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A Study on Object Detection in Region-of-Interest Algorithm using Adjacent Frames based Image Correction Algorithm for Interactive Building Signage

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Abstract

Recently, due to decrease hardware prices and the development of technology, analog signage has been changing to digital signage for providing content such as advertisements, videos. Furthermore, in order to provide advertisements and contents to users more effectively, technical researches are being conducted in various industries. In addition, including digital signage that uses displays, it can be seen that it provides advertisements and contents using diverse devices such as LED signage, smart pads, and smart phones.

However, most digital signage is installed in one place to provide contents and provides interactivity through simple events such as manual content provision or touch. So, in this paper, we suggest a new object detection algorithm based on an adjacent frames based image correction algorithm for interactive building signage.

Keywords: *Interactive Building Signage, Image Correction, Object Detection, ROI*

1. Introduction

Recently, due to the decrease display prices and the development of diverse technologies, advertising media have been shifting from traditional analog media such as newspapers and signage to digital signage that combines LCD and LED-based displays with IT technology. In accordance with the trend of the times, research on application fields of related technology has already been actively carried out in the field of digital signage related industry in Korea, and it is growing through collaboration with industry through continuous research in various fields abroad. In addition to digital signage that uses displays in everyday life, it can be seen that it provides advertisements and contents using diverse devices such as LED signage, smart pads, and smart phones.

However, most digital signage is installed in one place to provide contents and provides interactivity through simple events such as manual content provision or touch.

In order to solve this problem, in this paper, we want to interactive function for signage using new algorithm by using the camera on the signage and we propose a new object detection algorithm based on adjacent frames based image correction algorithm for interactive building signage. It is possible to detect a more effective object by correcting the image damage caused by the shaking or the like, and to display the forward situation dynamically according to the situation based on the detected object.

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The order of this paper is as follows. First, Section 1 is Introduction. In Section 2, we present the contents of previous research related to the proposed algorithm. In Section 3, we propose a new object detection algorithm using adjacent frames based image correction algorithm for interactive building signage. Finally, Section 4 concludes this paper.

2. Related Work

When an image is acquired from an attached camera, the image is shaken due to an external factor and is captured. For compensate for this, an image correction algorithm using a continuous image frame is needed[2]. First, in order to correct the image, the feature points of the images existing in the consecutive frames should be extracted, and the descriptors of the feature points should be retained[3]. A keypoint is a part that can best represent the characteristics of an image and represents a point that is robust against noise, rotation, size conversion, and brightness conversion. Therefore, the feature point in the image is mainly selected as the vertex of the polygon or the end point of the line segment. Finding feature points and feature point descriptors, SIFT(Scale-Invariant Feature Transform) and SURF(Speed-Up Robust Feature) algorithms are typical algorithms[4].

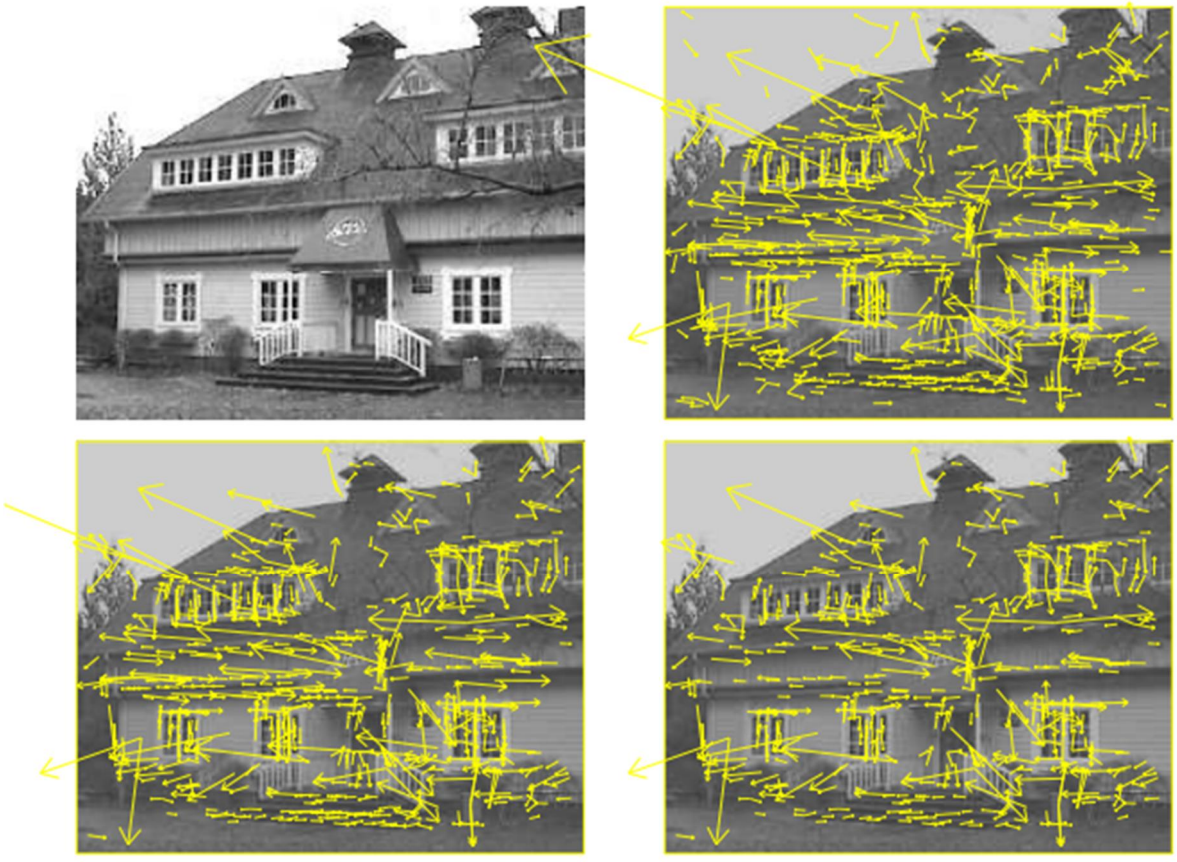

Figure 1. The Result of SIFT algorithm for finding keypoints and descriptors[3]

And then, Feature point comparison is performed based on feature points and feature point descriptors from adjacent frames to extract the same feature points. In order to make a quick comparison, the same feature points are extracted using the K-d tree or the K-nearest neighbor algorithm, and the movement of the feature points on the image is estimated.

The image can be estimated in three dimensions based on the motion in two dimensions but in two dimensions. To do this, we need to find a geometric transformation matrix, which is a matrix that represents the movement in three dimensions by the movement of points on two dimensions. we need to find a geometric transformation matrix, which is a matrix that represents the movement in three dimensions by the movement of points on two dimensions. To do this, we use the RANSAC algorithm(RANdom SAmple Consensus). The geometric transformation matrix can be used to acquire the corrected image on successive frames, and the object can be more clearly distinguished by using the acquired image sequences[5].

Based on the related research, it is possible to correct the shaking of the image caused by the vibration or the wind when acquiring the image through the camera attached to the signage. Finally, we want to develop interactive function such as expressing forward situation or reproducing contents in a signage linked by recognizing the situation ahead.

3. Object Detection in Region-of-Interest Algorithm using Adjacent Frames based Image Correction Algorithm for Interactive Building Signage

In this paper, we propose the object detection in Region-of-Interest algorithm using adjacent frames based image correction algorithm for interactive building signage. Proposed Algorithm can be used to digital signage for interactive building signage.

This section consists of the concept of proposed algorithm, and flow chart of the proposed algorithm.

3.1 The Concept of The Proposed Algorithm

The goal of object detection in Region-of-Interest algorithm using adjacent frames based image correction algorithm for interactive building signage is to be able to detect objects more effectively in a fixed or movable signage, and to provide users with an interactive function.

The figure 1 is describe about one of example about the proposed algorithm.

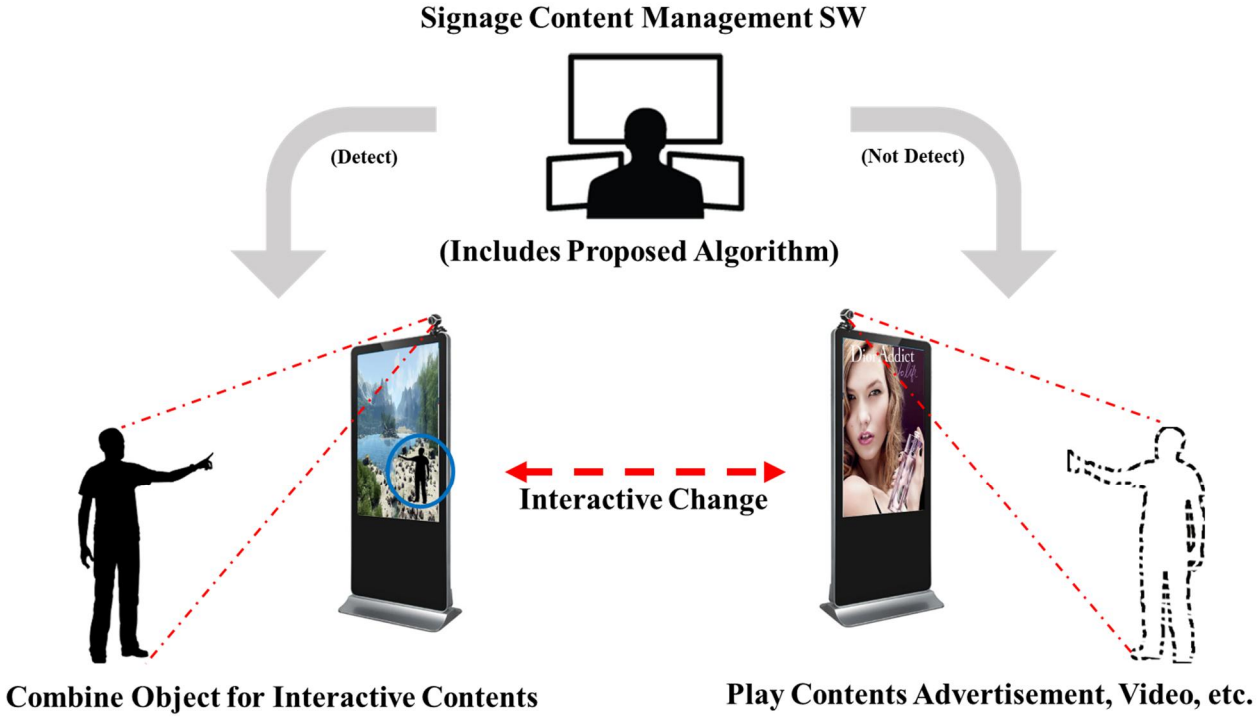

Figure 2. The Concept of The Proposed Algorithm System

As shown in Figure 2, Camera is attached to the front of the signage and continuously acquire image frames. After correcting the image through the image correction algorithm based on the acquired image, ROI is set according to the situation in which the object detection algorithm is executed. If the object like person exists in front of the signage, the interactive building signage will display about combining contents using camera, otherwise, interactive building signage will display about contents such as advertisement, video, etc.

3.2 Flow chart of The Proposed Algorithm

The proposed algorithm works inside a device that displays actual contents in connection with a building signage. A camera is connected to the content display device, and it will be implemented software in device. The following figure 3 shows the flowchart of the proposed algorithm.

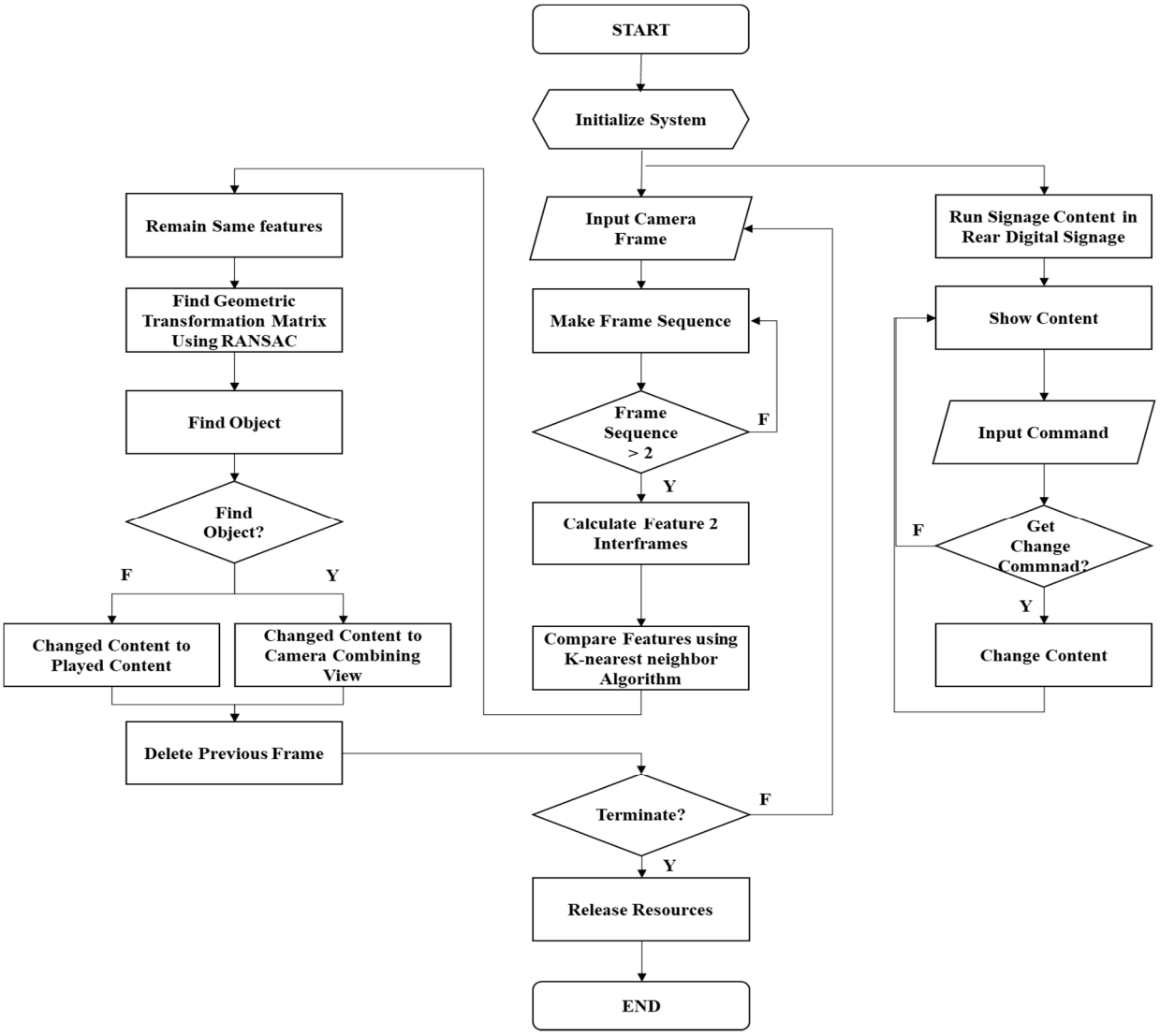

Figure 3. The Flow Chart of Suggested Algorithm

A camera is mounted in front of signage to obtain an image frame, and a PC for processing the image frame is disposed. When the system is started, camera controlling program and signage contents management program performs the initialization at the same time, and when the initialization of camera controlling program is completed, the image frame is continuously acquired from the camera. An image

sequence is generated based on the acquired image, and an image correction algorithm between adjacent frames is performed when the number of image sequences becomes two or more.

For the image correction algorithm, feature points of neighboring frames are extracted through a feature point extraction algorithm and compared to extract similar feature points using K-nearest neighbor algorithm for all feature points. When the comparison of the feature points between adjacent frames is completed, the image is corrected through motion estimation of the feature points.

Determines the forward screen transmission or the content reproduction based on the detected result, and transmits a command to the content presentation program of the building signage according to the determined status to inform the user that the content can be changed.

When the object is detected through the camera, it is confirmed that the contents can be switched and traveled when the contents are switched. The ROI is set according to the attributes of the building signage content. It is possible to play the forward situation when the object is detected through the object detection algorithm to recognize the uniqueness such as person, and to play the previously displayed content when the object is not detected.

4. Conclusion

In this paper, we proposed object detection in Region-of-Interest algorithm using adjacent frames based image correction algorithm for interactive building signage. It can compensate camera distortion caused by movement when an installed building signage is operated. We have designed algorithm for interactive building signage system

When applying the implemented algorithm and system to the field, it is possible to provide advertisement and contents effectively by improving the safety through providing interactive contents. It is expected to be a valuable reference material for interactive building signage study. It is expected that the interaction with various industry and fused in mobile environment It is expected that it can be used to derive application service.

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