Towards a Residential Micro-Location Based Product and Service Recommender System

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Abstract. Mobile smartphone applications can be used to provide users with suitable location-based product or service recommendations. Recent developments of micro-location based recommender systems take the customers' in-store location into account and try to provoke immediate purchases decisions in close proximity to the actual product. Furthermore, an increasing number of mobile retailing apps allow to make purchases online using the phone itself as the point-of-sale (POS) and thus making the existence of a physical POS obsolete. However, such online retailing applications do not leverage the customers' micro location. As people spend most of their free time at home we will implement a micro-location based recommender system in the Smart Home context. We suggest a novel approach of mapping rooms in a customers' apartment to departments in a retail store, thereby transferring the idea of in-store marketing to in-home marketing. As a result we construct an improved recommender system for (1) micro-location based in-home marketing and (2) interest-based marketing based on customers' domestic room preferences.

1 Introduction

Context aware product recommender systems are an ongoing field of research [1]. Contextual information in this case can for example be the customers's mood, her age, or the current date and time. The well-established pervasiveness of smartphones even allows to extend a customer's context by location (e.g., [4]) which is easily derived using GPS or WiFi. As soon as the location of a person is known it is simple to recommend suitable products (e.g., *There's a Starbucks just around the corner*) or services (e.g., *The next gas station is only 100 meters away*). In the retail industry it is of particular interest to know where exactly in the store a customer is located to send out personalized coupons or offers related to the specific department. While in theory very interesting, it has been shown that the technology available is either inconvenient (e.g., NFC tags placed on shelf) or unreliable (e.g., WiFi triangulation). Lately Apple introduced iBeacon which overcomes some weaknesses of GPS and WiFi and theoretically allows in-store navigation. That way a recommender system would be able to recommend truly context aware recommendations using micro-locating services, e.g., promoting current wine discounts only to customers standing in the wine department.

It is reasonable that all those technologies try to provide recommendations near the actual product to provoke immediate purchase decision. Various mobile shopping apps exist, allowing customers to purchase products or services wherever they are and independent of a physical point-of-sale in their proximity. Thus, as smartphones are ubiquitous the point of sale became ubiquitous as well (cf. Amazon or Ebay). Taking this into account we are currently developing a micro-location based recommender system that is aware of the current location of the customer in her own apartment, allowing to recommend suitable products there similar to in-store promotions.

2 A residential micro-location based recommender system

We extend the idea of offering micro-location based recommendations in-store to an in-home scenario by arguing that customers are more accessible to recommendations if they factor in the current situation. Transferring the idea of in-store navigation where we would recommend wine related offers if standing in the wine area we recommend products and services based on the customers position in the apartment. Figure 1 shows an architectural plan of an average apartment. For the sake of simplicity we assume every apartment has a living room where people probably spend most of their time, a bathroom for personal hygiene, a kitchen for preparing (and maybe consuming) food, and a bedroom to get rest.

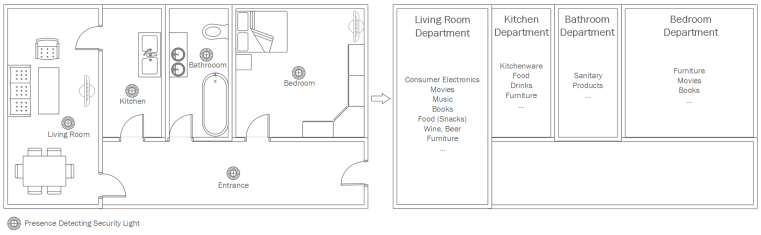

Fig. 1. Mapping the customers' apartment to retail store departments

We furthermore assume that there is some kind of entrance where the event of somebody entering or leaving the apartment can be tracked. Similar to in-store locating it is not trivial to locate a customer in a specific room of her apartment. In our experimental setup we will use the Comfy [4] security solution which is capable of determining the presence of a user in a specific room. This

[4] Comfy is a startup developing a smart security solution which can detect presence of individuals in specific rooms.

presence information is then used by Cosibon's[5] mobile product recommender system to determine relevant products in the consumer's current context.

We regard the apartment of a user as a retail store and the room she is currently residing in as the respective department. Consequently we will only recommend products and services related to the respective department. That might be consumer electronics or Blu-Ray movies in the living room, kitchen equipment or food in the kitchen, sanitary products in the bathroom and so forth. We might also argue that customers using their smartphones in the bathroom are bored and have nothing else to do, thus actually being accessible to any kind of product or service. A sample mapping of a customer's apartment to the respective departments is shown in Figure 1. We also included some examples of suitable product categories.

3 A micro-location based recommender system at home

In this section we suggest two approaches of how to leverage the knowledge derived from Comfy's security light solution (or any other Smart Home technology capable of capturing presence data on a room level) and use it as input to Cosibon's mobile recommender system (or any other recommender system).

Let $A = LivingRoom, Bathroom, Kitchen, Bedroom$ be an apartment, P be the set of available products and services and $p \in P$ be an item. Every product has an associated set $p_d \subseteq A$ indicating the relevant rooms (i.e., departments). The set S of products to be recommended for a given room $r \in A$ is then simply calculated as

$$S(r) = \{p \in P \mid r \in p_d\}.$$

While this first approach is limited by the fact that the customer actually needs to be in her apartment, the second approach uses a weighted measure to determine how relevant a product is based on the presence history. Therefore, the second approach is applicable everywhere, since it relates the presence with the product. By evaluating the presence data we can derive the importance of a room to an individuum, mapping this against the importance of a product to a room using some similarity function. Furthermore, for every room r we assign a weight ω_r indicating the usefulness of that product for the room.

$$\mathrm{sim}(p, A) = \mathbf{1}_{S(A)}(p) \; \frac{\sum_{r \in A} w_r(p) \cdot \frac{\mathrm{presence}_{\mathrm{customer}}(r)}{\mathrm{presence}_{\mathrm{avg}}(r)}}{\sum_{r \in A} w_r(p)}$$

That way for example, if a customer spends a lot of time in the kitchen although we know she has also has a living room we might assume she is interested in cooking and thus will more likely recommend kitchen related products or services.

[5] Cosibon is a startup developing mobile apps for retailers which include advanced product recommendation algorithms amongst other features. If integrated with a retailer the system has access to a customers' purchase history together with extensive tracking data to evaluate her purchase intentions and feedback.

In any case both approaches are planned to be part of a two-step recommender system. We will use the presented approaches to pre-sort results based on the respective room (e.g., living-room vs. kitchen) and then use Cosibon's existing recommendation algorithm to return a more detailed recommendation based on further information like purchase history or personal interests.

4 Conclusion

In this paper we have suggested a novel approach of how to leverage smart home devices to map a customers' apartment to respective retail store departments. This can be used to enhance existing product and service recommendation algorithms. As to our knowledge there is no ongoing research in this field, we would be happy to present out approach at RecSys'14 in order to gain valuable feedback from the recommender systems community.

References

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