

# Interactive Multi-dimensional Queries for Retrieving Social, Spatial and Temporal Multimedia

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**Abstract:** We propose a scheme for faster and more effective retrieval of temporal, spatial and social multimedia from large collections. We define interactive multimedia queries that allow simultaneous query refinement on multiple search dimensions. User interaction techniques based on line and iconic sketches allow specifying queries based on the above definition. We prototype a multi-user travel media network and implement the proposed user interaction techniques for retrieving locomotion patterns of the users. The proposed queries facilitate easy input and refinement of queries, and efficient retrieval.

## 1 Introduction

Online multimedia collections are usually distributed along a combination of spatial, temporal and social dimensions. Social networking sites are good examples for such collections. At the current state, querying multiple dimensions for retrieving multimedia is a tedious task that requires several iterations. In this paper, we propose an interactive querying strategy that will both speed up querying and provide better visualization of results.

## 2 Interactive Querying

A standard search query  $Q$  can be defined as  $Q(S_1, S_2, \dots, S_n)$  where each  $S_i$  is a subset of a set  $\zeta_i$  that corresponds to each search dimension. It returns an ordered list of results  $L_Q(X_1, X_2, \dots, X_n)$ . We extend this definition to form an interactive multimedia query  $Q'$ . In addition to  $L_Q$ ,  $Q'$  also returns a sub-domain  $R(S_1, S_2, \dots, S_n)$  where  $\cup S_i$  is the smallest subset of  $S_i$  that contains  $L_Q$ . A refined query can now be applied on  $R$ , instead of the universal set  $\cup \zeta_i$ . The interface for querying can be designed to show each  $\zeta_i$  separately, and be updated with  $S_i$  when results are returned. Figure 1 illustrates an interface that allows interactive querying on spatial, temporal and social dimensions. The user can enter each type of query in the

corresponding region. The regions with no input will be updated to show the domain of results.

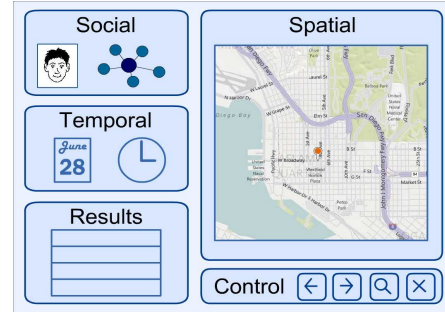


Figure 1: Overview of interactive querying.

For the proposed queries to be effective, fast and intuitive methods are essential for querying the three dimensions. We propose an icon-based interaction technique for forming social queries. A user is represented with an icon. This is intuitive due to its similarity to the use of profile pictures for visualizing users in social networking sites. We also added three extra icons to represent groups of users according to their social relationship with the current user; friends, friends of friends, and others. These icons can be added to a blank canvas area to query for the corresponding users or groups.

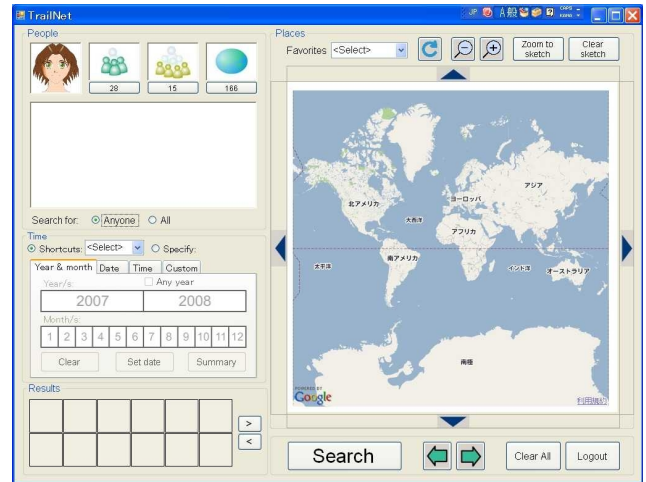
We adopt spatial and temporal queries designed in our earlier work [1], for the respective dimensions. Spatial queries are entered by sketching on a map, and temporal queries by sketching on an interactive calendar.

### 3 Prototype and Results

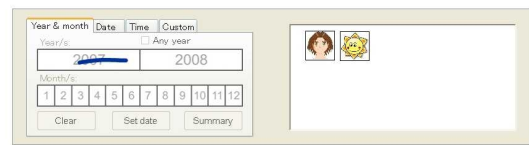
We implement the proposed interactive multimedia queries on a multi-user network of travel media named *TrailNet* (Figure 2a). A user can login to TrailNet to enter and retrieve his/her travel media such as GPS traces, photos and videos. They can browse data shared by other users. The users can also become friends with other users.

The user can specify queries by combining the interaction techniques described above. Figure 2b illustrates a socio-temporal query for the movement of two users, during the year 2007. Figure 6c is a screenshot of the results returned for this query. The calendar shows the temporal sub-domain of the results (September and October, 2007), with highlighting. The map has changed to show the region where the results are coming from. It shows a summary of result with a graph-like visualization. The non-navigating segments are shown as circles with the mean location of the user as the center. The radius of the circle visualizes the confidence of the location estimation. The navigating segments are visualized with arrows. The user can refine queries in all three domains repeatedly, until the desired results are returned. The bottom right region of the window contains the list of results. Each segment is shown as a clickable square panel. The icon on the panel represents the user who owns the segment. The circle or arrow on the panel indicates whether the segment is navigating (arrow) or non-navigating (circle). Clicking on a panel gives a detailed visualization of the corresponding segment. The actual GPS data points are plotted on the map, joined by lines, with changing color to indicate direction of movement.

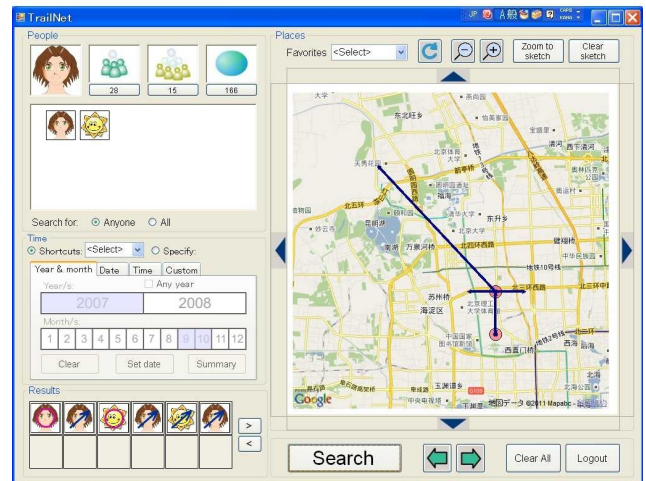
The sketch-based interaction techniques, combined with interactive querying, provided a fast and effective method for retrieving multimedia from TrailNet.



(a)



(b)



(c)

Figure 2: Example query and results.

We plan to deploy the proposed interaction strategy on Facebook, where a large collection of spatial, temporal and social multimedia is readily available. A user study for evaluating social queries is currently in progress.

### References

- [1] G. C. de Silva et al.: "Sketch-based Spatial Queries for Retrieving Human Locomotion Patterns from Continuously Archived GPS data," *IEEE Transactions on Multimedia*, 11(7):1240–1253, Nov. 2009.

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