

Personalized Electronic Tour Guide: Free Tourists from Trip Design

Project for Algorithm: Analysis and Theory

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Abstract. This project introduces the concept of tour planning. It includes the brief introduction of the personalized electronic tour Guide concept which provides personalized tour planning for tourists. It also lists all the requirements and rules for each group. Please read this document carefully and complete the corresponding tasks.

Keywords: Tour Planning, Points of Interest (POI).

1 Tour Planning Problem

Tour planning is a challenging task for tourists when tourists are going to visit a new city. They need to gather massive information from different sources to acquire some knowledge about the Points of Interest (POIs) such as famous interesting spots, kinds of restaurants and hotels. Then, tourists are required to make a selection among the POIs according to their preferences and design a feasible tour plan under the limit of a series of constraints such as time and budget.

To provide convenience for tourists, the Company of Where to Go (CWG) is going to develop a kind of online web/app called Personalized Electronic Tour Guide (E-Guide) which offers personalized tour planning for tourists. When a user queries a tour plan in a city, the E-Guide first predicts user's interest to each POIs, and then designs a concrete tour planning that includes the visiting sequence and duration of POIs as well as transport method and transport time between two POIs.

To realize this conception, some properties of POIs need to be taken into consideration during the design such as visit duration, the category (e.g., museum, parks, restaurant, and hotel), cost budget, time windows and so on. Here, time windows refer to the available visit time of POI. For instance, there usually exists an opening time and a closing time for museums and the visit must be called during this window. Many other properties can be considered to obtain a more realistic and satisfactory tour.

In this web/app, the CWG also desires to consider users' preferences and their provided constraints. Usually, users own different degree of interest to different categories of POIs. Hence, to decide whether a certain POI is worth going by a user, which is measured by "satisfactory score" here, it not only depends on the POI's popularity among the public, but also the user's interest to it. Moreover, users can provide some constraints of their expected tour like total travel days, maximum cost budget, maximum travel hours in one day and so on.

In conclusion, E-Guide aims to free tourists from tour planning, and they can conveniently derive a concrete tour that maximizes their satisfaction and takes many realistic constraints into consideration.

2 Tasks Overview

2.1 The E-Guide

Assume you are the leader of the Development Group and you are offered to give a concrete model and scenario for E-Guide. In your scenario, it is required to determine:

1. What kind of properties of POIs will you gather and what constraints can the user queries in your web/app.
2. How to model user's preference and the standard of "satisfactory score".
3. A method/algorithm to derive a tour that maximizes the user's satisfaction.

2.2 The E-Guide with Super-POI

The mentioned tour design only determines the visit sequence of POIs while ignores the inner detailed information of POIs. The Company also wants to consider one special kind of POI with large scale, which we call it Super-POI here. These kind of POIs have plenty of detailed information like interesting spots, path with beautiful scenery and popular activities. For instance, an amusement park usually covers a large area with several activities in it and tourists sometimes also desire a route strategy for travel. Moreover, Super-POI sometimes has several entrances & exports which is also desired to be chosen in the tour plan.

Please revise your model to additionally recommend the inner route in the selected Super-POIs.

3 Specific Requirements

Here is some specific requirements on your project:

3.1 Problem Formulation and Algorithm Design

Please formulate the tasks formally as mathematical programming problems. You need to define variables carefully and model the description of every requirement and constraint mathematically. Then, please judge the difficulty of your defined problem. Whether it is in P, NP, NP-Complete, or NP-Hard? Prove or clarify your conclusion.

Next, please design an efficient algorithm to solve the tour planning problem. You need to carefully think about the time complexity and/or space complexity of your algorithm. In your final report, you need to describe your design first, then introduce the necessary concepts, symbols, definitions, etc., and write the pseudo code of your design.

We recommend that you think about a feasible algorithm at first, then consider optimize the complexity. Both the feasibility and complexity are highly related to your final scores.

3.2 Theoretical Analysis

For this part you are aiming to distinguish the theoretical properties of your problem and algorithm designs, including the time complexity and/or space complexity. Note that if the problem you are dealing with is in P, then prove the correctness of your design. Otherwise discuss the feasibility or the approximation property of your algorithm.

3.3 Experiments

In this part, you need firstly describe your dataset in detail as well as how you make/collect the data. Then, show and analyze your experiment results.

Data Collection Consider the two tasks in Section 2, gather all necessary information of POIs of one of your favorite city by yourself. Here is some cities we recommend: Seattle, San Francisco, Hangzhou, or Guilin (in China).

Specifically, you can refer to any public dataset sites to collect the information you need. You can also write some Python Web Crawlers to fetch the data. Some famous map sites like Baidu Map or Google Map provide the public API service, which might be helpful to you. For example, you can refer to <http://lbsyun.baidu.com/index.php?title=webapi> for the web API service of Baidu Map.

There are some specific requirements for your dataset. For example, if the dataset you collect is related about museums, then for each one, you need to show clearly the ticket price, time windows (opening time and closing time), position (lat and lng), popularity (does it worth to visit?), average recommended time spent on it, and so on. As to the data size, you should collect at least 50 POIs.

You also need to give detailed documentations on your dataset. Note that both the documentations and the quality of your dataset is highly related to your final scores.

Performance Evaluation You can test the efficiency of your algorithm by conducting simulations on your dataset. We recommend to use figures and tables to illustrate your ideas or show the results more clearly. You can use Visio, Excel or MatLab to generate the figure.

4 Report Requirements

You need to submit a report for this project, with the following requirements:

1. Your report should have the title, the author names, IDs, email addresses, the page header, the page numbers, figure for your simulations, tables for discussions and comparisons, with the corresponding figure titles and table titles.
2. Your report is English only, with a clear structure, divided by sections, and may contain organizational architecture like itemizations, definitions, or theorems and proofs.
3. Please include reference section and acknowledgement section. You may also include your feelings, suggestion, and comments in the acknowledgement section.
4. Please define your variables clearly. If needed, a symbol table is strongly recommended to help readers catch your design.
5. Please also include your latex source and simulation codes upon submission.