

Exploring Cultural Heritage in Augmented Reality with *GoFind!*

Loris Sauter, Luca Rossetto and Heiko Schuldt
Department of Mathematics and Computer Science
University of Basel, Switzerland
{firstname.lastname}@unibas.ch

Abstract—Historic photo collections are important instruments to document the development of cityscapes in the course of time. However, in most cases, such historic photos are buried in archives that are not easily accessible. But even when cultural heritage archives are opened and exposed to the public, for instance by specialized digital libraries, the value of the individual images is limited as they can only be used in the context of the digital library’s retrieval engine and independent of the actual location that is being displayed. With *GoFind!*, we bring the retrieval engine of historic multimedia collections to mobile devices. The system provides location-based querying in historic multimedia collections and adds an augmented reality-based user interface that enables the overlay of historic images and the current view. *GoFind!* can be used by historians and tourists and provides a virtual view into the past of a city.

I. INTRODUCTION

As time goes by, cityscapes exhibit changes which are often happening so slowly that they are almost unnoticeable. Over years, decades and centuries, however, these gradual developments have the power to substantially change the face of entire cities. To enable the experience of such changes and to set them into their local context, we present *GoFind!*, a system which combines location-based multimedia retrieval with an augmented reality client for mobile devices. *GoFind!* enables users to query collections of historic multimedia content for perspectives of their current surroundings and overlay them onto their current view using a mobile device. This way, *GoFind!* offers a virtual window into the past.

In this paper, we present the *GoFind!* retrieval capabilities and the AR-based user interface on the basis of a historic multimedia collection of the city center of Basel.

The remainder of this paper is structured as follows: Section II surveys related work in the field of augmented reality in cultural heritage applications while Section III describes *GoFind!*’s architecture. Section IV briefly outlines what can be seen in the demonstration and Section V concludes.

II. RELATED WORK

When considering multimedia collections in a mobile setting like in touristic applications, two challenges arise: First, novel query types are needed that go beyond pure keyword search (e.g., ‘show me all images that have been taken from the current location’, or ‘show me all photos of bridges that look similar to this one’). Second, the search results need to be presented in an attractive and intuitive way to a user.



Fig. 1. View of a current cityscape with an augmented reality overlay.

Conventionally, retrieval systems organize search results in ranked lists, ordered by relevance (similarity). When search takes place on mobile devices with limited screen sizes, this approach is no longer effective. Augmented reality provides an innovative approach to visualize retrieval results by using an overlay between different result objects, or an overlay between the current camera view of a mobile device and the retrieval results. While this has been addressed in various types of applications, only few highly specialized systems for selected locations in touristic applications exist [2], [4]–[6], see also a survey in [3].

III. *GoFind!*

This section describes *GoFind!*, its system architecture and modes for user interaction.

A. Architecture

GoFind! is comprised of two system components: i.) the back-end which processes retrieval queries and provides the multimedia data and ii.) the front-end which handles all user interactions. For the back-end, *GoFind!* uses the vit-rivr [8] content-based multimedia retrieval stack which also supports spatio-temporal queries [1]. The front-end component of *GoFind!* is implemented as an Android mobile application and built upon Unity3d¹. It uses Google ARCore² for the functionality required for the augmented reality display, such as visual odometry estimation. The front-end communicates

¹<https://unity3d.com/>

²<https://developers.google.com/ar/>

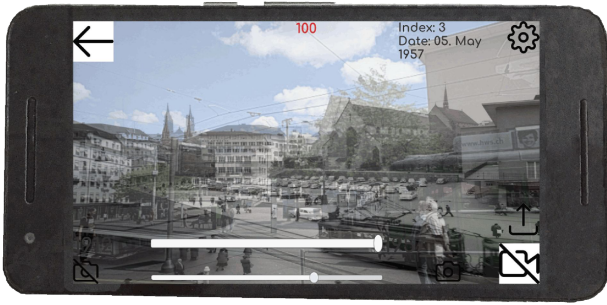


Fig. 2. View of a current cityscape with an semitransparent overlay of a historic perspective of the same location.

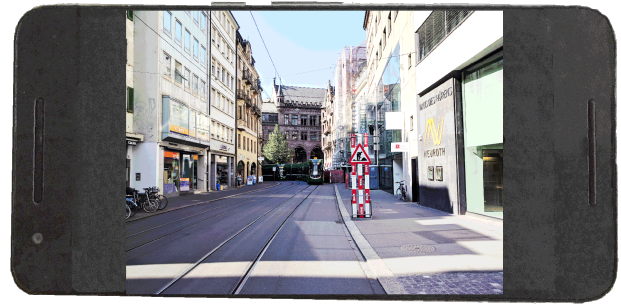


Fig. 3. View of a current cityscape through a smart phone.

directly with vitivr’s retrieval engine Cineast [7] via a RESTful API and obtains the relevant multimedia data via HTTP from a dedicated web server.

B. User Interaction

When a user wants to explore the history of a city using *GoFind!*, they can first specify a region and/or an interval of time they are interested in. *GoFind!* will then query the back-end for all available results and cache their location. Afterwards, the user can move freely through the city. Whenever they come into proximity of a location of which a relevant historic perspective exists, *GoFind!* notifies the user accordingly. To view the appropriate result, the user is then given two options: they can either view the historic image in a semi-transparent full-screen overlay of the current scenery as recorded by the smartphone’s camera as illustrated in Figure 2 or they can place the historic image as a virtual object into the physical space as depicted in Figures 3 and 1. In the first option, the user is given a slider that allows to fade between the current and the historic view. In the second option, the user can simply move around the virtual image in order to compare the historic with the current view. Using the first option, the user can also retrieve images within close proximity from different time points in time. By doing so, *GoFind!* not only creates a virtual window into the past, but also displays a convenient timeline of images of roughly the same location. The user can switch the points in time by an additional slider.

IV. A VIDEO DEMONSTRATING *GoFind!*

GoFind! is demonstrated by a video³ that starts by showing the query paradigms supported by *GoFind!* and how users can input the query data. First, query-by-example is shown where the user captures a photo from a building in order to search for similar ones. Second, the query-by-time-period user interface is demonstrated, where users specify a time interval from which to retrieve images. Next, a scenario of query-by-location is presented where users query the system for images at a location they will eventually reach. It is also possible to combine several of these query paradigms. In the next clip, the user starts the location-aware notification service which runs in the background and causes *GoFind!* to notify

the users as soon as they are in close proximity to the target (i.e., a location for which a query result is available). From the two presentation modes outlined in Section III-B, the AR-based user interface is shown first. The retrieved historic image virtually stays at its position while the user explores this view into the past. In the alternative mode, the historic image is superimposed onto the camera feed and aligned manually by pointing the smartphone in the appropriate direction. In case multiple images are available at the same location, the user can switch between them.

V. CONCLUSION

We presented *GoFind!*, an augmented reality application enabling the experience of historic cityscapes in their original local context. *GoFind!* can be a helpful tool to enable historians and tourists to explore the history of their surroundings.

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³<https://youtu.be/W14e8SRZGkA>