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AR Tourism Recommendation System Based on Character-Based Tourism Preference Using Big Data

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Abstract

The development of the fourth industry has enabled users to quickly share a lot of data online. We can analyze big data on information about tourist attractions and users' experiences and opinions using artificial intelligence. It can also analyze the association between characteristics of users and types of tourism. This paper analyzes individual characteristics, recommends customized tourist sites and proposes a system to provide the sacred texts of recommended tourist sites as AR services. The system uses machine learning to analyze the relationship between personality type and tourism type preference. Based on this, it recommends tourist attractions according to the gender and personality types of users. When the user finishes selecting a tourist destination from the recommendation list, it visualizes the information of the selected tourist destination with AR.

Keywords: *Image Analysis, AR, Big Data, Machine Learning, Emotional Tourism, Recommendation System*

1. Introduction

Recently, the development of the fourth industry and the spread of the Internet and mobile devices have greatly expanded. This allows users to quickly share their experiences and thoughts online, regardless of time and place. The increase in these data has led to the formation of big data. The development of technology that analyzes big data and processes it into meaningful information has become important.[1] We use artificial intelligence actively to analyze big data. It has already been combined with the tourism industry in many ways to help tourists make decisions and enrich their travel experience.[2] Research on AR technology is also actively being conducted with research related to the integration of digital media technology and tourism contents.[3] There are differences in tourism preferences depending on the nature of the user. We can use it to provide personalized tourism recommendation services.[4]

The system proposed in this paper recommends tourist attractions based on the preferred type of tourism by

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personality type, which is divided into machine learning in advance when users enter their gender, personality type and desired tourist area. We manage it using Database and lists the next recommended tourist list, which is highly correlated with the selected tourist destination if the user chooses a tourist destination from the recommendation list. When the user completes the selection of the tourist destination to visit, the system provides the information of the selected tourist destination as AR service using the camera on the user's mobile phone.

Section 2 describes the analysis of tourism image based on AR and big data, and the analysis of tourism preference using machine learning. Section 3 describes the overall system structure and flow charts for each area. Section 4 actually applies the system to analyze tourism preferences by user characteristics and implement AR visualization services. Section 5 describes the system summary and future research tasks.

2. Related Works

2.1 AR

AR(Augmented Reality) is an area of VR(Virtual Reality). It is a computer graphics technique that blends 3D virtual images into the real world that users see with their eyes. You can maximize your experience with visual and auditory information.[5] Recently, fourth industrial technology has been developed in convergence among various fields. By utilizing AR for tourist-tailored services, strong tourism inflow can be achieved.[6] This paper applies these AR technologies to the customized tourist course recommendation system to improve visual immersion. Through this, we want to highlight the AR field as the evolution of tourism contents.

2.2 Big Data-Based Tourism Image Analysis

Big data involves systematically managing and analyzing large amounts of structured and unstructured data and combining these data to create very great value. Recently, research and projects using big data have been actively carried out in various fields of the tourism industry. We can collect the big data on web to identify frequency of reference of major words, centrality of connection between words, etc. Based on these analyzed data, we can analyze the association between tourist images and tourist attractions in a particular region.[7]

2.3 Analysis of Tourism Preference Using Machine Learning

There is a link between users' MBTI personality types and preferences by type of tourism.[8] As a result of clustering data on users' tourism preferences using K Means algorithm of machine learning, we clearly classified it into two types, Introvert Type and Extrovert Type. There is a correlation between classified personality types and tourism preferences.[9] This paper applies this to analyze the relationship between personality type, gender and tourism preference. We used Pearson correlation coefficient to analyze correlation.[10]

3. Proposed System

3.1 System Architecture

Figure 1 shows the architecture of the tourist destination recommendation system using machine learning and big data. We divide each area into the Data Preprocessing Layer area where it preprocesses pre-populated data, the User Interface Layer area that provides a customized recommendation system to users based on pre-populated data, and the Database Layer where it stores actual data. In the Data Mining Processing area, it crawls data on web pages in the Web Crawling area. It refines Data that is crawled in the Frequency Analysis by Tourism area and analyze the frequency of reference by tourist destination. It stores the frequency of this analysis, the names of tourist attractions collected in advance, the type of tourism to which they belong, and the region in the Tourist Sides Information. In the Machine Learning area, it groups preference data by type of tourism collected in advance into clusters. In the Correlation area, it analyzes the correlation between the clustered personality type and gender and tourism preference. It also analyzes the correlation between preferences by type of tourism by gender and stores them in the Correlation of Tourism Preference area. The service provider stores information and AR models on the AR Model of Major Tourist Sites in advance. User Input Data enters the user's information. Based on all processed data, it recommends customized tour list using

the database. It visualizes the appearance and information of the selected tourist destination in AR Visualization.

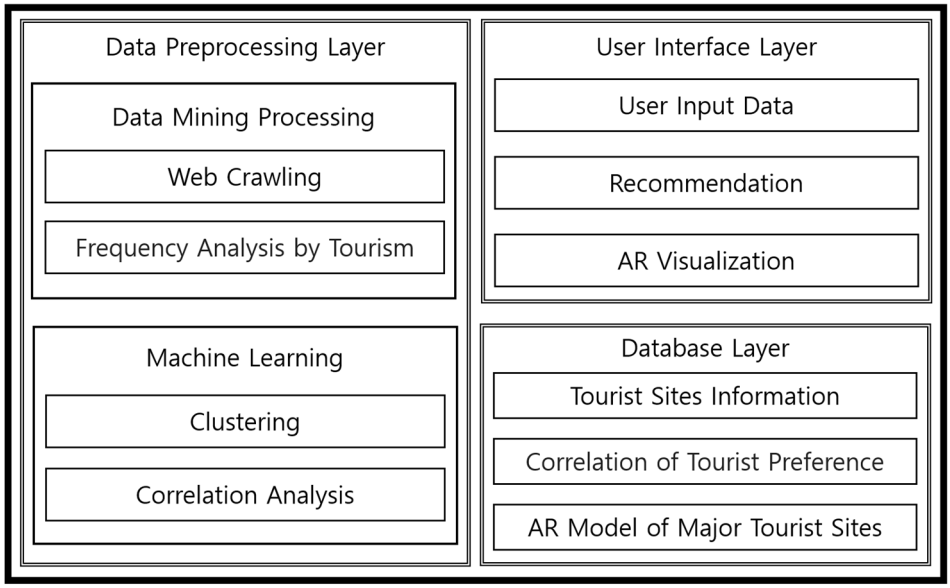

Figure 1. System Architecture

3.2 Analysis of Character-Based Tourism Image Using Machine Learning

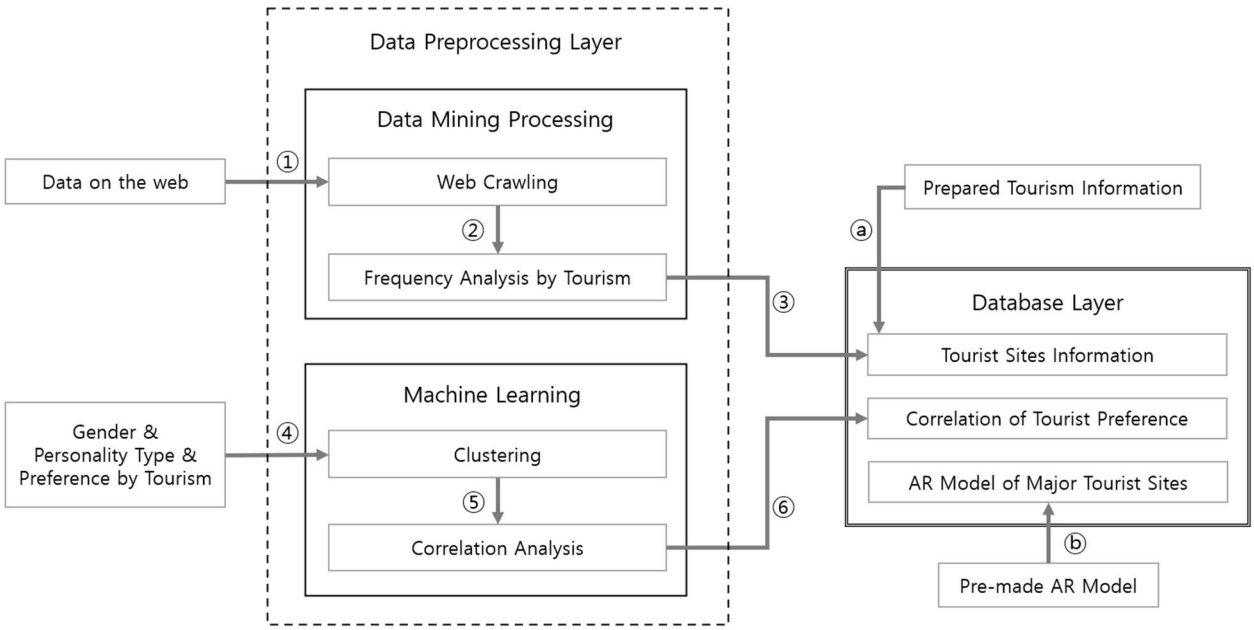

Figure 2. Flowchart of Character-Based Tourism Image Analysis

Figure 2 shows the flowchart of character-based tourism image analysis. The service provider prepares information on tourist sites and AR models of major tourist sites in advance and stores them in the database through ⓐ and ⓑ. It crawls data on the web for tourist areas as keywords in ①. It refines the crawling data and analyzes the frequency of reference by tourist destination in ②. It stores these analyzed data in the database via ③. It clusters pre-collected Gender, Personality Type, Preference by Tourism information. And

it classifies personality types as Introvert Type and Extrovert Type in ④. Based on the classified personality types, it analyzes the correlation between gender, personality type and tourism preference in ⑤. It stores the analyzed data in the database through ⑥.

3.3 AR Framework Based on Emotional Map

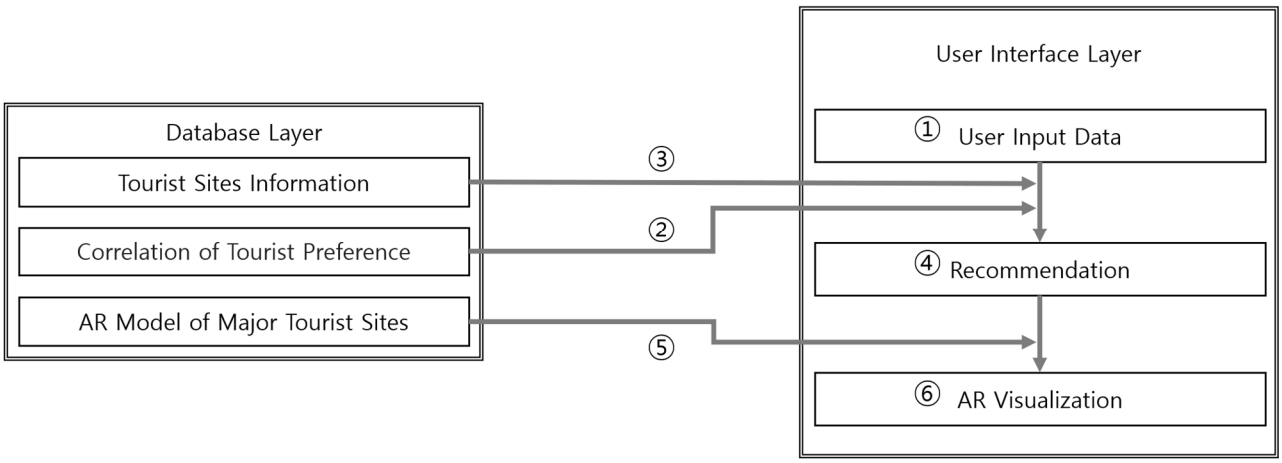

Figure 3. Flowchart of AR framework based on emotional map

Figure 3 shows the flowchart of AR framework based on emotional map. The user enters the user's MBTI personality type, gender, and region to tour in ①. The system accesses the database through ② to identify the type of user's personality and the type of tourism that is highly correlated with gender. It lists tourist attractions corresponding to the type of tourism identified in ② in order of high frequency of reference through ③. It uses these loaded data in ④ to list recommended tourist lists. When the user finishes selecting a tourist destination to pass through, it loads the AR model stored in the database through ⑤. The System provides information on tourist sites as an AR service in ⑥.

4. Applying System

4.1 Analysis of Tourism Image Based on User Characteristics

Tabel 1. Frequency of mention of tourist attractions in Jung-gu, Seoul

Tourist Site	Frequency	Tourist Site	Frequency	Tourist Site	Frequency
Myeongdong	936	Seoul Plaza	231	Korea Chamber of Commerce and Industry	32
Han River	610	Donuimun Museum	214	Shinsegae Department Store	32
Seoul Lite Festival	577	Nodeul Island	196	Lotte Department Store	31
City Hall	452	Gwanghwamun	189	National Theater	29
DDP	445	Sungnyemun	143	East Seoul Tourist Hotel	26
Eulji-ro	377	Seoul Museum of Art	120	Myeongdong Cathedral	26
Namsan Mountain	347	Russian Legation	103	Namsangol Hanok Village	25

Dongdaemun	299	Gyeongbokgung Palace	78	Central Market	24
Seodaemun	288	Shilla Hotel	64	Toegye-ro	24
Seoul Station	285	Namdaemun Market	53	Gwangjang Market	22
Deoksugung Palace	281	Lotte Hotel	45	Deoksugung-gil	22
Independence Park	274	The Namsan Tower	43	National Museum of Korea	21
Cheonggyecheon (Stream)	265	Seoul City Wall	39	Wongudan	18
Chungmuro	257	Chungjeongno	34	Dasan Fortress Trail	17

Table 1 shows the top 42 results by analyzing the frequency mentioned by conducting web crawling with the keyword "Travel in Jung-gu, Seoul" and refining the words corresponding to the tourist name. The system stores analyzed results in the DB and uses as criteria for recommending tourist attractions.

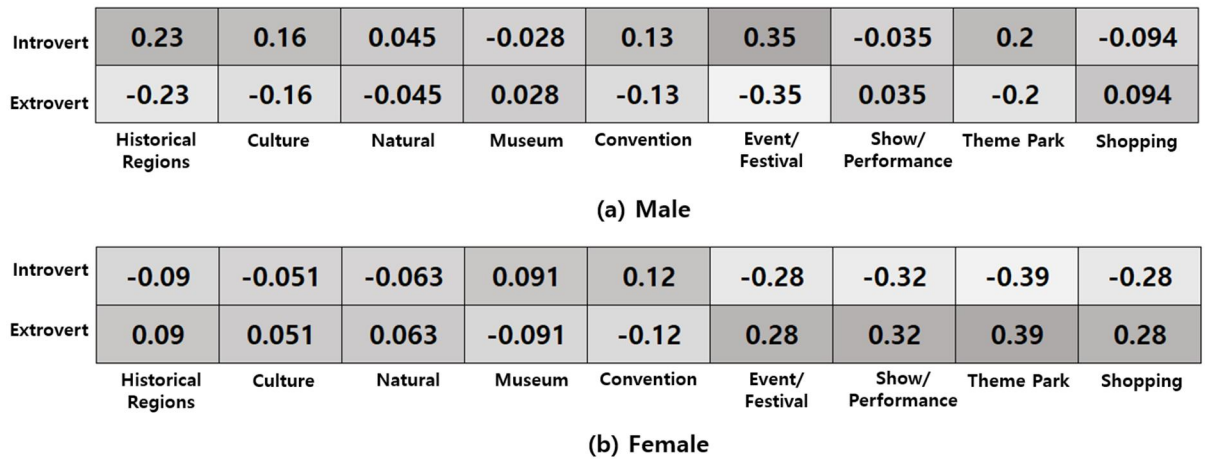

Figure 4. Correlation of Tourism Preference by Personality Type and Gender

Figure 4 is the result of classifying data by gender and then analyzing the correlation between personality type and tourism preference. There was a difference in the correlation between personality and tourism preference depending on gender. For men, there is a large association of tourism preferences according to personality types in the types of Historic Regions, Event/Festival, and Theme Park. For women, there is a large association of tourism preferences by personality type in Event/Festival, Show/Performance, Theme Park, and Shopping.

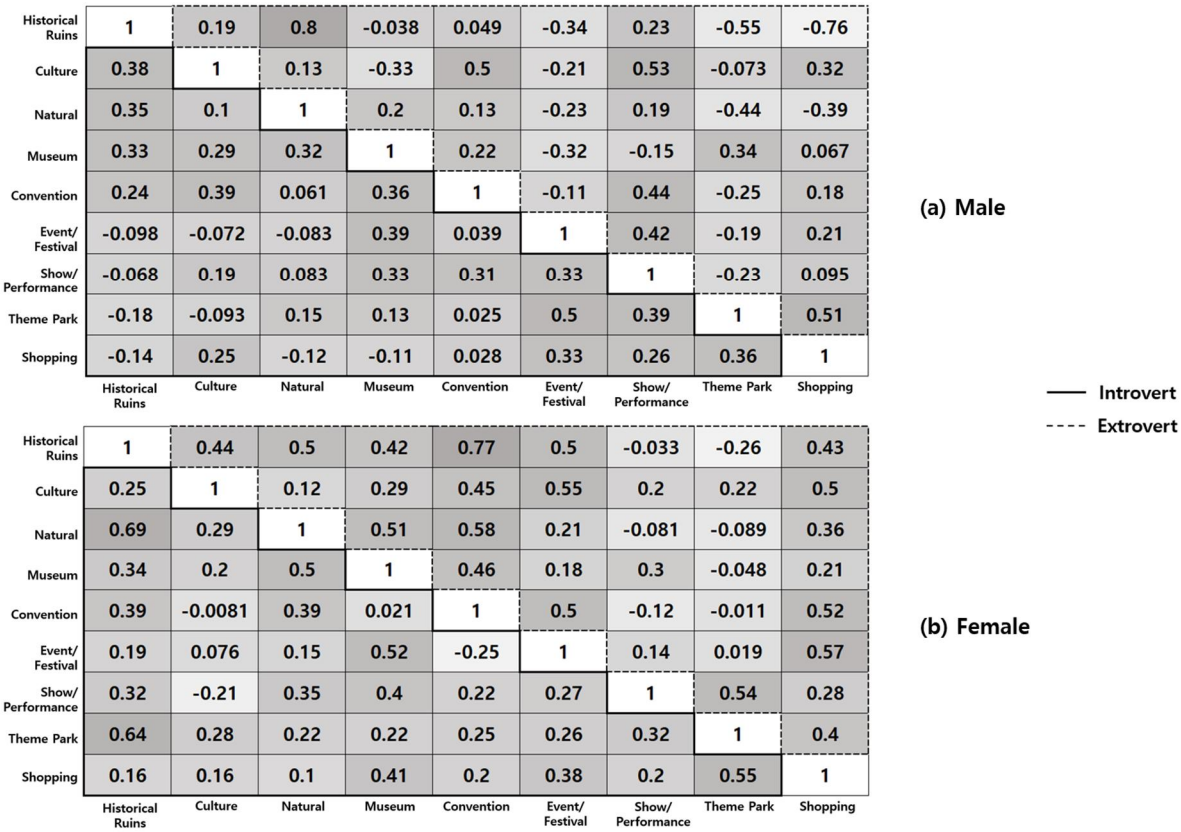

Figure 5. Correlation of Tourism Preference by Gender

Figure 5 is the result of classifying data by gender and then analyzing the correlation between personality type and tourism preference. It stores these analyzed data in the DB and uses it as a criterion for recommending tourist attractions.

4.2 Implemented System

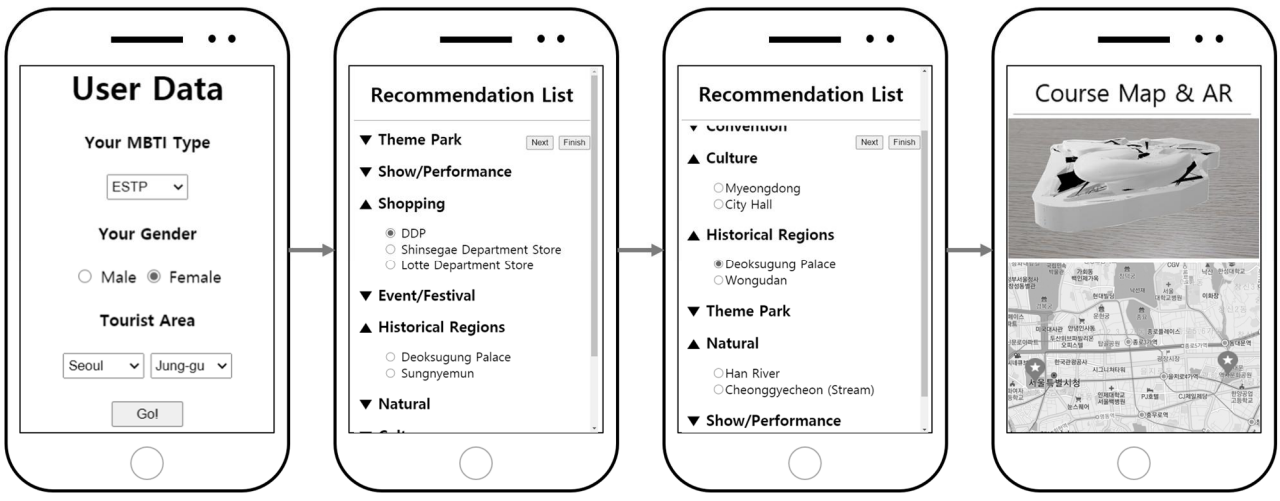

Figure 6. Examples of proposed systems – Extrovert Type & Female

Figure 6 shows the actual application of the proposed system. In (a), user enters information that a female user of ESTP travels to Jung-gu, Seoul. The system approaches the Correlation of Tourist Preference and lists the types of tours in order of high correlation with the Females and Extrovert Types (see Figure 4 – (b)). It loads the names of tourist attractions with high frequency of reference by type from the Tourist Sites Information and lists as (b). The user selects DDP from the recommendation list. The system re-accesses the Database to find tourist attractions with high tourism types and high frequency of references that are highly correlated with the Shopping type (see Figure 5 – (b)). It re-lists the loaded tourist site information as shown in (c). When the user completes the selection of tourist attractions by repeating the steps in (b) and (c), it uses the Kakao Map API, as shown in (d), to mark the selected tourist attractions in the form of markers, and provides information about them as AR services.

5. Conclusion

In this paper, we propose a tourism recommendation system based on individual characteristics. To this end, we divided individual personality types into introverted and extroverted types and analyzed them according to gender. We analyze the correlation of tourism type preferences according to the characteristics classified types. It also analyzed the correlation between tourism types. The analysis results showed significant differences in preference correlation for each type. Using this, we can recommend tourist types with high preferences depending on individual characteristics, and other types of tourist attractions related to this can also be recommended. The goal of the recommendation system is to provide customized services. As a result, factors to consider increase over time. As user records accumulate, analysis of data should continue. In addition, data analysis will need to be conducted every time a new tourist destination is added or reorganized. With the development of the Internet, the importance of technology to process big data into meaningful information is increasing. In the future, by adding user characteristicWs and tourist destination data, customized recommendation types should be analyzed and trained through artificial intelligence to increase accuracy, and evaluation of them should also be considered.

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