Scenarios for dynamic recognition of context drifts and adaptation of the mobility agenda (Extended Abstract)

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Motivation

In traditional recommendation systems (RS), the user preferences towards an item are calculated solely based on user ratings [1]. However, the importance of context in RS has gained huge interest in recent years [2]. Such context aware RS (CARS) experience better trust in recommendation results than RS without context relation [3]. Reported results and conclusions about how different kinds of dynamic context changes can affect the behavior of CARS gained less research attention. This paper describes, given two scenarios, the idea of context drifts. We propose a framework which shows how to incorporate different types of context drift in CARS.

Framework

In our framework (Fig. 1), we have given various modules, from which the scout, the context engine and the mobility agenda are the central pieces. Firstly, we describe the user model, which includes personal preferences of a person. The personal preferences comprise information about typical point of interest (POI) a user is visiting, e.g. restaurants, gym, grocery stores or fuel stations with according time stamps. Thus, the output of the user model is the typical behavior of a person on various days. The Recommendation System (RS) module calculates, based on the typical behaviour, POI recommendations to the user, incorporating different attributes for the recommendation like length of stay at POI. The mobility agenda (MA) calculates the most probable daily schedule of a user with corresponding routes, given the typical behaviour, the POI and current route information receiving from the Intermodal Route Planning (IRP) engine. IRP provides available routes, considering live information about bus, metro, suburban trains, tram, locations of available car sharing offers and real time traffic information (RTTI). The context engine (CE) includes information about current time and location of the user, current and next appointments, given the calendar of the user, live public transfer information (LPTI) and RTTI. Thus the MA holds information about the probability of when a person will be where by using which means of transportation.

Fig. 1: The Modules in the Context-Drift Framework

A scout module checks each time interval for deviations between a pre calculated context state of the mobility agenda and the corresponding actual context state received from the context engine. If the scout detects an anomaly, it decides whether or not a recalculation of the route and the corresponding recommendations on the route is needed. We define the context drift as every context anomaly between the pre calculated and the corresponding actual context states that influences the following route and
POI. This work deals with the problem of (1) incorporating different context types in the context engine (2) recognition of dynamic context changes in the scout in order to (3) recalculate the intermodal route planning and adapt the POI recommendations. Following we show which types of context drifts we are looking at and how our proposed framework deals with them. As a prerequisite for both scenarios we have the MA given, which involves the next appointment information (time and location), an intermodal route suggestion and appropriate POI sequence suggestion.

**Route Anomaly**

In this scenario, the user deviates from her pre calculated route. The reasons for this can be various, e.g. lost way, grocery shopping, driving around jam or train delay. As we’re implementing intermodal route planning, we incorporate different modes of transportation, thus we have basically two types of route anomalies, street geometry anomaly (SGA) and public transport geometry anomaly (PTGA). SGA occurs when the user is driving a car and departs from a route on purpose or unintentionally. PTGA occurs when the user actively changes the train, takes another one or when the expected train doesn’t arrive on time, given the MA. In contrast to traditional navigation system, which calculate a new route if the user deviates from the pre calculated one, we estimate the probability that the user won’t make it in time to the next appointment given her current position, the transportation type and the POIs on the route and only then start to recalculate an alternative route incorporating different types of transportation. The scout initiates a recalculation of the route and an update to the POI sequence on the new route, bearing the already visited POIs in mind.

**POI Anomaly**

The second context drift occurs, if the active user deviates from the pre calculated POI sequence. Given the most probable agenda of the user, the travel information and additional context information, like weather or next appointments, the RS calculates possible POIs on the most probable route. The RS recommends POI sequences to the user, which it knows are on the route and are timely relevant, because it takes the typical behavior information from the user model into account. A POI sequence can be first refueling the car, then going for lunch at a pre calculated location afterwards looking for a parking space near the destination. If a person deviates from the suggested POIs (meaning that it drives by the POI, finishes earlier at POI or visits another one), the scout notices this type of drift and initiates a recalculation of the route and POIs recommendation. The recalculation of the new route incorporates different POIs, keeping in mind the already visited POIs and their constraints. The route anomaly and POI anomaly are interdependent. If a route anomaly occurs, presumably a POI anomaly will follow, but only if the route anomaly implies a delay on the future agenda. If a POI anomaly occurs, a route anomaly might follow.

**References**

