Foldable Augmented Maps

Sandy Martedi[*1], Hideaki Uchiyama [†1], Guillermo Enriquez[‡1], Hideo Saito [§1],
Tsutomu Miyashita [¶2], and Takenori Hara [‖2]

[1]Keio University, Japan
[2]Dai Nippon Printing Co., Ltd.

Abstract

This demonstration presents folded surface detection and tracking for augmented maps. We model the folded surface as multiple planes. To detect a folded surface, plane detection is iteratively applied to 2D correspondences between an input image and a reference plane. In order to compute the exact folding line from the detected planes, the intersection line of the planes is computed from their positional relationship. After the detection is done, each plane is individually tracked by frame-by-frame descriptor update. For a natural augmentation on the folded surface, we overlay virtual geographic data on each detected plane.

1 Introduction

In this demonstration, we present folded surface detection and tracking for augmenting paper maps. This work is based on our previous work of single map image retrieval using 2D standard maps with intersection dots [1].

Our demonstration presents a new way to display and interact with a physical map. The user can hold the map in front of the camera and see the 3D visualization overlaid on top of the map. The user can also fold the map and see the 3D visualization will change dynamically depends on the folding. Therefore, the user can experience the novel interactivity so called foldable augmented maps.

The tracking method utilized geographic-meaning dots on the surface as the marker. In our knowledge, no other work presents detecting and tracking a folded surface using a simple folding model. Therefore our work can give an intuitive example of paper manipulation for augmented reality.

2 Setup

The setup of our demonstration consists of three devices: a laptop, a Point Grey Camera and a video projector. We use a laptop with specifications: Intel Quad core 2.8GHz, 4GB RAM equipped with GPU. We use a 640×480 pixel Point Grey camera. The result is projected into a screen using a video projector.

The input of our demonstration is color-printed paper maps printed. The content of the maps is areas in Japan and is provided by the CAD CENTER CORPORATION in Japan.

[*]e-mail: sandy@hvrl.ics.keio.ac.jp
[†]e-mail: uchiyama@hvrl.ics.keio.ac.jp
[‡]e-mail: nacho4d@hvrl.ics.keio.ac.jp
[§]e-mail: saito@hvrl.ics.keio.ac.jp
[¶]e-mail: Miyashita-T2@mail.dnp.co.jp
[‖]e-mail: Hara-T6@mail.dnp.co.jp

3 Interaction

We presents two interactions in our demonstration. The first is folding paper maps interaction and the second is accessing the map data interaction using a hand gesture.

3.1 Folding Paper Maps

The user can fold the map in two directions and see the 3D contents adjust dynamically based on the orientation of the map. Based on two directions, four folding types are formed as illustrated in Figure 1. The virtual contents are augmented on folded paper maps on top of each plane independently as illustrated in Figure 2 (a).

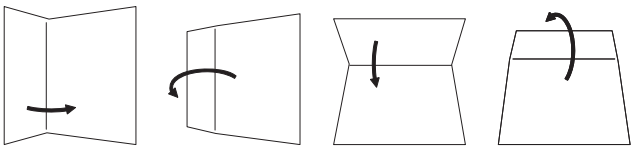

Figure 1: The user can fold the paper maps in four folding types. (a) Left-right valley folding. (b) Left-right mountain folding. (c) Top-bottom valley folding. (d) Top-bottom mountain folding.

3.2 Accessing the Map Data

The user can access the map data by pointing the symbol printed in the map. We define pointing interaction by observing the position of finger tip. If a user's finger tip constantly stays close to one of map symbols in several consecutive frames, the map symbol is recognized as pointed. We overlay a picture as related data when a map symbol is pointed as illustrated in Figure 2 (b).

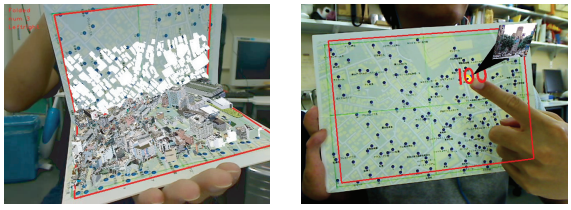

Figure 2: Interaction result. (a) Augmentation on a folded surface. (b) The user accesses the map data by pointing a symbol printed in map.

References

[1] H. Uchiyama, H. Saito, M. Servieres, and G. Moreau. AR GIS on a physical map based on map image tetrieval using LLAH tracking. In *Proc. MVA*, pages 382–385, 2009.