3D and Sequential Representations of Spatial Relationships among Photos

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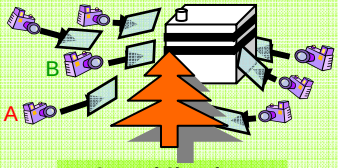
Abstract

This project proposes automatic multiple representations of spatial relationships among photos for structure analysis and review of a photographic subject (object/area). Based on camera tracking, photos are shown in a 3D virtual reality space to represent global spatial relationships. At the same time, the spatial relationships between two of the photos are represented in slide show sequences. This proposal allows people to organize photos quickly in spatial representations with quantitative meaning.



Several Shootings at the Real World

Camera Tracking

3D Representation (Virtual Space View)

Sequential Representation (Slide Show)

Other Representations (in Future)

Real-time Browsing

- **Area Analysis**
- **Shooting Flow Review**
- **Situation Understanding**

Concept

For better shooting and more interesting/meaningful browsing
- Record shooting actions in the real world quantitatively,
- Convert the real world data into activity maps in real-time, and
- Allow for getting new perspectives and new ideas for next shooting

Shooting Actions

Change shooting locations

Select shooting targets

Shoot at a certain moment

Quantitative Recording

Convert into Multiple Formats

Overhead view of shooting points

Flow view of shootings

Mixed view of abstract data & concrete photos

Real-time Representations

Human Camera Interaction

New shooting

New ideas

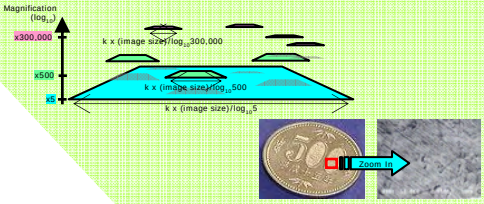
New data

New perspectives

Applications

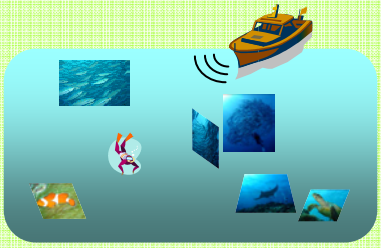
For Material Researchers

Material researchers takes photomicrographs of one material with several magnification levels. To analyze its structure, they make annotations or manual layouts to show the spatial relationships. However, these manual tasks are time-consuming, and the results cannot be easily converted to other formats. They also usually show only qualitative relationships. Our proposal allows them to make such layouts in multiple formats quickly and quantitatively.



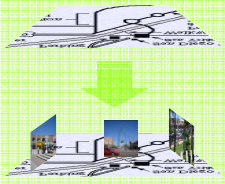
For Scuba Divers

Some scuba divers like to shoot fishes under the sea and want to record where they met the photographic targets. But it is difficult to percept shooting locations and directions because under the sea is like a weightless environment. Our proposal helps them to know where they are, they shoot, and the photographic target fishes live.



For Travelers

Maps are really helpful for travelers to walk around unfamiliar areas. But travelers sometimes misunderstand the orientations, distances, and landmarks because map information is somehow abstract. Our proposal can show the photos that travelers took there on the maps so that they can relate the map information and scenes they saw. It is helpful to merge the virtual world on a map and the real world they perceived.



Prototype Implementation

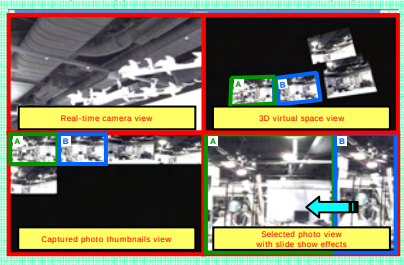
We implemented the first prototype system with an indoor use camera, a six-degree-of freedom sensor, and a Linux PC.

Camera Tracking

High quality camera tracking in real space is required. Since such tracking technologies have been proposed in the augmented reality (AR) research area, we decided to use a camera tracking method developed for AR systems.
We used an AR software development kit (SDK) called "MR Platform SDK" for camera tracking. This SDK allows us to track a camera in real space in real time using a six-degree-of-freedom sensor (POLHEMUS FASTRAK). Because the SDK is designed for easy enhancement by users, other tracking methods, such as GPS, ultrasound sensor, inertia sensor, and computer vision technique can be used with the SDK. We will use these methods for camera tracking in future prototype systems.

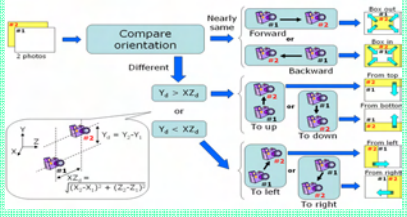
Software

The prototype has four views on a PC display.



Slide Show Effects

The prototype system has six slide show effects. A suitable effect is selected through this flow.



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