Thermo-Key: Human Region Segmentation from Video Using Thermal Information

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Abstract

For segmenting human region from video images, this paper propose a novel technique called "Thermo-Key." While conventional approaches use color, depth, or background subtraction, the proposed method uses thermal information to detect the human region. We have already implemented robust and attractive applications.

1   Introduction

Automatic segmentation of objects from an image has always been a major research field. This is because the segmented objects are very useful in broadcasting and virtual reality applications. This paper focuses on the segmentation of human region.

2   The Thermo-Key

There has been a significant amount of research among this topic. In this paper, we propose to utilize the thermal image captured by a thermal vision camera for this purpose. If the temperature of the body is higher than the surroundings, the "high-temperature region" will be the very region to be the "human region." The thermal image is used as blending coefficient to superimpose the segmented figure. The benefits using this method are as follows.

1. Particular background is not required (compared to chroma-keying)

2. Robust to the change of the background (compared to background subtraction)

3. Objects can move back and forth (compared to segmentation using depth information)

Our method covers the areas where previous techniques are unsuccessful of segmenting the human region. That is where this method benefits and is expected for further application.

In order to realize such system, it is required to capture color and thermal images of a scene from an identical viewpoint. We designed and implemented a novel optical system that utilizes a special mirror that is transparent for visual rays but reflects infrared rays. This is essential for avoiding the parallax error that occurs when color and thermal cameras are simply placed at slightly different viewpoints. Without this capturing system, we cannot realize our concept.

3   Applications

We have already implemented several applications those are highly robust against the lighting and background condition. They are also very attractive, since you can see and control segmented yourself-image in a screen interactively. You can move, resize and change the transparency of your figure. This means that the transparency
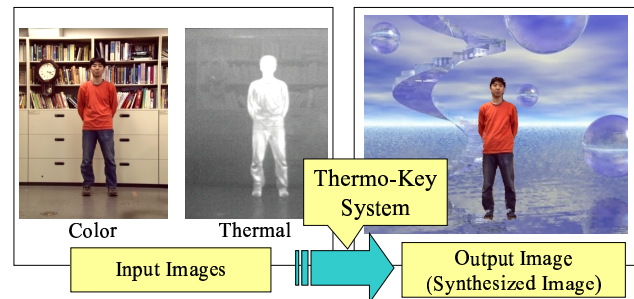

Figure 1: Overview of the Thermo-Key system.

is also utilized as a non-verbal information. In addition, you can use a snap shot of your video image as a pointer to enhance your presentation.

Moreover, you may enjoy thermal interaction. This means that you can make part of your body disappear by holding a cold object in front of your body. You can also make something invisible appear by warming up the object or the air around.

Developed applications are as follows:

- Video avatar in virtual environment: you can dive into cyberspace.

- Presentation with a tiny "yourself-pointer": you can appear on a screen as a pointer.

- Communication support system: two systems are connected over network.

4   Future Works

We are planning to keep developing this system toward these fields of application. As one of such approaches, designing interfaces which would make use of our method and optimization of the segmentation method would be considerable. Moreover, the advantage of our method would be remarkable with the downsizing of the system, which will provide great availability for practical use.

Acknowledgement