

Context-aware Navigation through a Shared Photo Collection

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ABSTRACT

In this article we present an application to navigate through a photo collection, using context. In this application, the user context is represented by the photos that are close to him according to one or several dimensions. For example, the user's context can be represented by the photos that were taken near him during a precise period like the Second World War. Such a context permits the user to move in the photo collection just by walking and to get photos of the surroundings that were taken during another time period. This application offers other services, such as temporal navigation to get different views of the current place, route planning or virtually entering into closed buildings.

INTRODUCTION

A trend of the recent years is the important development of digital cameras and camera phones, which enable people to take and view pictures almost anywhere, at anytime. As more and more of these image capture devices are spread in the world, the concept of a collaborative, distributed web-cam becomes possible: instead of keeping digital pictures isolated on personal albums or photo blogs, a global sharing, indexing and access to the digital pictures taken by people would effectively provide the service of a virtual web-cam. Such a concept offers interesting perspectives, especially in the context of mobile users.

In our preceding research [1], we developed a photo navigator relying on such a collection of users contributed pictures. This navigator can be used to enhance the physical exploration of a place by someone, by providing him a virtual co-navigation of his surroundings on a mobile device. Co-navigation implies that while the user physically moves he also implicitly navigates through the photo collection. Some of the possibilities of such a navigation scheme include: looking ahead in a direction,

viewing other aspects of the current place, or continuing to explore a direction in spite of physical restriction, such as a closed door or a wall.

In this paper, we give an overview of this photo navigator¹. In the next section of the paper we define the notion of multidimensional context, which is applied to the case of a photo navigator to support co-navigation. The third section outlines the photo navigator.

CONTEXT

Context in a photo collection

An information system is composed of several documents. In an information system the context of the user is composed by the documents that are close to the user. In this paper, we consider an information system that is composed of digital pictures. Therefore, in this information system the context of the user is represented by the set of photos that are close to him.

Proximity can be determined according to several dimensions. For example, consider the Web information system. The pages that are close to the user can be determined with respect to the temporal dimension, the thematic dimension, and the topological dimension. With respect to the temporal dimension the user context is the set of web pages that user visited recently. With respect to the thematic dimension the user context is the set of pages whose content is similar to the content of the current page, such as the related pages proposed by Google.

In this paper we consider a photo collection, which is an information system that is composed of digital photos. This information system is organised according to three dimensions: the physical dimension, the temporal dimension and the textual dimension. To organise the information system and determine the photos that are close to the user, photos are tagged with meta-information: the location where the photo was taken; the time when the photo was taken; textual comments on the photo. In the considered photo collection, the user context can be determined according to one or several dimensions. For example, according to the tem-

¹The text of this paper is mainly extracted from [1]. Our goal here is to present our interests and experience.

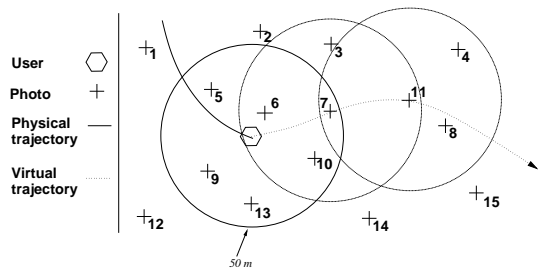


Figure 1. Example of a virtual navigation through a set of photos

poral and the physical dimension, the user context is composed by the photos that were taken near him and recently.

Context aware navigation

In the preceding subsection we have presented how to determine the user context inside a photo collection. This user context can be used to support the user while he is navigating through the information system. Navigation consists in going from one document to the other, such as the Web navigation.

We distinguish two kinds of navigation schemes: physical navigation and virtual navigation. Physical navigation consists in physically going from one document to the other. Physical navigation is supported by constantly presenting the user with his context, made of physically close photos. The photo navigator monitors the user's physical location and automatically updates the user's context. When the user's location changes, the context is updated and the photo navigator presents the new photos.

Virtual navigation consists in jumping from one document to the other. The user virtually moves in the information system. The user context is also used to support virtual navigation: while he is physically navigating, the photos present in the user's context can be used as entry points to start a virtual navigation. By selecting a photo present in his context the user virtually moves to this photo's location. According to this new location, we can determine the new user's context. Starting from his new virtual location, the user can select a photo from his new context and move to another virtual location. Using this mechanism, the user virtually traverses the information system by jumping from one photo to another.

The figure 1 presents a virtual navigation example. We have a set of 15 digital photos distributed in the physical space. The user is physically navigating this set of photos and his context is the set of photos located at less than 50 meters of his current location. On the figure the user's physical context contains the photos 5, 7, 9, 10 and 13. From this location he can move to one of the photos present in his context. In this example, the user chooses to virtually move to the photos 7. At

this new location his context contains 3, 6, 10 and 11. Then he moves to the photo 11 and so on.

OVERVIEW OF THE PHOTO NAVIGATOR

In the preceding section we have presented how context can be used to support a user which is navigating in a photo collection. In this section we outline a photo navigator which implements these concepts. This navigator supposes that a shared collection of photo is available.

The navigator continuously monitors the user's location to propose him photos that were taken near him. It enables the user to physically and virtually navigate through a photo collection. This navigator was implemented on a pocket PC. Figure 2 presents screen captures of the photo navigator.

To illustrate the benefits of such a navigator, we present in the following subsections a typical use scenario and the different services proposed by this navigator. A detailed description of the navigator is presented in [1]

Scenario

The user starts by physically navigating the information system, so his context contains the photos that are physically close to him. These photos are displayed on the navigator's screen. While he moves, the user's context is automatically updated and the changes are reflected on the screen.

Then, the user arrives in front of a castle. To decide whether he wants to visit this castle or not, he starts a virtual navigation. He selects a photo of the castle from his context and the location of this photo becomes his virtual location. The user's context is updated according to his new location, so the user is presented with new photos; the photos which surround his virtual location. By making some jumps, he can virtually enter the castle and discover the interior.

Eventually, he decides that he will not visit the castle, but he would like to see it in winter. Therefore, he changes his temporal location and set it to winter to get some photos of the castle covered with snow. Then, he continues his visit with his temporal location set to 1945. Now, while he visits the city, his context contains photos taken near him just after the Second World War, enabling him to virtually visiting the city in the past.

Services

Physical selection of photos

While the user is physically navigating the photo collection, he has the possibility to save the photos that he enjoys the most. Using multidimensional navigation, he can save unusual or rare photos. For example, using temporal navigation, when the user is on the seaside in the summer he can get photos of the beach during the winter, under the snow. While the user walks in an area with buildings that are under construction, he can get a preview of the area with architect's sketches; he can

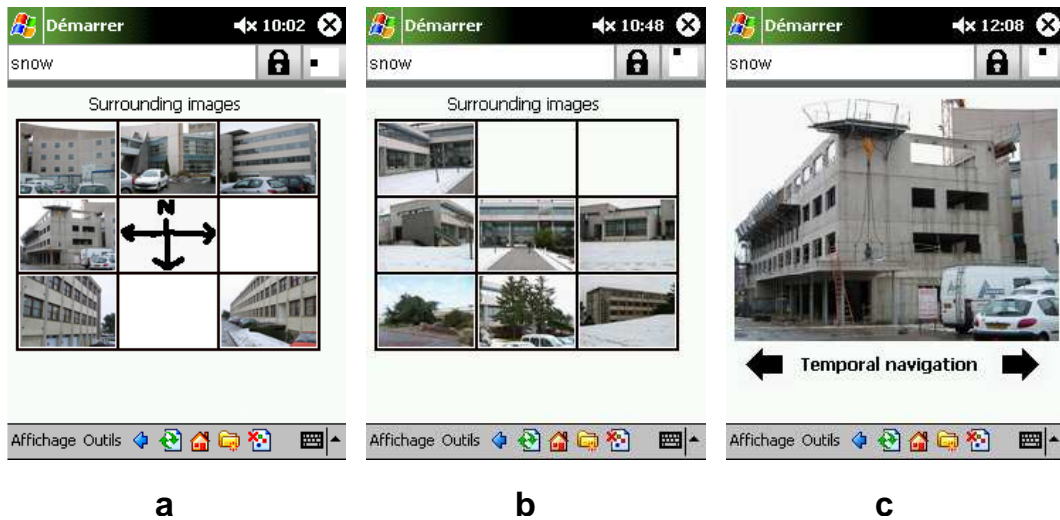


Figure 2. Image a: a screen capture of physical navigation. The user’s location is represented by the cross at the screen centre. Image b: a screen capture of virtual navigation. Image c: a screen capture of temporal navigation.

also get a view of the area before the constructions of new buildings.

Route planning

While the user physically navigates the photo collection he can use virtual navigation to plan his route. When the user selects a photo from his context, he virtually jumps to the location of this photo and his context is updated accordingly. By jumping from one photo to another, this mechanism enables the user to virtually explore the neighborhood and discover an interesting place. Then, he can lock this place as his next destination. In this case, while the user physically navigates, the navigator presents the close photos and also displays a compass which indicates the direction to be taken to reach the destination.

Going beyond walls and closed doors

The mechanism of virtual navigation can also be used to virtually go where it is usually impossible. For example, when the user is in front of a closed building or a building that is impossible to visits, the user can make some virtual jumps to virtually enter into such a building and get a view of the interior. This mechanism is also interesting to plan a visit and decide whether the user and his family will visit or not the building. Like route planning, this mechanism enables the user to accelerate his physical navigation and helps him to take decision on what to do next.

Virtual web-cams

Temporal navigation also proposes another interesting possibility. If we consider that we have access to a vast amount of photos, then by using temporal navigation it is possible to get different views of the current place. That is, the user accesses to different “versions” of the place according to the temporal dimension.

If the physical and temporal density of the photo collection is sufficiently high, then the user can even monitor the activity of the place. We call such a mechanism a virtual web cam. There is no web cam, but the successive photos taken by the users permit the user to get a view of the place that is similar the view given by a true web cam. In fact, using virtual navigation it is even possible to monitor the activity of a place where the user is not physically present. Such a scenario is realistic if we consider the amount of digital photos that are created in the physical space with mobile phones or digital cameras. This mechanism assumes that the users share their photos on a global index.

CONCLUSION

In this paper, we presented a photo navigator that enables a user to navigate through a photo collection using context. The user context is represented by the photos that are close to him according to one or several dimensions, such as the photos that were taken close to him and recently.

The photo navigator proposes several services that rely on virtual and physical navigation. Services include: physical selection of photos, going beyond walls and closed doors, route planning and virtual web cams.

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