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# Multiple Clusters of Sightseeing Spots Discovery for Tourist Satisfaction Improvement Utilizing Network Motif

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## 1. Introduction

Improving tourist satisfaction has always been an important issue in the tourism industry. There are a lot of ways to improve tourist satisfaction, such as the decoration of sightseeing spots and improving the transportation of sightseeing spots to make tourists be able to reach sightseeing spots more conveniently. But all these methods are accompanied by a lot of cost. And the process of improvement may affect the sightseeing spots, so that the sightseeing spots cannot operate normally in a short or long time.

In this study, we proposed an analysis model for tourist destinations. Through this analysis model, we can discover multiple clusters of sightseeing spots with high evaluations from tourist destinations, which means tourists who have fully traveled these clusters of sightseeing spots will be more satisfied than tourists who have not fully traveled. Then, it can be expected that by guiding tourists to visit all the sightseeing spots in the cluster, the satisfaction of tourists about the sightseeing spots in the cluster will be improved. The flow is as follows. We first extracted the tourism keywords from the guidebooks introducing sightseeing spots. Then, based on the data collected from experiments conducted in Kyoto, we constructed a complex network of tourists and sightseeing spots. After that, we add the corresponding tourism keywords for each sightseeing spot. Finally, analyzing with the network motif, we successfully discovered multiple clusters of sightseeing spots that can be used to improve tourist satisfaction.

## 2. Related Work

### 2.1 Tourist Satisfaction Improvement

There are many methods proposed for improving tourist satisfaction. YC Lin et al. [1] consider the professional ability of tour guides as part of tourism products. Therefore, their idea for improving tourist satisfaction is to improve the professional ability of tour guides. K Nield et al. [2] investigated the impact of food service on tourists' satisfaction and explained that high-quality food service can be used to improve tourists' satisfaction. But the above methods have limitations. For example, YC Lin's method cannot improve the satisfaction of those self-guided tourists. K Nield's method also does not work for tourists who do not eat in tourist destinations. In this research, the analysis model we proposed for improving sightseeing spots only needs to collect information of tourists and sightseeing spots. And based on the analysis model, we can discover multiple clusters of sightseeing spots and improve the satisfaction of tourists by guiding tourists to fully experience multiple clusters of sightseeing spots completely. What's more, the analysis model focuses on the sightseeing spots themselves and it can let more tourists know some attractive multiple clusters of sightseeing spots. Therefore, different from above researches, we tried a new way to improve the satisfaction of tourists.

### 2.2 Network

In recent years, network has gradually been applied to the study of tourism. Chenyi Zhuang et al. [3] used social networks and calculated the weight of each node in the network to find obscure sightseeing spots. Yeamduan et al. [4] judged the influence of various factors on tourist satisfaction by calculating the weight of links in social networks. However, in our research, we tried to use a complex network to discover multiple clusters of sightseeing spots for improving tourist satisfaction based on the network motif, which is the first attempt as far as we know.

## 3. Methods

The discovery flow of multiple clusters of sightseeing spots is as follows. We first extracted the tourism keywords from the guidebooks introducing sightseeing spots. Then, based on the data collected from experiments conducted in Kyoto, we constructed a complex network of tourists and sightseeing spots. After that, we add the corresponding tourism keywords for each sightseeing spot. Finally, analyzing with the network motif, we discover multiple clusters of sightseeing spots.

### 3.1 Tourism Keywords Generation System

The system flow is as follows. First, we collect the tourist guidebook catalog and do morphological analysis. Then we extract proper nouns words [5] as the candidates. We count the frequency of each candidate word and select the high part of words as tourism keywords candidates. We decide sightseeing spots by field survey. Next, we invite Kyoto locals to determine which tourism keywords matches each sightseeing spots. By above method, we match these tourism keywords and sightseeing spots.

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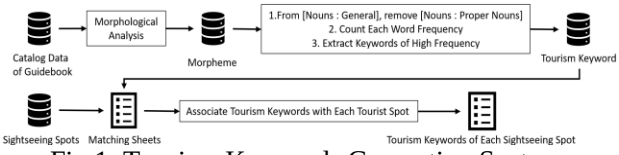


Fig 1: Tourism Keywords Generation System

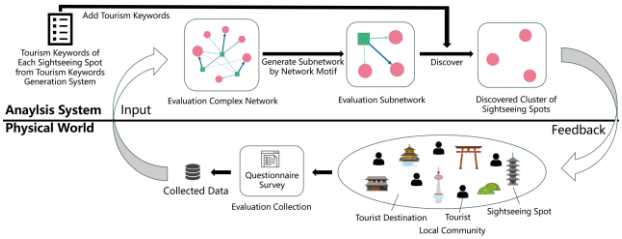


Fig 2: Tourist Destination Analysis Model

### 3.2 Tourist Destination Analysis Model

The tourist destination analysis system is a system for discovering clusters of sightseeing spots using information on tourists and sightseeing spots. The flow is as follows. We first collect data which are tourists, sightseeing spots, and tourists' evaluation information through free-play experiments conducted in the tourist destination. Then, we use these data to generate complex networks and calculate the network motif [6] of the complex network. After that, we extract all subnetworks that conform to the network motif from the evaluation complex network based on the network motif. Then we only keep the sightseeing spots nodes and remove the tourist nodes of these subnetworks. Next step, we add the tourism keywords corresponding to each sightseeing spot generated by the tourism keywords generation system as an attribute to all the sightseeing spots of the subnetwork. Then, we analyze the tourism keywords and evaluation of each sightseeing spot in each subnetwork to obtain multiple clusters of sightseeing spots that can be used to improve tourist satisfaction. Since the number of nodes in the network motif can be set, we can get a variety of different numbers of multi-cluster sightseeing spots.

## 4. Experiment: Multiple Clusters of Sightseeing Spots Discovery in Kyoto

We first selected 80 sightseeing spots and obtained satisfaction data from experiments in Kyoto [7]. Then we used the above data to generate a complex network. After that, we collected data from 23 guidebook catalogs introducing Kyoto and extracted the tourism keywords. Next, we matched these tourism keywords and sightseeing spots. Finally, we combined the tourism keywords of each sightseeing spot with the evaluation complex network to discover multiple clusters of sightseeing spots.

## 5. Result

We calculated the network motifs of 3 sizes, and based on the motifs of these 3 sizes, we discovered 3 kinds of cluster sightseeing spots with potential to increase tourist satisfaction and the number of them are 125 (2-size), 166 (3-size) and 144 (4-size).

The example cluster of sightseeing spots is composed of "Well 1", "Gyojabashi Bridge" and "Traditional store 1". "Well 1" is a small well and it located in a small alley. This well is used to draw water in daily life. "Traditional store 1" started from 1860 and mainly sells tea. Tourists can drink a variety of freshly brewed tea in the shop. The common tourism keyword for the above sightseeing spots is "water". When visitors visit well 1, they can learn about the way people fetched water every day in the past. When tourists visit "Gyojabashi Bridge", they can enjoy the clear river under the bridge. Because the prerequisite for a perfect cup of tea is water, visitors can enjoy the mellowness of the combination of water and tea when they visit traditional store 1. It is conceivable that tourists will be more easily satisfied because of the multiple enjoyments that water brings them, after they have completely visited these three sightseeing spots.

## 6. Conclusion

In this research, we proposed an analysis model for discovering multiple clusters of sightseeing spots. Then, based on that, we used data collected through experiments conducted in Kyoto to try to discover clusters of sightseeing spots. To the best of our knowledge, it is the first effort of discovering such multiple clusters of sightseeing spots using network motif and the result is that we successfully discovered multiple clusters of sightseeing spots which have the potential for tourist satisfaction improvement.

In the future, we may plan to customize clusters of sightseeing spots, which means discovering different clusters of sightseeing spots for different people.

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