(Stable)Virtual Landmarks: Spatial Dropbox to Enhance Retail Experience

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Current Retail Store Scenario
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- Books
- Gents Garments
- Ladies Garments
- Perfume
- Shoes
- Food
- Watches
- Toys
- Mobiles
- Customer Care
- Entrance
- Cash Counter

Alice: Customer
Current Retail Store Scenario

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Current Retail Store Scenario

Get Generic Comments
Get Generic Offers

Offers: Not Personalized
Not Varying at different locations

Comments: On overall Mall

Alice : Customer
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Bob: Mall Admin
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Alice: Customer

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Getting Only Macro Analytics

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Micro Location Annotations via Landmarks

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RetailGuide : Retail Analytics App
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Alice: Customer
RetailGuide: Retail Analytics App

Comment

Would like to see more choices for white dress

Alice: Customer
RetailGuide: Retail Analytics App

Comment

Would like to see more choices for white dress

Alice: Customer
RetailGuide : Retail Analytics App

More Customers

Alice : Customer

Comment

Would like to see more choices for white dress
RetailGuide: Retail Analytics App

Comment

Alice: Customer

Would like to see more choices for white dress

More Customers
The white gown is beautiful

Customer service is not good on Wednesdays

Would highly recommend the dark blue Denim Jeans

Offer: Buy 2 Jeans and get 1 book free on Thursdays

Alice: Customer

Would like to see more choices for white dress

Comment
RetailGuide: Retail Analytics App

Spatial Dropbox

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Outline

- What are Virtual Landmarks?
- Challenges - Stable Landmark Detection.
- Application Framework using Landmarks.
- Experiments and Results.
- Conclusion, Future Works and Beyond.
Landmarks = Mobile Sensors + Location
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Landmarks = Mobile Sensors + Location

No Signal

Android Sensor Box

Accelerometer Sensor

Light Sensor

Orientation Sensor

Proximity Sensor

Temperature Sensor

Gyroscope Sensor

Sound Sensor

Magnetic Sensor

Pressure Sensor

Magnitude of Magnetic Field (μT)

Time in Seconds

Acceleration (m/sec^2)

Time (Sec.)

Unique Signature
Pruning Virtual Landmarks
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H. Wang et al., “No need to war-drive: unsupervised indoor localization,” in Proceedings of MobiSys ’12, (New York, NY, USA)
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Landmark Pruning Architecture

- Calculate Landmarks
  - Users’ Activity Traces
    - <time, sensor value, comments>
  - Estimate Location using existing landmarks
  - Stable Landmark Database
    - Annotate Comments
    - Mall Admin
    - Push local Comments
    - Get Analytics & Push offers

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Which Feature Set to Choose?

- Multiple sensor combinations give Landmarks.
- Three feature combinations are sufficient.
Finding (Stable) Virtual Landmarks

- Stable Landmarks are essential for RetailGuide to work.
- Converging to a stable landmark from different user traces is non-trivial.
Finding (Stable) Virtual Landmarks

- Very less stable landmarks.
- Skew in sensor measurement across devices.
- Solution: Maintain different database based on sensor manufacturer.
Stable Landmarks: Characteristics

RetailGuide Architecture

Users’ Activity Traces
<time, sensor value, comments>

Estimate Location using existing landmarks

Stable Landmark Database

Calculate Landmarks

Push local Comments

Get Analytics & Push offers

Mall Admin

Annotate Comments

CNeRG
Experimental Setup : Pseudo Experiment

- Simulated mall scenario in the CS Department 2\textsuperscript{nd} floor.
- 4 users at different time.
- Smart Phones used – Samsung Galaxy S2 and Samsung S3 with Android 4.2 OS.
- RetailGuide App used.
Pseudo Retail Scenario

Comments are entered while crossing simulated retail aisles

Retail Aisles

- Soap & Detergents
- Food
- Utensils
- Jeans

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Experimental Settings

- **Data Collection – Android App**
  - Start the app and follow different traces in the corridors.
  - Sensor data collected and sent to the server periodically.
  - `<Timestamp comments>` are pushed to the server.

- **Server Side – Apache server**
  - Landmarks detected and annotated in Stable Database.
  - Push reviews + offers to phone.
  - Java Application for Mall Owner to manage the Analytics.
Some Virtual Landmarks

- High-Light Landmark
- Wi-Fi Landmark
- Low-Light Landmark
- GSM Landmark
- Gyro Landmark
Customer Side Android App

Users’ Commenting Interface

Pushed Notification of Comments
Mall Admin Side Analytics

- Can utilize the trend to decide on the offers.
- Browse the data traces to identify patterns of activity.
Using RetailGuide App: Comments

- Comments annotated to nearest Landmark
- ~75% accuracy in annotation despite localization error
Using RetailGuide App : User HeatMap

**Red areas** on the map are where users are spending more time.
Conclusion

- Demonstrated the use of Virtual Landmarks in RetailGuide.

- High accuracy of annotation and analytics services.

- Real-time end-to-end applications relying on Landmarks can be realized.
Future Works

- Server is online, experiments to be done in a real shopping mall like Big Bazaar.

- Better interface for android app and better analytics facility for mall owners.

- Carry out experiments with more varying factors like phone orientation.

- More experiments on the accuracy and robustness of RetailGuide.
Future Beyond RetailGuide

- **iBeacon**
  - Most importantly, Shoppers are ready to share their locations.

- **Gimbal**

- **Estimote**
Thank You