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# A Proposal of Fake-free Ranking Method and Its Application : O2O-based Local Information Providing Service☆

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ABSTRACT

The widespread use of smartphones with a variety of features has enabled mobile Internet-based services. One of these is online-to-offline (O2O) based services that connects online users with offline stores to add value. Applying this O2O strategy to local information retrieval induces online users to be linked to offline regions, thereby enabling the exchange of local-based information and helps create new value. This paper proposes and illustrates the implementation of O2O-based a local information providing service that utilizes photos of the local attraction. Also, we propose a fake-free ranking method to provide reliable local information to users and suggest its application of the service.

☞ keyword : O2O service, Fake-free ranking, Location-based service, Walking navigation, Mobile Service

## 1. Introduction

With the widespread use of smartphones, users are accessing the mobile Internet anytime, anywhere. Many users are not only accessing the mobile Internet to search information, but also using social media, which allow them to interact with others, such as other individuals or companies.

In addition, LBS (Location-based Service) is emerging as a core service for smartphones on offline environment, IoT (Internet of Things) increasingly focuses on people's daily lives and working environments by involving additional smart devices and sensing methods[1-3].

As users are actively engaged in the online space of smartphone-based mobile Internet, an online-to-offline (O2O) strategy that creates value between online and offline spaces is drawing attention. O2O is a service that creates new value by connecting online and offline spaces, which refers to interactive marketing that drives consumers offline to online and online to offline spaces [4].

A point cashback service is a typical service that introduces the O2O strategy. The service provides a smartphone app to accumulate or use points, and makes use of a smartphone's low-power communication function to provide users with online coupons from nearby stores to encourage store visits and engage in sales activities. On the other hand, smartphone taxi calling app services are a representative O2O-based service. While the traditional phone-based taxi calling services require users to key in their location, they can automatically locate the users using their smartphone's location sensors. Users can also search and mark their destination on the map without having to explain it to the taxi driver [5-6].

As such, O2O-based services use various functions of smartphones to connect online users with offline stores and

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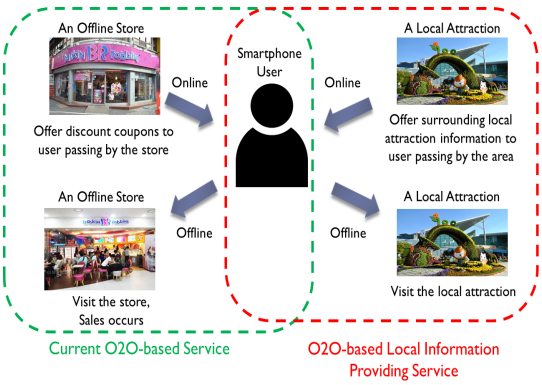
businesses. It is expected that these features could be applied to facilitate local-based information exchange and to create new value for the region based on it. For example, the left side of Figure 1 is a typical O2O-based service, which shows how online users are lead to offline stores by providing nearby store coupons for smartphones. For example, as shown on the right side of Figure 1, by guiding online users to respective attractions by providing local attractions around them.




(Figure 1) Comparison of O2O-based services with O2O-based local information retrieval services

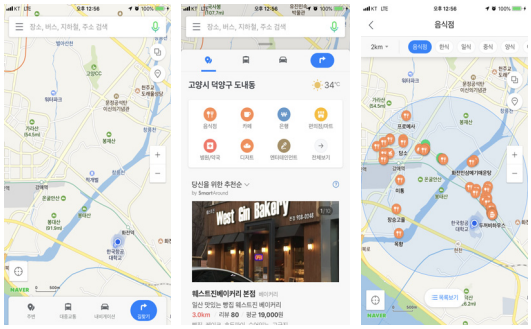
Accordingly, this paper proposes a local information providing service that applies an O2O strategy. The proposed service provides the local attraction photos of the user's surroundings on the map so that the user can be lured to visit the attraction. When displaying photos on the map, overlapping can occur. In this case, the highest-rank photo is displayed as a representative. At this time, the commonly used recommendation ranking method is feared to be a manipulation. Based on user sequential behavior, this paper proposes a "fake-free" ranking method.

The composition of this paper is as follows: Section 2 looks at existing services and general O2O-based services to provide local information. Section 3 proposes O2O-based local information providing services and provides examples of implementation. Section 4 proposes a ranking method that is difficult to manipulate. Section 5 concludes.

## 2. Related Researches

### 2.1 Local information providing service using maps

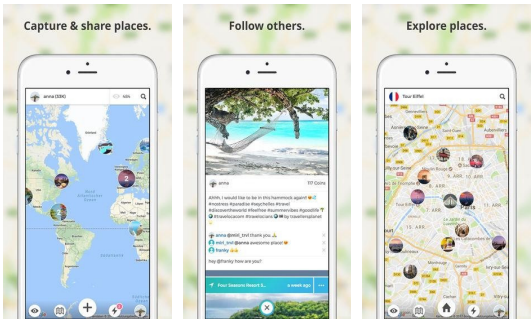
As a smartphone service that searches local information using maps in Korea, there are KakaoMap and Naver Map. Both services are originally map services, but they provide local information through additional functions. For example, KakaoMap can display a list of suggested restaurants around the user and search and suggest keywords that many people around them have searched for by tapping "View recommendation information" at the bottom of the map. For Naver maps, when a user taps "View surrounding search categories" at the bottom of the map, the service lists searched keywords organized by categories such as restaurants, public transportation, life, hospitals, etc (Figure 2). The user can get detailed information on the map when he chooses from the keywords.



(Figure 2) Naver Maps : Surrounding search

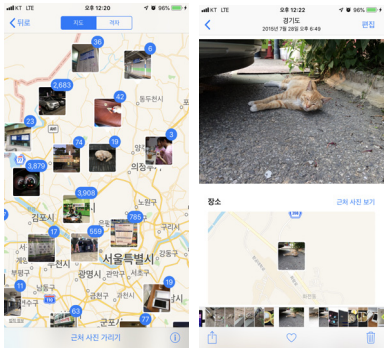
### 2.2 Local information search and delivery service using photos

DestiPod[7] and Apple's photo app are smartphone services that display photos taken by users on the map. DestiPod is a similar service to Instagram's Photo Map, providing a visual overview of where the user's photos were taken. By moving the map, users can also search for photos taken by themselves and their friends based on location (Figure 3).




(Figure 3) DestiPod : Showing photos of users on the map

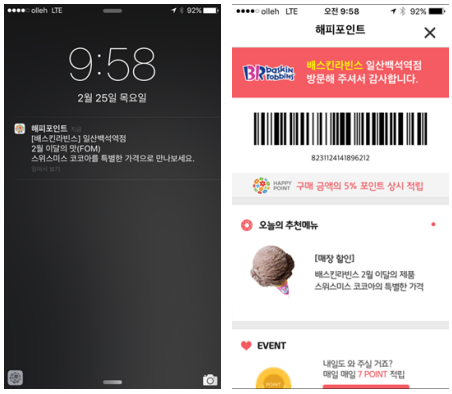
Apple's photo app, built into iOS, is a service that displays photos on the map based on GPS data of photos and provides location-based search using the map. Users can find photos using the location of the photo taken (Figure 4).



(Figure 4) iOS Photo : Showing photos on the map

### 2.3 Current O2O-based services

A variety of services are introducing O2O strategies that link online users with offline stores by utilizing a variety of functions that are built into smartphones. Among the typical O2O-based services, there is the point cashback service. Figure 5 shows the Happy Point service[8] for smartphones that allows users to accumulate and use points. This service utilizes a BLE (Bluetooth LE) beacon. When a user's smartphone recognizes a nearby BLE beacon, the coupon of the store where the beacon is installed is provided to the user in the form of a PUSH message, leading the user to visit the store. Users can get the latest coupons for various nearby stores by simply using the service.




(Figure 5) Happy Point : an examplar O2O service

Meanwhile, Kakao Taxi is a taxi calling service that adopts the O2O strategy. Using the smartphone's location sensor, users can call up taxis without having to key in their location and instantly identify the current location of the taxis they call on the map. Users can also search and mark their destination on the map without having to explain it to the taxi driver.

## 3. Local Information Providing Service based on O2O

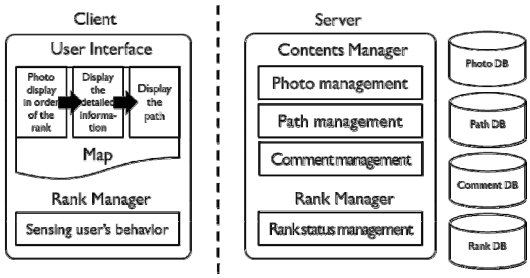
The current O2O-based service creates new value by linking online users with offline stores and or business owners. Applying these characteristics of O2O-based services to local information providing services will allow online users to connect to offline regions, which will enable local-based information exchanges that have so far been difficult with existing regional information providing services. And this will create new value for the local area.

Therefore, in this paper we propose the following as one method to introduce an O2O strategy for local information providing services: an O2O-based local information providing service that utilizes the attraction photos as one of the methods. The service offers social community functions that enable users to exchange information with each other around an attraction by supporting the upload of new user-taken attraction photos, also allowing other users to write comments on uploaded photos.

In the proposed service, users typically exhibit sequential

behavior, such as searching for photos, selecting photos, and moving to places. In this paper, we design the ranking method so that the user's sequential behavior affects the rank of the photo. Details of the ranking method proposed in this paper is described in Chapter 4.

Figure 6 shows the system structure of the proposed service. Client consists of user UI for interaction, such as providing the user with attraction photos, and a rank manager for reflecting the user's behavior in the rank of the photo. In addition, the server consists of content managers and rank managers to store and manage information, such as attraction photos, comments, and so on. Detailed implementation of the proposed service based on this structure is described in each section.




(Figure 6) Structure of the proposed service


(Figure 7) Example of a photos mash-up depending on zoom-level

## 3.1 Providing the attraction photos

The service proposed in this paper mashes up the attraction photos as markers on the map. The service then uses the coordinate information from a GPS module to display the user's current location on the map. Based on this location, the service requests the server for photos that are within the set range. If overlap occurs during the mash-up process for a client, a photo with the highest rank is shown as a representative marker. Meanwhile, when the display space is created by zooming in on the map, photos with a low rank are displayed. Figure 7 shows the difference of photos displayed on the map depending on zoom-level.

If a photo which is mashed-up on the map is selected, a list of photos appears at the bottom of screen that are not displayed due to low rank (left of Figure 8). This minimizes the omission of surrounding photos, and allows users to slide the photos on the bottom from side to side and view all of the photos from the surrounding area.

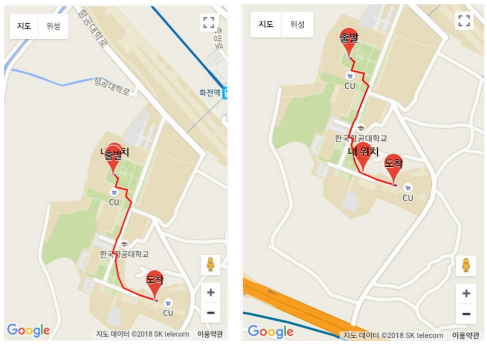
When a user selects a photo listed at the bottom of screen, the service shows detailed information in the form of the Polaroid photo (right of Figure 8). For detailed information, there are comments from the photo uploader, button for walking navigation, button for comment making, and comments from other users. In particular, social community formation will be possible through exchanging comments between photo uploader and users based on photos.


(Figure 8) Example of showing detailed information of an attraction photo

## 3.2 Walking navigation

The proposed service provides walking navigation that shows users how to navigate to the selected attraction photo. This function is activated by tapping the "walking navigation" button within the photo details. The user's current location is set to origin and the location of the photo

is set to destination. The service shows the shortest walking path on the map, as shown in Figure 9. It also provides paths through multiple locations via tapping "add waypoint" button. A marker indicating the user's location in real time allows a user to ensure that he follows the right path.




(Figure 9) Example of walking navigation

### 3.3 Uploading the attraction photos

The proposed service provides function to upload users' own taken attraction photos with comments. Once a photo is uploaded, the server extracts the GPS coordinate information from the EXIF data on the photo, identifies the location where the photo was taken, and stores it in a database. The uploaded photos are properly provided according to the location information of the photos when users search for attraction photos. In addition, the service reflects user responses on the rank of the photos so that it will affect the priority of next search.

## 4. Proposal of Fake-free Ranking Method

The service proposed by this paper provides attraction photos on the map by searching using the user's location and set range. If pictures overlap in the process of map display, the highest-rank photo will be mashed-up as a representative marker. When a user taps this representative photo, photos that were not displayed are shown in order of each rank. As such, the rank is used in the service to list photos in the order of when they are searched and displayed. In this section, we examine the existing ranking system and propose a ranking method to be used in O2O-based services proposed in this paper.

### 4.1 Current ranking system

A typical method to rank user-generated content(UGC) is using a recommendation system, which is widely used by online communities' bulletin boards in Internet-based services. The system places a recommendation button on UGCs so that users can press the button if they want to. In addition, the system ranks UGCs based on the number of recommendations collected and determines the order of they are shown. For example, Daum's news service places comments in the order in which many recommendations are received (Figure 10).


(Figure 10) Example of comments placement by the recommendation system

By the way, the recommendation system has concerns about falsifying of ranking by pressing the button for UGCs with a malicious intention. If UGCs are shown based on the falsified ranking, the reliability of services would decline. Therefore, the services are looking for ways to prevent the falsiying of ranking. For example, Stackoverflow.com which is an online community to exchange programming knowledge places answers in the order in which many recommendations are received and exposes the best answer chosen by the question owner among them. In contrast, Youtube hides its ranking method. This is a big issue in the field of informatics and a lot of research is underway.

For the proposed service, this paper proposes a fake-free ranking method based on user's sequential behavior. Due to the service ranks user-taken attraction photos(UGCs) based on the user's sequential behavior, the method doesn't take advantage of the recommendation button. Since pressing the button on the small display of smartphones may be inconvenient to use and therefore the user's opinion may not be well received. It also may be a basic solution to the falsification because it blocks an overt way – pressing the button – to falsify ranking with impure intentions.

## 4.2 A fake-free ranking method based on user's sequential behavior

This paper proposes a fake-free ranking method using the user's sequential behavior. This method defines the user sequential behavior for normal service use step by step and reflects it in the rank of the photo depending on which step the user on. Each section provides details on the sequential steps of behavior and how to use the proposed method.

### 4.2.1 User sequential behavior steps and reflects it to the rank

We define the user sequential behavior steps for normal use of the proposed service as follows:

Step 1. Recognizing Information
: Utilizing the services proposed by this paper, a user selects a specific photo(UGC) during the search for a surrounding attraction.

Step 2. Interest in the Information
: The user reads information, such as comments on the photo he or she selected

Step 3. Action on the Information
: The user is interested in the location by viewing the selected photos, and he or she will go to the location via the walking navigation function.

Step 4. Feedback on the Information
: Additional activities such as posting a comment on a photo or taking a new photo and uploading it to the service are conducted in the location where the user has moved.

User sequential behavior is divided into four stages. Step 1 to 2 occur on a user's smartphone and define them as an online action. Steps 3 to 4 are the actual actions taken by users in the real-life space, which are defined as offline actions.

If a user's behavior step increases from one to two, three and four, the user's interest in the photo can be judged as being reliable. Therefore, it is reasonable to use this step in order to add weight to the rank of the photo. At this time, it would be better to place a greater weight on Step 3 and 4 than on Step 1 and 2 because offline actions are more costly (time, effort, etc.) than online actions. Weighting by rank is part of the study and are not described in this paper.

On the other hand, consider ignoring the order of the steps. For example, a user posts a comment to a photo without reading the information and move to the location (ignoring 2nd and 3rd step, only performing 1st and 4th step.). Rather than being interested in the photo, it is likely that someone who knows the information and location of the photo posted the comment. Thus, in this case, the weight of the rank is only as much as the weight of step 1 which is performed normally, can be reflected in the rank of the photo to prevent rank manipulation.

In other words, the proposed ranking method requires actual action to raise the rank of the photo selected, and therefore requires costs to manipulate the rank. Such costs make it difficult to manipulate the rank, so the reliability of the rank can be achieved to a degree compared to the existing recommendation ranking system.

### 4.2.2 Application of proposed ranking method in proposed service

Figure 11 shows the flow of the service which is an application of the proposed ranking method. The service proposed in this paper represents the attraction photo around the user on the map as a marker. If overlapping occurs, the photos are mashed-up on the map and the highest-ranked photo is displayed as a representative photo.


(Figure 11) Flow of the proposed service

Selecting this representative photo will list the photos that were not displayed in rank order at the bottom of the screen so that users can receive all the photos around them. If the rank is the same, the order can be determined using the number of comments on the photo, the number of views of the photo, the date the photo was uploaded, etc.

Selecting a specific photo from among the listed photos, the user is provided with detailed information about it. This is considered user feedback and reflects the weights corresponding to Step 1 of the user sequential behavior in the rank of the photo.

In addition, if the user scrolls through the information provided and places the comments located on the screen for an arbitrary set time, then the service considers them to have been read by the user and reflects the weights corresponding to the Step 2 in the rank of the photo.

The weight corresponding to Step 3 is reflected in the rank of the photo when the walking navigation is called by tapping the Find Path button and the user reaches the location while Step 2 has been applied.

At this time, the proposed service is assumed to be used by a pedestrian. Therefore, the provided photos are the attractions within walking distance, so if the user's moving speed is fast enough to determine that he is using a vehicle, it will be judged to be a fraudulent use to manipulate the rank. In addition, using the walking navigation while Step 2 is not applied, it will be judged to be fraudulent use.

If the user posts a comment or uploads a new photo while Step 3 has been applied, the weight corresponding to Step 4 is reflected in the previously selected photo. At this time, comments and new photos are given separate weights to reflect users' interest in the photos they have previously selected as much as possible.

Meanwhile, in step 4, the target of the rank reflection is the previously selected photo, so a method that reflects the rank of the new photo in consideration of the service's usability is needed. It is further study and not described in this paper.

## 5. Conclusions

This paper proposed an O2O-based local information providing service that utilizes attraction photos as one of the ways in which local information exchange is activated based on O2O strategy. Users can obtain attraction information by simply using this service, using photos of their surroundings displayed on the map. Users can also exchange their opinions with other users about the regions by selecting a photo. The walking navigation function also guides online users to real-world attractions.

We also proposed an automatic ranking method that would be difficult to manipulate, which is needed to provide users with surrounding attraction information in implementing the proposed service. This ranking method ensures reliability in the order of the photos displayed according to rank, and the user can contribute to the photo rank only by using the proposed service.

In the future, further research will be carried out on how to determine the weight of the ranking method proposed and the rank of the newly uploaded photo. In addition, a user evaluation will be conducted to confirm the convenience and usefulness of proposed services and research on extending the proposed service functions, such as providing comments or recommended routes using the ranking methods proposed in this paper.

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