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Review of the Techniques for Location Based Service Development

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Abstract. Location based services (LBS) provide useful information to the users based on location information. Location information can be implicitly gathered by the mobile devices carried by the users or explicitly provided by the users. LBS are so useful that there are so many practical LBSs. Examples of LBS include vehicle navigation systems, mobile workforce management systems, intelligent traffic management systems and many others. We review recently introduced techniques of developing LBS. Then, we propose our design of an LBS system for local area tourism. The proposed system displays a map. Then it also displays marks representing points of interesting in the boundary of the map. It further provides detailed information of the place associated with the mark selected by the user.

Keywords: Location Based Service, Mobile devices, Mobile App.

1 Introduction

Location Based Service (LBS) is so popular that it became a part of our daily life. We drive without worrying about how to find the place even when we visit the place for the first time using the vehicle navigation system running on smartphones. Examples of LBS include vehicle navigation system, smart museum guide, smart advertisement, travel information service and so on.

This paper reviews the techniques recently published in the LBS field. Similarity analysis between two trajectories, group nearest neighbor and contents recommendation is widely used in LBS development. Recently introduced techniques of these topics are discussed.

Then, we introduce our design of LBS system for local area tourism. The system displays a map. Then it also displays marks representing points of interesting in the boundary of the map. It further provides detailed information of the place associated with the mark selected by the user.

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2 Related Works

A trajectory is a sequence of ordered pairs, (time, coordinate), representing that the moving object was located at the place represented by the coordinate at that time. With the similarity between trajectories we can predict object's movement, associate a trajectory to the road network, analyze traffic flow and find out the migration patterns of wildlife. Therefore, the similarity problem has been hot research topic in various fields. The authors of [1] introduced a dynamic time warping algorithm, shown in Figure 1, to estimate the similarity.

```
DTW (Q, C, D)// Q and C are the two trajectories. D is the distance matrix, each d[i][j]
in D is the distance between qi and cj.
 1 dtw[]= new double [n][m];// initialize matrix dtw
 2 dtw[0][0]= 0;
 3 for i = 1: n;
 4       dtw[i][1]= dtw[i-1][1] + d[i][1];
 5 for j= 1:m;
 6       dtw[1][j]= dtw[1][j-1] + d[1][j];
 7 for i = 1: n;
 8       for j= 1: m;
 9            dtw[i][j]= d[i][j]+min{dtw[i-1][j-1], dtw[i-1][j], dtw[i][j-1]}
10 return dtw;
```

Fig. 1. The process of the Dynamic Time Warping algorithm

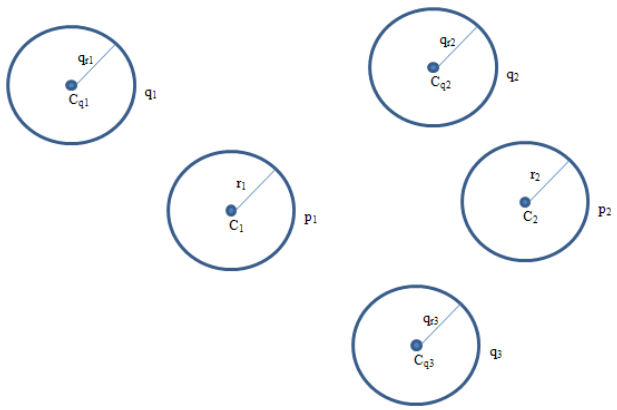

Fig. 2. A Range-based probabilistic group nearest neighbor query

Group nearest neighbor search has been widely used in solving practical problems in computer science. Find the point in P={p1, p2} that is nearest to all points in Q={q1, q2, q3} in Figure 2 can be an example group nearest neighbor search if points in P and Q are fixed. If locations of points in P and Q are not fixed but any places within their range with arbitrary distribution, then the query becomes a range-based probabilistic group nearest neighbor (RP-GNN) query. The authors of [2] proposed two novel pruning methods to improve the performance of RP-GNN.

The authors of [3] proposed a hybrid contents recommendation service using LBS and NFC (Near Field Communication) technology. The proposed service recommends contents using viewing path information through LBS and viewing exhibits information through NFC. Their algorithm to extract the viewing path is shown in Figure 3.

The algorithm to extract the viewing path [3]

```
1: Procedure extractViewingPath
2: for each Area[i] in the museum, i= 1,2,…,Area.Count do
3:     if User.Area[i].ViewingTime > Area[i].avgViewingTime then
4:         User.ViewingPath = Area[i]
5:     end if
6: end for
7: return User.ViewingPath
```

Fig. 3. The algorithm to extract the viewing path [3]

The authors of [4] presented a novel method for improving contents recommendation accuracy using LBS-based users viewing path similarity. They used the algorithm shown in Figure 4 to estimate the similarity between two paths [4].

```
simPath(User,preUser)
{
   int No = intersection(User.Path, preUser.Path);
   int TotalNo = User.Path.Count;
   pathSim = No/TotalNo;
   return pathSim
}
```

Fig. 4. The algorithm to estimate the similarity between two viewing paths [4]

The authors of [5] analyzed the apps used at the 5th AEMM Meeting. These apps perform a role to cultivate students' creativity and interest. With these apps, students can read the missions assigned to them by scanning the QR code, take pictures, write reports, edit photos and them via SMS.

3 Design of our LBS System

We propose an LBS that is integrated with live broadcast and online shopping as shown in Figure 5. Points of interesting are classified into five categories. For example, if a user clicks the "to see" button, museums, exhibition centers and sceneries are marked on the map. If a user clicks a mark, then detailed information of the place associated with the mark is displayed.

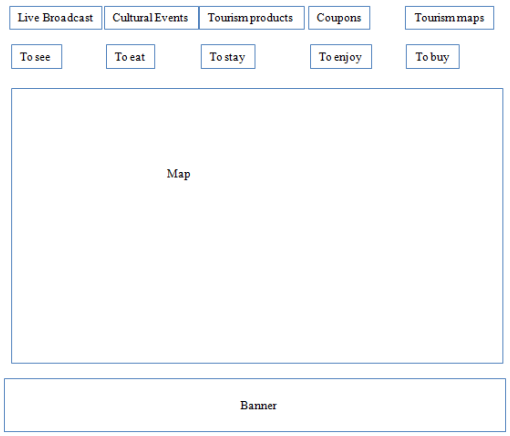

Fig. 5. Our design of the main page of the LBS

4 Conclusion

This paper introduced our design of an LBS system for local area tourism. This system is integrated with the live broadcast and online shopping. We are planning to implement the system.

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