history as the most important and most related data among the user profiling data. So, we had tried to predict the next license purchase action with the license purchase history data. Table 1 shows the user profiling data in online music site. In real circumstance, user's license purchase action reflects not only license purchase history but also many other elements included in user profiling data. But if we can get sufficiently exact prediction result with just user's license purchase history, we

also can evaluate the efficiency of the history tracking analysis based on the user profiling data and recommendation from the analysis results.

As the history tracking analyze algorithm based on the user profiling data, we adopted the aged-MRU (Most Recently Used) algorithm. The aged-MRU is a very simple algorithm that can apply to increase the priority of recently used license. To apply the aged-MRU on the history tracking analysis method, metadata should be extracted from the user profiling data. Table 2 shows the metadata related on the user license.

**Table 1** User profiling data

| User profiling data categories | Data in detail |
|---|---|
| License purchase history | - Purchased license item<br>- Purchase date, number, items<br>- License characteristics |
| User information | - Age, Gender, Birthday<br>- Residence & types<br>- Occupation, grade<br>- Hobby, choices |
| Data access history | - Yearly, monthly, weekly<br>- Seasons<br>- Access actions and logs |
| Data access characteristics | - Playlist<br>- Mostly / recently listened used lists<br>- Preference genre<br>- Recommendation (artist, fan, friend) |

**Table 2** License related metadata

| Matadata types | Contents |
|---|---|
| License items | - Number of purchase<br>- Period of purchase<br>- Time & data of purchases |
| Item types | - Download / streaming / complex<br>- Single / multiple<br>- Period (1, 3, 6 months)<br>- Membership / one-time |

To apply the aged-MRU algorithm with metadata from user profiling data, we need user profiling data generated from real users. Therefore, we had collected the user profiling data, extracted the metadata on license purchase history from the user profiling data, and applied on the history tracking analysis.

## 3. Environments

In this work, we targeted Melon, the major online music site provided by Loen Entertainment Co. in Korea [10]. Melon is the biggest online music site that has been occupied over 70% of online music distribution in Korean, and provides online music services for 24 million users with over 3.2 million of music.

In 2014, Melon decided to open the last 10 years big data including the user's music purchase history and music utilizing pattern for the music artists and entertainment companies. At the same time, Melon had developed the fan consumer metric based on the big data that can give individual user's preference on artists and music genres, and provides the recommendation service as a form of the personal familiarity. Melon also opened "Partner Center" as a front-end marketing information spot for the entertainment companies and artists. The personal familiarity system and the partner center can provide user profiling data including music purchase tendency, listening tendency, license purchase and utilizing pattern for each user.

The user license has many types in music license case. The streaming license and download license are the most typical license provided by online music sites and distributers. The complex license is a kind of combined license type that ties up the streaming and the download service.

Table 3 shows the user license types provided by major music sites and distributers in Korea. These licenses are provided in the form of coupon for all music in their own database beside the individual license. All the licenses are a sort of streaming, download or complex. The complex license includes streaming license and download license. Most of the case, the streaming license gives unlimited music listening but limited download count in a complex license. In chapter 4, we had performed history tracking analysis on the user profiling data for the license types. First,

we had analyzed the next license purchase for the streaming license, download license and complex license, and also analyzed the license purchase action for the periodic licenses such as short term license less than 1 month and long term license more than 3 months.

**Table 3** User license types

| | Melon | Genie | Mnet | Bugs | Soribada | Naver | Monkey 3 |
|---|---|---|---|---|---|---|---|
| **Unlimited streaming** | Term | Term | Term | Term | Term | Term | Term |
| **Limited streaming** | O | X | X | X | X | X | X |
| **Single streaming** | X | X | X | X | X | X | X |
| **Unlimited download** | X | X | X | X | X | X | X |
| **Limited download** | Max. # of songs | Max. # of songs | Max. # of songs | Max. # of songs | Max. # of songs | Max. # of songs | Max. # of songs |
| **Single download** | O | O | X | X | X | X | O |
| **Unlimited streaming + unlimited download** | Term | Term | Term | X | X | X | Term |
| **Unlimited streaming + limited download** | Term + Songs | Term + Songs | Term + Songs | Term + Songs | Term + Songs | Term + Songs | Term + Songs |
| **Extra Services** | Music Video | - | - | - | - | - | - |

* Term: A periodic term, 1, 3, 6 or more month(s)

* O: Service available, X: Service not available

* Max. # of songs: Limitation number of download allowed, 30 / 60 / 90 songs

## 4. Analysis and Results

To get the prediction on user's next license purchase based on the user profiling data, many sets of metadata which is concerned with the license purchase history that can be tracked through aged-MRU algorithm should be extracted from real user profiling data. For this work, we have to access the database interface that can connect the Melon big data for user profiling database. But the big data access interface can only be accessed by authorized artists, companies and organizations and not grant to individuals. Thus, we picked 44 sample users

among the melon users and gathered user profiling data for each sample user. For each user, we manually extract the appropriate metadata from the user profiling data submitted by users.

Next, we constructed the user's license purchase history through history tracking analysis method with aged-MRU algorithm. The history tracking analysis contains purchase strength measuring stage by using consecutive purchase history or multiple license purchase logs. The aged-MRU algorithm weights corresponding database items for each license by using user's attributes and tendency. The relative weight between weight and strength also set into a balance. The aged-MRU algorithm then finds the license purchase inertia and finally converts the license purchase inertia into the prediction of user's purchased action for the next license purchase and the periodic license respectively.

Table 4 shows the comparison result between license purchase prediction (Prediction) and user's real license purchase action (Real Activities) for the next license purchase. The Prediction shows a user's purchase possibility for the same license as the next purchase. The Real Activities shows the ratio of the user's real license purchase actions for the same license among the all real license purchases.

Table 5 shows the comparison result between Prediction and Real Activities for the periodic licenses. In this case, Prediction shows the re-purchase possibility for the same periodic license, and Real Activities shows the ratio of real periodic license purchases for the same period among the total periodic license purchases.

**Table 4** Comparison Results for the Next License Cases

| Next License Type | Prediction | Real Activities | Similarity (%) |
|---|---|---|---|
| Streaming | 64 | 75.3 | 84.9 |
| Download | 75 | 89.9 | 83.3 |
| Complex | 78 | 94.2 | 82.9 |

**Table 5** Comparison Results for License Term Type

| Periodic License Type | Prediction | Real Activities | Similarity (%) |
|---|---|---|---|
| 1-month | 44 | 36.3 | 81.2 |
| 3-month | 88 | 72.3 | 78.2 |
| 6 month or more | 90 | 80.4 | 88.1 |

The real activities in Table 4 show the fact that large part of users who has only a streaming license or a download license would purchase the other license in next purchase in case of music license. In other word, lots of users in this case would not make back-to-back purchase on the same license. This result shows that only a streaming license or download license purchased users would not prefer a specific license but purchase appropriate license fit to the circumstance, season and time for the next license purchase. But in case of the complex license purchase, users have high possibility of consecutive purchase on the complex license as the next license preference. It shows that most of the complex license users would have steady tendency to purchase and utilize various kinds of music in a long time. Therefore, this kind of user prefers the complex license that gives full streaming service and part of download in a single license, and purchases it in a series with the same type of license. These results show that the analysis of metadata in user profiling data has lots of effectiveness on analyzing the user license purchase tendency.

The real activities in Table 5 show that monthly license purchasers have low possibility of back-to-back license purchase when they would like to purchase the next license. Otherwise, long term user who purchases more than 3 months-package license has high possibility of consecutive license purchase. Since most of online music sites and distributers are providing the monthly based license at least 1-month, the light users who want to buy several music in a short term has a least consecutive license purchase history. For more than 3 months license, users have strong tendency to purchase the license in a long-term basis. Prediction analysis result also shows similar tendency for metadata analysis on user's purchase history of periodic license. Therefore, periodic license has very closed relation with the metadata analysis result from the user profiling data as like the next license purchase.

In summary, we had compared the prediction from the metadata analysis with the user profiling data on user's license purchase action and the real activities for user's license purchase, and finally had got the good result over the average 80% of coincidence between user's real license purchase activities and history tracking analysis result based on the aged-MRU algorithm with the user profiling data.

## 5. Conclusions

In this work, we collected the metadata concerned with the license purchases from 44 user's user profiling data in a specific online music distributer, and evaluated the coincidence between the license purchase predictions and the user's real license purchase actions by using history tracking analysis method based on aged-MRU algorithm. The comparison results show the license purchase prediction has very closed coincidence with the real license purchase actions over 80% if there are sufficient metadata in users' profiling data. This coincidence shows the user profiling data has deep relation to the user's license purchase actions. Thus, we found out the user profiling data can be effectively applied to the design stage of prediction methodology of the user's next license purchase actions.

Many internet information system users consider the recommendation of the online site or other users when decides to purchase the new license. If the license distributers or license management companies give very nice recommendation based on the user profiling data and metadata on user license purchase history that can fit the user's hobby or taste, user would strongly like to purchase the license and be increasing to get the exact copyright on one's work.

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