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Adaptive Recommendation System for Tourism by Personality Type Using Deep Learning

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Abstract

Adaptive recommendation systems have been developed with big data processing as a system that provides services tailored to users based on user information and usage patterns. Deep learning can be used in these adaptive recommendation systems to handle big data, providing more efficient user-friendly recommendation services. In this paper, we propose a system that uses deep learning to categorize and recommend tourism types to suit the user's personality. The system was divided into three layers according to its core role to increase efficiency and facilitate maintenance. Each layer consists of the Service Provisioning Layer that real users encounter, the Recommendation Service Layer, which provides recommended services based on user information entered, and the Adaptive Definition Layer, which learns the types of tourism suitable for personality types. The proposed system is highly scalable because it provides services using deep learning, and the adaptive recommendation system connects the user's personality type and tourism type to deliver the data to the user in a flexible manner.

Keywords: *Deep Learning, Machine Learning, Adaptive Recommendation System, Big Data, Personal Type*

1. Introduction

With the development of Information and Communication Technologies (ICT), several systems are used to provide personalized services[1]. Recently, research on a recommended system using big data is mainly being conducted. The majority of recommended systems collect user data and process and manage the data collected as big data to provide customized services to users [2]. Recommended service systems provide services by processing data such as user's browsing history and interests based on algorithms. In this paper, we designed a system that connects the type of tourism to suit the user type using deep learning in these recommended systems to provide more personalized to these recommended systems. Deep Learning is a branch of machine learning, a technique in which a machine uses big data to classify data [3]. This not only classifies big data as

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the program designed by the developer but as a new class of data that comes in with a new pattern of data so that services can be provided and more diverse services.

The proposed system used deep learning for correlative classification by personality type, and an adaptive recommendation system was introduced to manage defined data and provide services to users. The system was designed in three layers according to its core role for efficiency and further scalability. The Service Provisioning Layer provides a user interface with layers that are encountered by real users. The Recommendation Service Layer will use the entered user information to connect the type of tourism to suit the personality type, and link the type of tourism with the area the user wants, eventually recommending the destination. Adaptive Definition Layer consists of a module that collects personality type and preferred tourism type data separately and a module that learns using that data.

The composition of this paper is as follows. Chapter 2 describes deep learning and adaptive recommendation systems as relevant studies. Chapter 3 designs deep learning and adaptive recommendation systems and describes the detailed modules and operating processes of adaptive recommendation system layers. Chapter 4 uses deep learning based on the system designed to define preferred tourism types according to personality type. Chapter 5 summarizes and organizes the system with the conclusion of this paper, and describes future research tasks.

2. Related Works

2.1 Deep Learning

Deep Learning is a part of machine learning and can be described as teaching a machine how to think [4]. The goal is to abstract the data using several nonlinear transformation techniques to classify and extract key content and functions. Using GPUs are mainly easy to calculate matrix or vector. It is based on Artificial Neural Network (AAN) and has come into the spotlight as hardware advances and big data form [5]. Typically, there are algorithms such as synthetic neural networks based on Deep Neural Network (DNN) in the form where several layers of hidden layers are located between input and output layers, and circular neural networks[6]. In-depth neural networks use error reverse propagation algorithms to optimize weights, which can be updated using probabilistic slope descent.

2.2 Adaptive Recommendation System

One typical form of personalization service is personalization recommendation service. It can be said that the first academic release of the personalization recommendation service was made in the mid-1990s[7]. Starting with the initial recommendation research, the recommendation problem has been widely studied, but various recommendation methods have been proposed based on various methods in the field of information retrieval and data mining.

Traditional recommendation services were mainly rule-based, with user-favorite information and tried to recommend matching content and services[8]. To solve the problem that a content base method is a method for recommending a new item based on items used or evaluated by a user in the past, and is easy to embody and directly reflect user's preference, but it is difficult to find[9].

2.3 Definition of personality type and tourism type

Referring to the definition of tourism type according to MBTI personality type, the personality type and the type of tourism were defined as shown in Figure 1. A total of three types of personality are introverted, extroverted, and neutral. As shown in Figure 1, priority was given for each of the four sections and 13 detailed

types.[10]

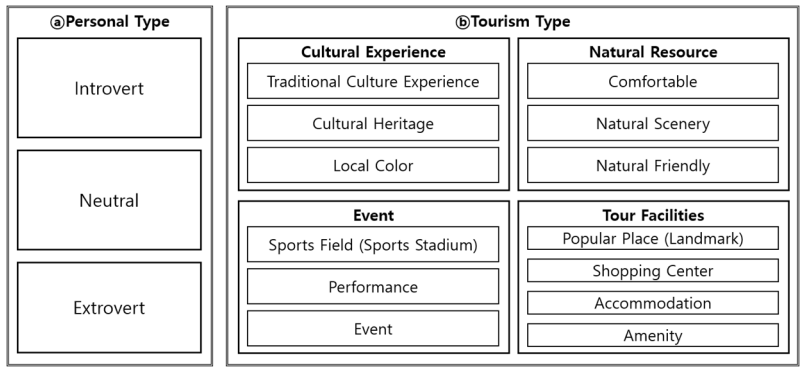

Figure 1. Personality Type and Tourism Type

Cultural experience type mainly enjoys cultural experience or historical site exploration, natural resource type prefers nature itself or related place, and event/event type enjoys participating in stadiums and various events. The type of tourism facilities favors a shopping center or landmark visit to each region by preferring places that are specialized in tourism.

3. Design of Adaptive Recommendation System

3.1 System Overview and Configuration

Figure 2 is the architecture of the deep learning and adaptive recommendation system designed based on the results of the tourism type that fits the personality type. The system is divided into three layers for maintenance and efficient handling. The Service Provisioning Layer is responsible for the interface provided to the user, while the Recommendation Service Layer provides the recommended service based on the user information entered. The Adaptive Definition Layer defines the type of tourism that fits the personality type, apart from the actual system of recommendation that is serviced. The Service Provisioning Layer consists of Visualization Service, which is the corresponding Web page for providing visualization services and is provided in the form of a Web service that is presented to users. The Recommended Service Layer consists of Data Processing Manager for managing input and output data. The detailed module consists of a Data Preprocessor module that connects the entered MBTI to a personality type used by the real recommended system and a Data Post-processor module that links the region with the tourism type. Adaptive Definition Layer consists of a Data Collector module that collects personality types and preferred tourism types in the form of a survey, and a Learning Processor layer where actual learning takes place using the data.

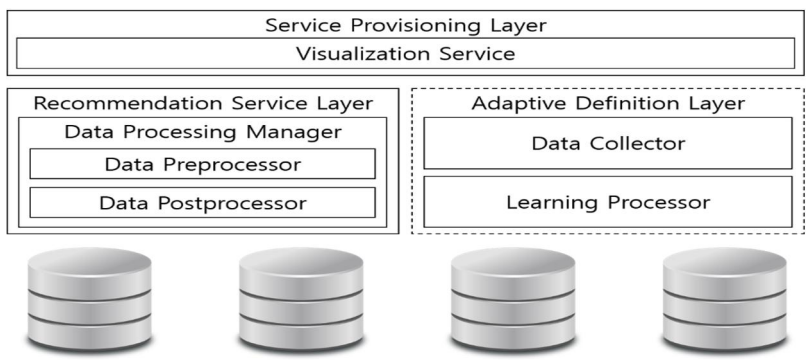

Figure 2. System Architecture

3.2 Operation Process of Adaptive Recommendation System

Figure 3 shows the system flow chart when the user uses the recommended service. Process ① is the process of a user requesting a service by entering their personality information, MBTI, and the desired area, through the Visualization Service. Process ② is the process of sending the user's request to the Data Processing Manager in the Recommendation Service Layer. Based on the information entered, the Data Pre-processor converts the user's MBTI information into a personality type used by the recommended service and sends it to the Data Post-processor via process ③. Data Post-processors connect tourist types that match user-entered areas and personality types. Based on the information, access DB through process ④ and search tourist attractions and send them back to Data Processing Manager through process ⑤. The retrieved data is moved to the visualization service via process ⑥. Process ⑦ will eventually be provided with recommended tourist attractions to users through the Visualization Service.

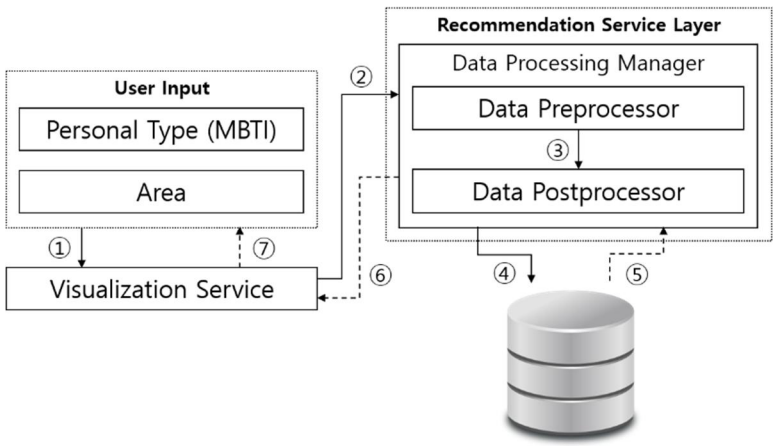

Figure 3. System Flow

4. Example of Applying

4.1 Learning of personality types and tourism types

We examined MBTI information and preference for 13 types of tourism through a survey, as shown in Figure 1. MBTI was used separately, both introverted and extroverted for the survey.

Figure 4 shows the modules configured to apply personality types and tourism types to the system for testing. The main module will call Data Collector when 16 kinds of MBTI information and 13 detailed tour type preferences used in Figure 1, are introduced through the survey. Data Collector converts the MBTI personal type into two types of personality: Introvert and Extrovert. The detailed tourism types entered will be converted into cultural experience type, natural resource type, event type, and tourism facility type and total 4 data. The input value is the preferred value of the four types of tourism and because of the small survey, there were three layers of 16 neurons. For learning, the active function used Relu. Because the final output has only two types of personality, sigmoid was used. The test results showed an accuracy of approximately 83.33% and the corresponding model was saved via Data Save.

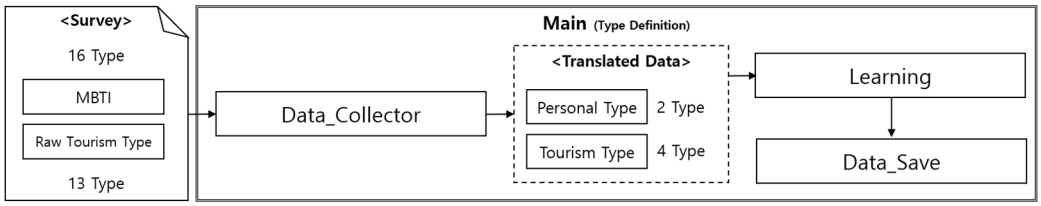

Figure 4. Learning system

4.2 Relationship between personality type and tourism type

Figure 5 shows a preference-based correlation between detailed tourism types obtained through deep learning based on surveys. Progress was made with data based on preference rankings for personality types and tourism types, and the graph is based on extroverted personalities. Relevance is expressed by the real number between -1 to 1 and means the relationship between items. The closer to 1, it is more related to the item, and the closer to -1, it has less relevant.

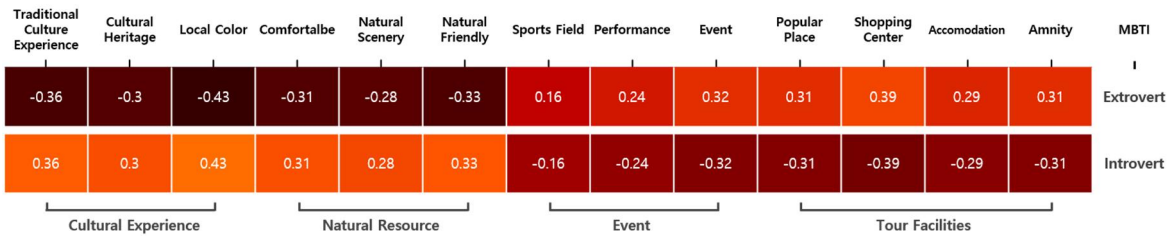

Figure 5. Correlation graph

Based on extrovert personality, cultural experience type and natural resource type have negative value and relatively less preference than positive type event type and tourism facility type. From the detailed type, it can be seen that extrovert personality does not prefer to visit places with relatively local colors, or to experience traditional culture and nature-friendly places. On the contrary, it can be seen that participation in shopping centers and various events is preferred. Introvert personality is the opposite result of extrovert personality and mainly prefers cultural experience type and natural resource type and relatively less preference for event or tourism facility type.

5. Conclusion

In this paper, we applied deep learning to the adaptive recommendation system to connect the tourism type that fits the personality type and designed the system to provide the recommendation for tourist attractions. Each layer consists of the Service Provisioning Layer, which is a visualization service, and the Recommendation Service Layer, which effectively searches and recommends tourist destinations for user input, and the Adaptive Definition Layer, which learns with the user's personality information and tourism type. The Service Provisioning Layer acts as the interface that users encounter and receives input from the user's personality information, MBTI, and the area they want to search. The Recommendation Service Layer consists of a Data Pre-processor that converts MBTI into a personality type used by the system based on user input and a Data Post-processor that connects tourism types and regions. Finally, data is retrieved and outputted through the Data Processing Manager. The Adaptive Definition Layer consists of a Data Collector, which collects personality types and preferred tourism types separately, and a Learning Processor, where actual learning takes place.

The features of the proposed system are as follows. First, deep learning is used to construct a system, which efficiently learns and processes a lot of data, thereby increasing the efficiency of the system. Second, data heterogeneity occurs when big data processing is performed using an adaptive system. Unlike the existing search system that searches based on text, the adaptive system is configured to output sub contents when searching for a specific type. Third, because the system is divided into three layers, if a specific part needs to be modified, only the corresponding layer needs to be modified, so the system is easy to maintain and repair.

In the future, it is necessary to collect more data to increase the accuracy of the preferred tourism type by receiving the user's personality type and preferred tourism type to provide more service to the users' needs, and to refine the personality type to increase the accuracy of the system.

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