Locations vs. Places

1 Locations
   1 Values measured by the underlying location sensing technologies
   1 Expressed in coordinates or landmarks
   1 e.g.: (-122.124511, 47.653932), nearby cell tower 34

1 Places
   1 Locales with semantic meanings to individual users
   1 e.g.: home, office, coffee shop
Translating Locations into Places

1. Places are more useful to applications than locations
2. Locations need to be translated into places

The 'place translator' needs mapping information between locations and places

1. Our goal is to generate the mapping information automatically from the user’s behavior (trace of locations)
Trace of Locations

1. Collected using Place Lab, a coordinate-based location system using a database of locations of WiFi hotspots.
2. E.g.: User initially stays at place A, then moves to place B and stays there.
3. Important places are those where the user spends a significant amount of time and/or visits frequently.

[Map showing trace of locations with marked important places]
Applying Clustering Algorithms

Problems

1. Clusters include unimportant locations (transitory locations between truly significant places)
2. Algorithms require the number of clusters as a parameter
3. Algorithms require a significant amount of computation
Time-based Clustering

1. Clustering locations along the time axis
   - A new location is compared with previous locations
   - If the new location is moving away, starts a new cluster
   - Then, ignore the clusters with short time duration
Two Parameters

1. Distance threshold \((d)\)
   - Determines the size of clusters

2. Time threshold \((t)\)
   - Determines the number of significant places

Determining \(d\) and \(t\)

Graph showing the number of clusters against time threshold (second) for different distance thresholds.
Determining $d$ and $t$

![Graph showing the number of clusters over time threshold for different distances](image)

Experimental Evaluation – Campus Trace

![Maps showing raw trace and traces with different time thresholds for different distances](image)
Experimental Evaluation –
City Scale Trace

Conclusion and Future Work

1. Our approach can automatically find significant places from the trace of locations
2. Future work
   1. Labeling extracted places using additional information (user’s calendar, other user’s labeling, photo [Patterson, et al. Ubicomp 04])
   1. Experimenting with two parameters (\(d\) and \(t\))
   1. Finding hierarchical places by varying the two parameters
   1. Using transitory locations to give familiar directions to destinations
   1. Connecting to the destination prediction system [Patterson, et al. Ubicomp 03]