IIMP 6010 – Cross-Disciplinary Research Methods I

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Group ID	Group 9 Gogogo!
Project title	Economical Outdoor Traveling for Photography Lovers
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Economical Outdoor Traveling for Photography Lovers
- Final Project Report -

Abstract

Customization of a trip is uneasy with individual preference, economical consideration, and even with ecological concerns. Travelers tend to take great pictures during the trip and particularly photographers are willing to challenge places with fewer visitors and discover local culture. This project aims to design a trip planning system considering cost effectiveness, comfort and happiness for photograph lovers. Our output recommended locations and paths were verified with an actual trip experiment. It is discovered that our system's plan can recommend places suitable for photographing with few visitors and artistic scenery, and provide happy traveling experience with less boring transportation. Please refer to our homepage for more detail: https://chenyingshu.github.io/gogogo/.

Introduction

Nowadays, more and more people prefer to customize travel plans instead of traveling with tour groups. To propose their own travel plans, a lot of aspects need to be considered, such as transportation cost and time, destination selections, etc. Specifically, it would be more challenging for outdoor photographers who consider not only aforementioned factors but also places for photographing. Some sites might be far from each other which causes photographers tremendous time and money to get those places. Some places are so popular that attract too many visitors, and thus become inconvenient for photographers to take photos. We found "Happy Maps" (Daniele Quercia; Quercia) provides with a good idea for happy paths in a map which also suits photographing. In this case, it is important to develop a platform which can provide outdoor photographers with cost-effective, reliable, and enjoyable travel plans.

The main goal for this project is to provide photographers with travel plans that allow them not only to be able to take beautiful pictures but also to spend less money and time. Given a target area, the system will recommend various famous photographing locations nearby. To propose an economical and sustainable tour plan for photographers, our system considers finance and energy economical factors and recommended locations with beautiful scenery and small population of visitors.

To summarize, our main contribution includes:

1) We prototype a trip planning for photograph lovers with consideration of economical factors and travel happiness, including traffic cost and time, energy consumption and photographing conditions.
2) We design a location recommendation mechanism which can dynamically recommend places suitable for photo taking, considering visiting population and popularity with latest information.
3) We simulate the humans trip planning with a greedy algorithm with economical factors.
4) Generated travel plan is visualized in an interactive map, where locations and paths can be further modified and customized.

Theoretical framework

The system basically involves data collection, location recommendation, path planning, and final visualization for results display.

Public photo data collection: To achieve economical and sustainable location recommendation, some location information is required, such as scenery quality for photo taking, location popularity (e.g., the number and frequency of visitors), or accurate place location in the map, etc. So, we collect data from the Internet.1) Instagram is a popular and globally widely used photo sharing platform, where netizens would like to share beautiful photos. Each post will gain some number of likes from others, indicating its popularity and indirectly imply the photo quality. 2) Instagram supports *tag* function, and users can label their post with different tag topics, which can be location names. Under each tag, there are total number of posts, which shows the popularity of this tag and estimated total visits. 3) In each post, user can also add location with specific location information including location (longitude and latitude) in the map, and location name.

Recommendation algorithm: With the collected location information, we start from a coarse-to-fine location candidate searching process within given area, then filter locations that do not meet our economical conditions, including few visitors, pretty scenery.

Path planning: Given the source location of the trip, we use greedy algorithm to compute a happy traveling path plan in terms of economical elements, including transport time and cost, energy consumption (in calorie unit).

Visualization: We finally provide a visualization service for the planned trip, which will be visualized in the interactive map "Google MyMaps" tool (Google). With our initialized plan, users can further modify and customize with locations and paths in the map with their own preference.

Method

Data Collection:

- Data for location recommendations:

We collect the number of most likes in the hot post and the total number of posts under a location tag, and retrieve the location longitude and latitude from the post location.
1) Location candidates: we use a coarse-to-fine strategy to get final photographing locations. Given a destination area (e.g., Kun Tong Line), we search all stations nearby first as coarse areas. And then we search these coarse areas as tags in Instagram and extract information (e.g., longitude and latitude) of finer locations in hot posts. These finer locations become photography candidates (see Fig.1 green spots).
2) Population of a location: For each location candidate, we retrieve total number of posts with this location tag in Instagram. The number of posts approximates the number of visitors.
3) Popularity and taken photo quality in a location: For each location candidate, we get the maximum number of likes in hot posts with this location tag in Instagram. The maximum number of likes implies the photo quality taken in the very place and the place popularity.

- Data for Path Planning:

1) Traffic time:
Travel time is a great consideration for travelers, and it would be influenced by several factors, like different means of transportation, choice of road and traffic conditions. As aforementioned strategies, we will consider both financial costs, calories and population density to determine which road and means of transportation should be taken. The data is retrieved from CITYMAPPER (Citymapper). For example, if we choose HKUST as the departure point and Jimmy Bridge as the destination point, travelers can get optional advice from this website.
2) Traffic cost:
Since it is our target to save money and enjoy our journey at the same time, we consider that taking buses with closer destinations while taking the Metro for longer distances. For instance, buses will be the first choice to travel from Jimmy Bridge to Kai Tak Public Pier, and the metro will be preferable if travelers choose to travel from Qi Man Estate to Whampoa World. Basically, buses are cheaper than the metro and both are sustainable ways for trips compared to taxi and private vehicles, so our traveling tools are chosen from buses and the metro rather than taxi and private vehicles.
3) Calories:
Calorie concerns mainly come from first- and last-mile and touring in sightseeing. First- and last-mile are calculated according to which bus station or metro station travelers choose to start or finish their trip. It is the fixed calorie consumption part while touring in sightseeing will be depending on travelers' preferences, which will not be calculated in place recommendation algorithm.

Location Recommendation

1) Input: List of candidate locations, number of locations that the user wants to visit, number of posts on Instagram and the number of max likes of the post under the location tag.
2) Output: Locations that the user is recommended to visit.
We want our travelling plan to be sustainable so we will avoid recommending places that are already popular and crowded. The places with too few posts will also be avoided. So, we locked down the number of posts in the range of 1k and 30k. After the first filtering, we will sort all the candidate locations and select the top n (number of locations that the user wants to visit) locations with highest number of likes. Please check more details in our pseudo code: https://github.com/chenyingshu/gogogo/blob/main/Code/recommendation_algorithm.txt.

Path Planning

After getting the recommended spots where users travel, the system need to give traveling paths suitable for the users requirements. When doing the path planning, we consider a cost function called *travel happiness*. According to our assumption, we relate the happiness with traffic cost, traffic time and calorie. The three weighted cost gives the final happiness cost from each spot to the others. We build a graph (see Fig.2 right figure) which consists of a set of nodes (spots) and edges (happiness cost). Our system needs to give a path which can guide the user to travel from a start spot and visit all selected spots. The path planning problem is turn out to be a travelling salesman problem. We

solve this problem using the greedy based method that always make the best choice at that moment. The system chooses the minimum happiness cost to determine the next spot to visit.

Data Visualization

After computation, we get information of departure location, recommended destinations and travel paths. Finally, we visualize travel spots and travel path in interactive map "Google MyMaps" (Google) as trip initialization. In "MyMaps" users can check individual spot and path information, and even further change destinations and traffic path according to his own preference (e.g., Fig.1).

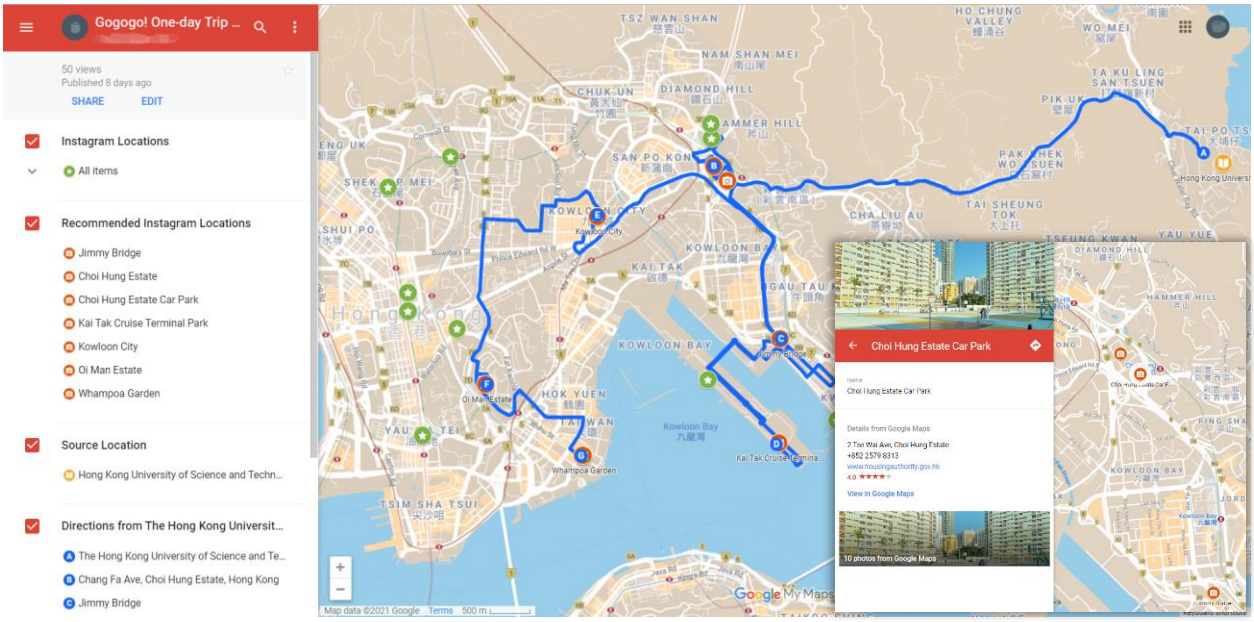

Figure 1 "MyMaps" visualization with our system output. Green spots are candidates, red spots are final recommended locations. Blue lines are paths. Bottom right: a snapshot of location information shown in "MyMaps".

System Prototype

There are 3 steps in our trip planning system, i.e., location recommendation with a given area, path planning with preference, and final visualization.

1) Input: User needs to input one destination area for Step 1. Then for Step 2, inputs are one source location to set off in the trip, and customized travel path happiness level composed with weighted transport cost, transport time and calories. There is no input for Step 3.

2) Output: In Step 1, it outputs progressive recommended locations for photo taking; in Step 2, a plan of travel paths with customized coefficients; and in Step 3, the visualized traveling plan in an interactive map with recommended locations and computed paths.

Welcome to try our demo in https://chenyingshu.github.io/gogogo/demo/.

Assumptions and limitations

***Assumption*:** Inspired from Happy Maps (Quercia), we believe the photographing locations should have good scenery and artistic capturing feature. We assume a place that is easy to take good picture is a place with fewer visitors than hot interest of places, but still popular for photo taking. For example, Choi Hong Estate is famous for photo taking which is not one of tourist attractions in Hong Kong. Thus, to get information about visiting population (#visitors) and photo taking quality in a location, we explore information in the public photo sharing platform (i.e., Instagram) and assume the number of posts and likes can imply visitor scale (population) and photo taking quality (popularity).

Different common travelers have different expectation for travel experience, which we name *travel happiness*. We assume traffic cost and time, and energy cost will mentally and physically effect travel experience. So we design a path planning algorithm considering traffic cost and time and calories.

We define factors including traffic cost and time, calories as finance and resource "economical" factors, visiting population and popularity as photographing conditions.

***Limitations*:** Our assumptions are based on our own experience; some factors might be omitted.

Results

Output trip plan:

We narrowed down the traveling range within a small area (i.e., Kwun Tong Line) in Hong Kong and conducted a traveling test based on the trip planned by our system with HKUST students. The system output a suggested map and paths starting from HKUST. Our system predicted travelling paths are HKUST to Choi Hung, then to Jimmy Bridge, and then to Kai Tai Cruise Terminal, then to Kowloon City, to Oi Man Estate, and finally to Whampoa.

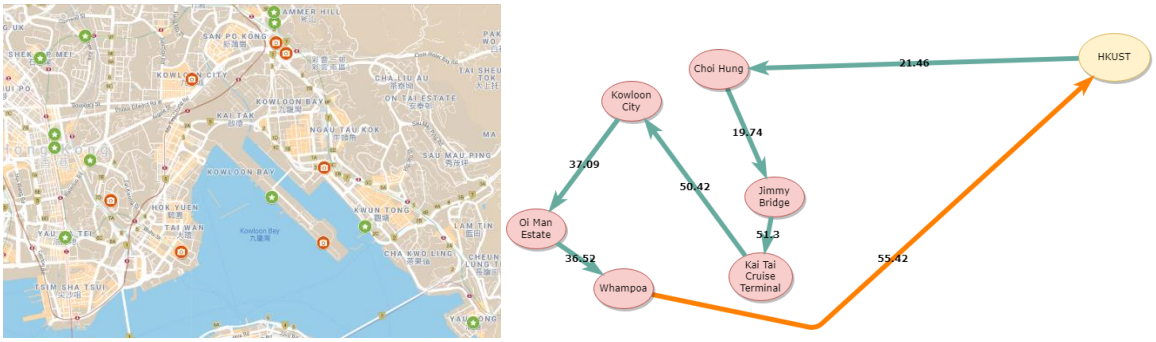

Figure 2 Left: Recommended locations (red spots) with economical and sustainable constraints, green spots are filtered out; Right: Predicted paths (in graph format, not yet visualized in map), numbers indicate happiness cost.

Validation with an empirical trip:

To verify the feasibility of our trip plan, we launched a trip complying with the planned trip lines. Photos and feelings are illustrated on slides which have been visually presented in the class. The trip was wonderful with beautiful scenery and fewer crowds, which means that the trip is feasible and sustainable for travelers. Some photos are shown in Fig.3, more pictures and results can be checked in https://chenyingshu.github.io/gogogo/.

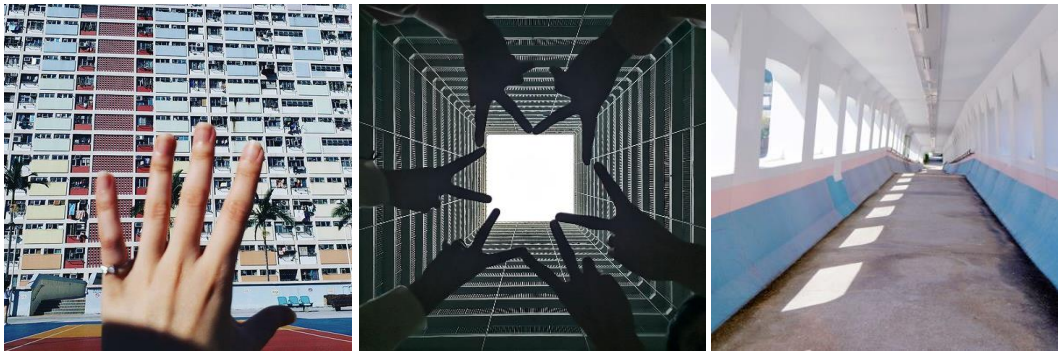

Figure 3 Some pictures taken during the empirical trip. All visiting places have few visitors and worth artistic photo taking.

Discussion and conclusion

To conclude, this project is to provide photographers with travel plans that allow them not only to be able to take beautiful pictures but also to spend less money and time on the trip sustainably.

However, we only considered limited sightseeing spots for photographers to visit, which will not offer them diverse options to choose from. Besides, the costs and calories are not so accurate in this project as preferences are distinct from person to person in travel modes choosing and in awareness of sustainability.

References

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