Sake Selection Support Application for Countryside Tourism

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Abstract. For the upcoming Tokyo Olympic Paralympic Games in 2020, the number of foreign tourists coming to Japan is expected to rise. However, there has been a problem with tourists becoming less likely to visit places outside of the urban areas. In order to solve this issue, a commitment has been made by the government to use "Sake Brewery Tour" to draw tourists to less populated areas. The purpose of this study is to find a way to encourage foreign interest to sake and sake brewers, and participant in "Sake Brewery Tours". We developed an application for the foreign tourists who are not much interested in sake. The approach of the study involved the presentation of sake selection in connection with wines, which have surprising similarities to the sakes, and encourage the tourists access sake brewer sites. 20 test users used the application, and the average screen residence time was 55 (sec) including the sake brewer sites, which was longer than the application for comparison, which shows the sake information alone. Therefore, we confirmed that the users come to have an interest in sake and sake brewers by showing the surprising connections with wine.

1 Introduction

The Tokyo Olympic Paralympic Games are to be held in 2020 [1]. This will cause foreign tourists to gather in Japan's urban areas, and in turn, create a problem in that it will be difficult to prompt tourists to visit places outside of the urban areas. In recent years, there has been a problem that very few tourists have chosen to venture the outside of the urban areas. Therefore, various approaches have been taken as an attempt to activate the country areas. For example, one approach has been to conduct "Sake Brewery Tours" [2]. This is carried out in a similar way to wine tours in France and California, and utilizes sake brewer as the main tourist attractions, and thus invites foreign tourists to the country areas. In this study, we developed an application to encourage the foreign tourists to be interested in participating in sake brewing tourism. Thus, we have taken an approach of presenting the surprising connections between wine and sake to the user. The reason for choosing wine to make our connection is that wine has the same way of brewing as sake, and the foreign tourists are commonly known to enjoy wine. For example, in the case of "Seisyu Kitanohomare

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Junmaigen-syu Samurai"(a sake name), the sake leads to "Kitanohomare Syuzou"(brewer) → "Otaru"(Location) → "Princess Mononoke"(Movie in the location) → "Hayao Miyazaki"(Director) → "Antoine de Saint-Exupery"(Writer who gave great influence on the director) → "CH.MALESCOT ST.EXUPERY" (Wine in winery that the writer's grandfather bought). We intended that the application invites the foreign tourists to the brewer and "Otaru" by showing connections such as the above.

The remainder of this paper is structured as follows. In Sects. 2 and 3, we present the proposed application and outline the background Linked Data to calculate the connections. Then, evaluations are reported in Sect. 4, before a discussion regarding related works in Sect. 5. In Sect. 6, we conclude this paper, and discuss the future works.

2 Proposed Application

We suggest use of our sake selection support application for people who are familiar with wine, but not much interested in sake. This application is able to use names of a sake list on a restaurant menu, to find a wine with surprising similarities to the particular variety of sake. Figure 1 shows a workflow of this application. The application is useful in the case that a user visits a Japanese restaurant, but is not familiar with the sake selection presented to him. There is already an application, that can provide the sake information such as brewers and flavors by reading labels on sake bottles [3]. However, there is no application, which provide sake's unique stock of knowledge related to wine. Figure 1(a) is of a screen that is displayed after taking a picture of a sake menu. A list of wines associated with the sake is displayed. However, due to the restriction of the screen size, the specific connections between the sake and the wine are displayed in the "?" mark at first. When the user recognizes a wine she/he is familiar with in the list, she/he taps the wine name. Then, the connection between the wine and the sake is indicated as shown in Fig. 1(b). If the user is interested in the sake, she/he can also tap the sake name. Then, Fig. 1(c) is displayed with the name of the sake and a picture of sake. Also, information such as the alcohol content of the sake and the URI of the brewer's website is listed at the bottom of the screen. If the user has become interested in obtaining more information at this point, she/he may access the brewer's website by tapping the URI.

2.1 System Architecture

Figure 2 indicates the system architecture to realize this application. The user starts the application, then takes a picture of the menu containing sake names. Then, the image that the user has taken is sent to a server. The server program analyzes the image, and sake names are extracted. Strings from the image are extracted using the Tesseract-OCR[1]. Tesseract-OCR is an OCR library. Also,

[1] https://github.com/tesseract-ocr.

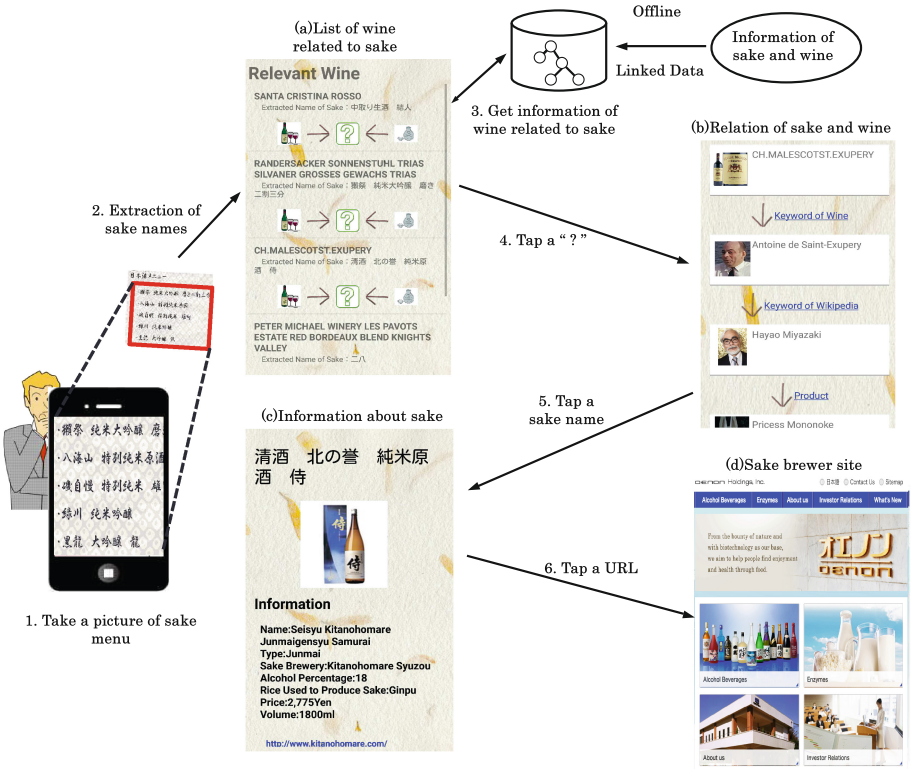


Fig. 1. Application workflow

a SPARQL Protocol and RDF Query Language(SPARQL) query is performed on a Resource Description Framework(RDF) DB called Sesame[2], in order to get all the names of sake varieties. RDF is in the form of a <subject, property, object>, and a SPARQL is a query language for RDF. More details are described in Sect. 3. Then, by using the edit distance between the obtained sake name and strings of each line extracted from the image, a sake name with the smallest edit distance is retrieved. Finally, wines associated with the sake and connection information are acquired by performing a SPARQL search with the sake name. After obtaining all the associated wines by following the background Linked Data described in the next section, the connection information is sent to the client. The information includes the wine names associated with the sake and the connection information between the sake and the wines. The client side displays the information to the user. When the user taps a sake name, a SPARQL search is performed again in order to get the information about the sake, e.g. descriptions and brewer sites, from the client. Then, the obtained information is presented to the user.

[2] http://rdf4j.org.

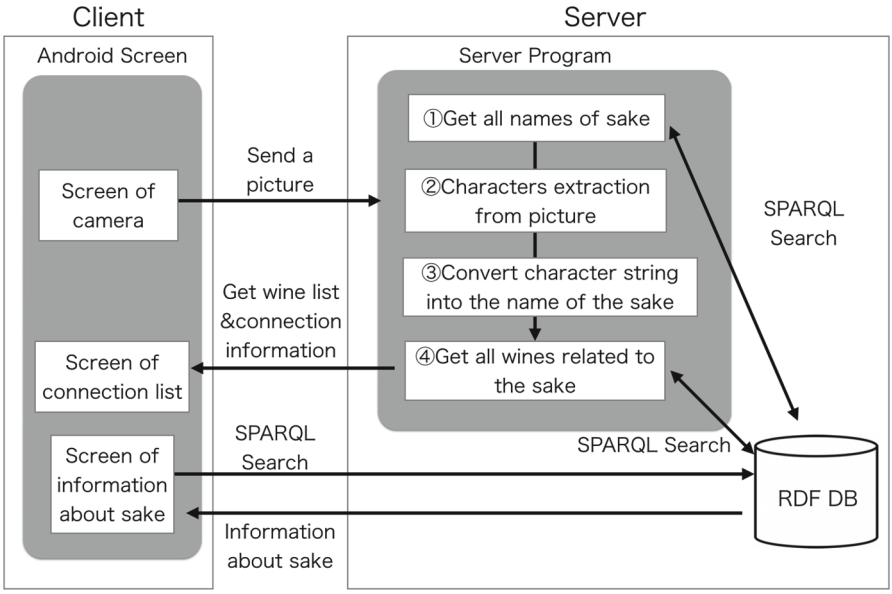


Fig. 2. System architecture

2.2 Example of Search

For example, "Seisyu Kitanohomare Junmaigensyu Samurai" is a variety of sake. Figure 1(a) shows that there is a connection between the sake and the wine called "CH.MALESCOTST.EXUPERY". The sake is made in a brewer named "Kitanohomare Syuzou" found in Otaru City, Hokkaido in Japan. Otaru is known as a stage of a cartoon film called "Princess Mononoke", which is directed by "Hayao Miyazaki", whose favorite writer is "Antoine de Saint-Exupery". Also, there is a winery owned by his great-grandfather, and "CH.MALESCOT ST.EXUPERY" is one of wines produced by the winery. This is a wine that has been associated with the sake. By noticing such surprising connections between the sake and the wine, the users become interested in the sake, and hopefully the sake brewer, and its area outside of the urban district.

3 Background Linked Data

Linked Data is a graph data, which is used to publish and share data on the Web proposed by Tim Berners-Lee[3]. In this study, the background information related to wine, sake, and their brewers, etc. has been converted into Linked Data. We collected a large amount of data described about sake and wine in several websites, and converted them in the RDF format.

[3] http://www.w3.org/DesignIssues/LinkedData.html.

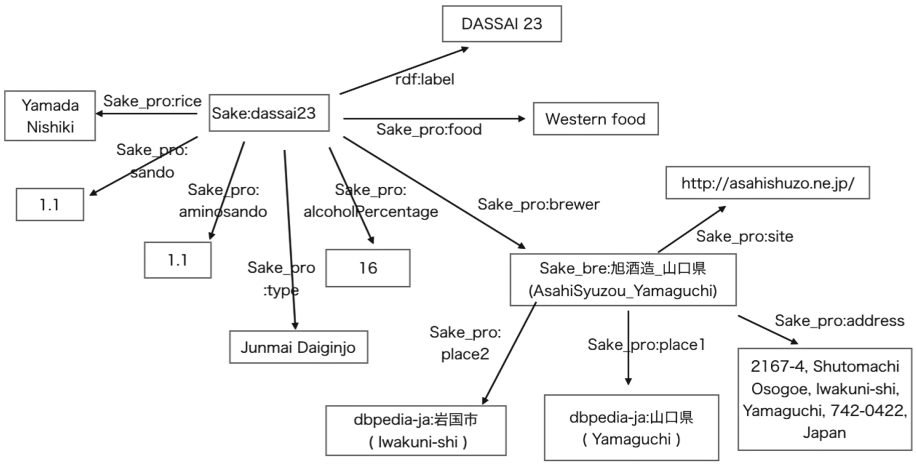
3.1 Conversion of Sake and Wine Data to Linked Data

As described above, we created a set of data related to sake and wine in Linked Data format. We collected the data from EC sites such as the Sake Brewer's official sites in Rakuten[4] and sites of sake tasting information. The converted data set consist of 186,000 triples <subject, predicate, object>, which corresponds to records in DB. For retrieving the wine data, we performed a morphological analysis on sentences in the wine comments, and also extracted the data from Wikipedia headwords. We used Mecab[5] as the morphological analysis engine. The extracted data are described with the DBpedia[6] resources. DBpedia is Linked Data, which contains Wikipedia infobox information. Then, properties are described in our own sake schema defined in our website[7]. Linking to the resources of the DBpedia made it easy to link the external data. We also used the data about the sister cities of the Council of Local Authorities for International Relations[8]. The data of the sister cities are used in order to make it easy to search the connection of brewers. In the previous example, a place was a stage of a cartoon file, and also a location of the sake brewer. However, less data would be used to make the connections in other places. Therefore, we used the Linked Data of the sister cities to facilitate the search. In addition, we used Linked Open Data called Location Site of Japanimation(LSJ)[9]. LSJ includes information about locations that have become stages of cartoon filmes. Figure 3 shows a sake called "DASSAI 23" in the RDF format. The resource is indicated as <`Sake:dassai23`>, and a property is a <`rdf:label`>, and an object is described as a literal "DASSAI 23". Although the sake brewer that made this sake is "Asahi Brewery" in Yamaguchi Prefecture, it is difficult to distinguish the same brewery in Oita Prefecture. Therefore, the URI is described as a representative URI, <`Sake_bre:Asahi_Yamaguchi`>. Information such as the polishing ratio of rice and amino acid level of the sake is also converted to the RDF format. Table 1 shows some of the properties that we have defined, where "Sake_pro:" is a prefix of <http://www.ohsuga.is.uec.ac.jp/sake/property/>.

3.2 Search Method

In this application, a server-side program is used to search wines related to the same based on the semantic relationship. A SPARQL query leads to the location of the sake brewer. Various contents are then associated with municipalities. For example, the content to be used in the search includes locally famous persons, stages of films, sister cities, and so on. The program searches for a wine through these contents.

[4] http://www.rakuten.co.jp.
[5] http://mecab.googlecode.com/svn/trunk/mecab/doc/index.html.
[6] http://wiki.dbpedia.org.
[7] http://www.ohsuga.is.uec.ac.jp/sake/property/wiki.
[8] http://www.clair.or.jp/j/exchange/shimai/data150831.xlsx.
[9] http://cheese-factory.info.

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PREFIX Sake:<http://www.ohsuga.is.uec.ac.jp/sake/>
PREFIX Sake_bre:<http://www.ohsuga.is.uec.ac.jp/sake/brewer>
PREFIX Sake_gov:<http://www.ohsuga.is.uec.ac.jp/sake/gov>
PREFIX Sake_pro:<http://www.ohsuga.is.uec.ac.jp/sake/property/>
PREFIX dbpedia-ja:<http://ja.dbpedia.org/resource>
PREFIX rdf:<http://www.w3.org/2000/01/rdf-schema/>
```

Fig. 3. Example of RDF

Table 1. List of properties

Defined property	Description
Sake_pro:brewer	sake brewery
Sake_pro:type	Type
Sake_pro:volume	Volume
Sake_pro:alcoholPercentage	Alcohol percentage
Sake_pro:rice	Rice used in the brewing
Sake_pro:food	Food that matches well
Sake_pro:temperature	Temperature suitable to drink
Sake_pro:smellTaste	Smell and taste
Sake_pro:price	Price
Sake_pro:site	Sake brewery website
Sake_pro:address	Address
Sake_pro:place1	Address1
Sake_pro:place2	Address2
Sake_pro:wiki	Word of Wikipedia which has the relation

For another example, in the case of "Kagatobi Junmaidaiginjou" (a sake name), the sake leads to "Fukumitsuya" (Brewer) → "Kanazawa City" (Location) → "COIL A CIRCLE OF CHILDREN" (Cartoon based on the location) → "Wearable Computers" (Key items in the cartoon) → "The Expendables 3" (Movie that uses the same items) → "Arnold Alois Schwarzenegger" (Actor in the movie) → "California" (State that the actor has been inducted into the office of governor) → "RIESLING SONOMA COUNTY" (Wine of the state). Figure 4 shows the above relation. The server program executes several SPARQL queries. Then, if it obtains wines in the resulted connections, it sends the data of the wine and any related contents to the client side of the application.

4 Evaluation

The purpose of the evaluation is to measure effectiveness of this application by analyzing the user behavior. In addition, we accessed whether the user is interested in sake and wine, or not.

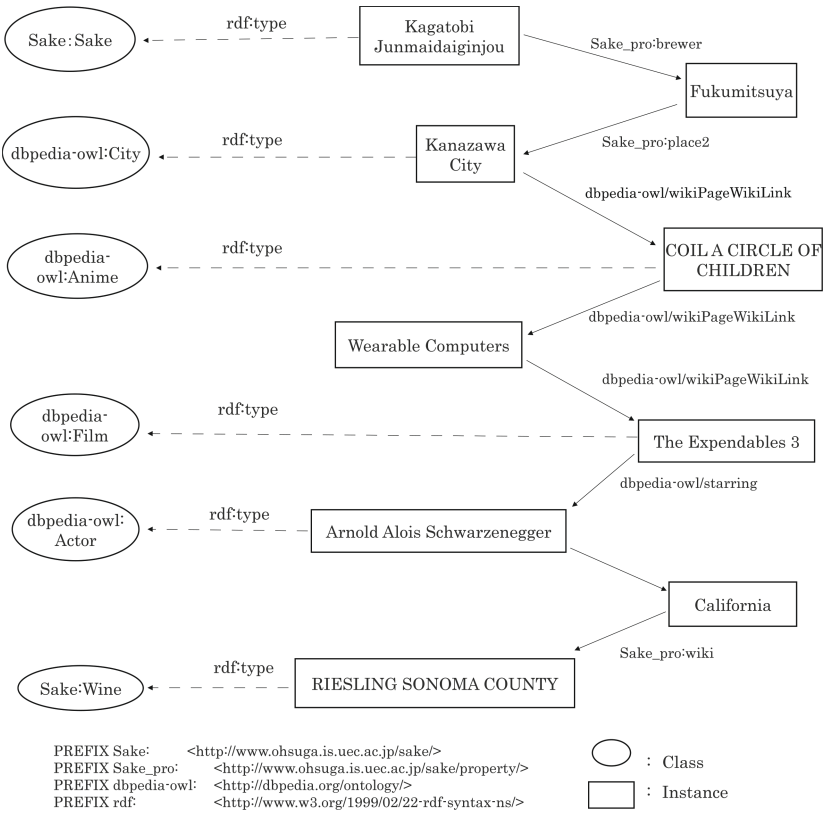

Fig. 4. Example of search method

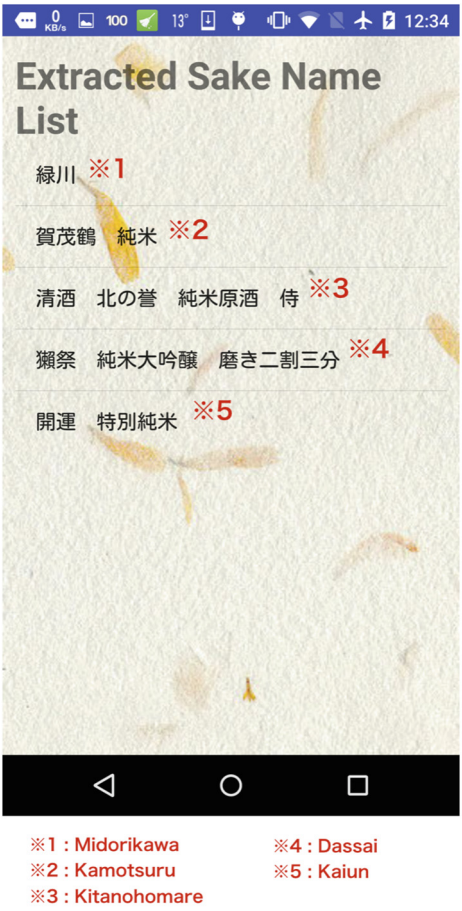

Fig. 5. Screen of comparison application

4.1 Experiment on Effectiveness

In order to confirm the effectiveness of providing sake and wine connections, we utilized Google Analytics v4[10]. Google Analytics is a free tool that can analyze users' behavior in the application. The evaluation items are the average residence time of each screen in terms of screen view and view rate. We also created an application that displays only the information of sake for comparison, which corresponds to the conventional application described in Sect. 2. If a user takes a picture of a sake menu, a list of sake names is read and displayed as shown in Fig. 5. Then, if the user taps a sake name, only the information of the sake is displayed as shown in Fig. 1(c). As with the proposed application, the brewer site is also displayed as shown in Fig. 1(d) when the user taps the URI. We compared

[10] https://developers.google.com/analytics/devguides/collection/android/v4/.

Table 2. Results of evaluation

	Degree of interest of sake	Degree of interest of wine	Avg.time on screen(seconds)	Screen views	%View
Compared application	1	1	0:00	0	0.00 %
	1	2	0:13	6	100.00 %
	2	1	0:24	3	100.00 %
	2	2	0:22	6	57.15 %
	2	3	0:06	7	50.00 %
	3	2	0:22	5	60.00 %
Proposed application	1	1	0:00	0	0.00 %
	1	2	0:55	3	100.00 %
	2	1	0:09	2	100.00 %
	2	2	0:39	7	62.50 %
	2	3	0:19	5	100.00 %
	3	2	1:06	4	75.00 %

these two applications by their subject use. The evaluation items included the screen residence time, the number of screen views and the view rate in the screen of Fig. 1(d), which is the last screen. The user information is the degree (1: hate, 2: neither, 3: love) of preference for wine and sake. We invited 20 users to participate in the evaluation. However, the number of sake varieties used for the sake menu in the experiment was five for now.

4.2 Performance Comparison

Table 2 shows the result of the evaluation. In terms of the average screen residence time, the screen staying time of the proposed application was longer than the applications to compare. For people who answered that they are not much interested in sake, the average screen residence time in the application to compare was 13 (sec), but the proposed application achieved an average of 55 (sec). Although there was no change in the number of screen views, the proposed application has higher scores than the application to compare in terms of the view rate. The average view rate of the proposed application was 73.00 %. On the other hand, the average view rate of the application for comparison was 61.20 %. If the screen residence time and the view rate will increase, the possibility that the users see the sake brewer sites will also increase. Thus, we can confirm the effectiveness of the proposed application.

5 Related Work

Sakenomy[11] is an existing application, providing a service related to drinking sake. Sakenomy is a sake information retrieval application that uses the recorded information of sake. Information that is recorded in the application is about 800 bottles of sake that are exhibited in a sake competition called "SAKE COMPETITION"[12]. If the user takes a picture of the label of sake, they can view information about the taste of the sake. In addition, the user can record information about sake tasting results, and it is possible to compare the results of the professional tasting with their own tasting. Ministry of Economy, Trade and Industry in Japan also developed an application similar to the above in the Cool Japan Initiative [3].

This application offers recommendations for sake selection. However, the user's preference data for sake are used for the recommendation and thus the application is not suitable for users, who are not familiar with sake.

A study of Nasugawa includes natural language processing of murmurs in Twitter [4]. This study analyzed 373 tweets including 131 shops located in Tokyo, and as a result, information about 10 taverns was obtained. Although it was difficult to identify tweets for analysis due to excessive noise, evaluation of the tavern identified was high. This showed the effectiveness of the micro-blog as a knowledge source.

As the recommendation of the relevant studies using the Linked Data, there is research of Khrouf [5]. Meta-information such as the location of the event information site is converted to a set of Linked Data. The event information recommendation system is constructed by a content-based approach. The method uses the similarity of the data structure and calculation of the sentence degree of similarity, by applying the topic model method to sentence events. Elahi et al. studied recommendation of pictures using the data converted into RDF from the user information on Facebook and Flickr [6]. Passant et al. proposed a method called "Linked Data Semantic Distance" to calculate a semantic distance between Linked Data, and performs a music recommendation [7]. Moreover, Mian et al. proposed the technique of recommending music to be associated the location information of the user [8]. Mirizzi et al. proposed a method for recommending movies by using the vector space model as a source of information for the DBpedia [9]. However, the method for recommendation from the semantic structure has not yet been applied to the liquor to the best of our knowledge.

6 Conclusion

In order to lead foreign tourists to sightseeing in the sake brewers in the countryside as the Tokyo Olympic Paralympic Games held in 2020, we developed an application that prompts the tourists to have an interest in sake by showing the surprising connections between sake and wine. Then, we evaluated the

[11] http://www.sakenomy.jp.
[12] http://sakecompetition.com.

application in terms of the view rate, the screen residence time and the number of screen views to measure the degree of relevance and interest for the users. Although the main contribution of this paper is a novel application proposal for supporting countryside tourism, the experiment of 20 test users showed that the application has the possibility that exposing the connections between wine and sake may cause the interest in sake and sake brewers in the user.

However, in this work, we developed a non-personalized application in order to avoid troublesome operations that is necessary for input the user profile (metadata). Also, the extraction of the user's tasting profile will take longer time to analyze. However, since a mechanism to customize the target wines based on tourists' metadata or specific answered questions by the user could substantially enhance the performance of the application, we intend to include the user's profile in the future version. We plan to analyze the view rate, the screen residence time and the number of screen views to estimate the user's profile including the preferable relations between the user and the sake/wine. In addition, we will incorporate more information about sake and wine, and increase SPARQL queries to find more surprising connections.

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