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Facial component detection using a Kinect for an Interactive Media Art

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Abstract. The 3D face extration and facial component detection are important preprocessing step of automatic human recongition for an interactive system. Using proint cloud from a depth sensor, the human and backgrouned are seperated using depth information. The head and body are seperated using the geometric characteristics of human shape. After finding nose tip using depth information of head, nose, forhead, eyes and lips are classified as facial components using depth curves in x- and y-coordination based on the position of nose tip.

Keywords: Face Extraction, Facial Component Detection, Interactive System

1 Introduction

Because every person has different physical characteristics, a person can be classified using vision-based, audio-based and medical information. Voice information and visual information such as face and fingerprints are used to distinguish mainly. Special factors such as DNA and facial and hand thermograms can also be used. These characteristics have a statistical similarity of gender, age, ethnic and culture. The demographic similarity can be effectively used of human computer interaction, biometrics and target advertising [1-3].

Two vision-based methods are mainly used for human classification in real-time. The color data from image sensors such as webcam and the depth data from a depth sensors such as a Microsoft Kinect are used. An image sensor has the advantage to analyze precisely with high resolution image. A depth sensor has lower resolution than image sensors, but it can obtain the depth data using IR camera in the dark environment. A multimodal classification method that simultaneously uses image data and depth data is also used [4-5]. Our approach uses Microsoft Kinect as a depth sensor considering the interactive media art exhibition in the dark environment [6].

Automatic human recognition system stores individual attributes extracted from human and uses them for classification. Facial components detection is important preprocessing step to find facial attributes such as face region. Because 3D points from a depth sensor are mixture of human and background, human segmentation and

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face extraction are needed. The curvature surface classification and projection curves analysis are used to find facial components [7].

2 Facial Component Detection

Recently depth sensors are installed and used to various interactive systems and media arts easily. Our approach is to use Microsoft Kinect with low resolution of 640x480. Figure 1 shows the process to extract 3D face from Kinect raw data. Raw data represent a set of points having a distance value from a sensor. First, a person should be separated from the background. Because the interactive system set areas for the user interaction, background and passerby outside the area can be removed. The noises and holes can occur in extracted human data. The depth noise filtering is applied to reduce noise and hole filling algorithm are used by using neighbor points. The surface are generated with uniform points by connecting neighbor points.

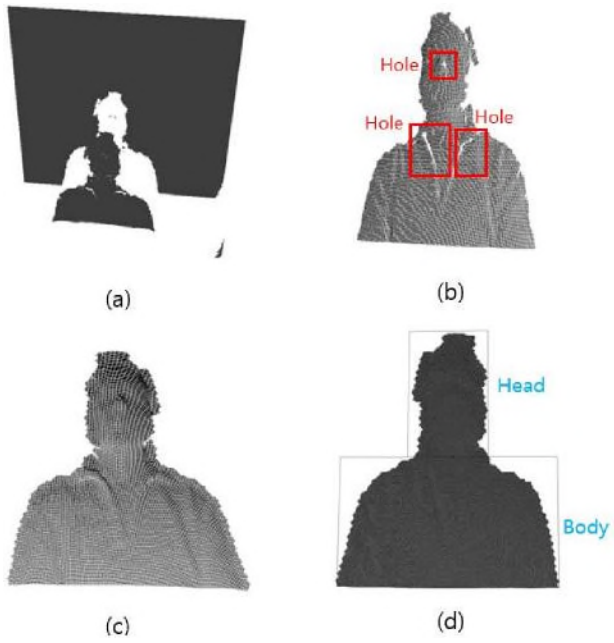

Fig. 1. Face and body detection with depth data: (a) depth data from a Kinect sensor, (b) Segmentation of human and background, (c) hole filling of human, (d) separation of head and body.

The curves of depth data of face are used for extracting facial components. The depth curve in x plane and y plane based on feature points is used to efficiently analyze the surface of face. Nose tip can be extracted by using the information that the nose is the most protruding component. After calculating the center of circle

surrounding face point, a circle with a radius of 5 cm can be generated. The nose tip can be founded inside of the circle by excluding the accessories such as hats. The glabella and the center of forehead and lips can be extracted by analyzing the depth curve in x plane including the position of the nose tip. Other facial components can be detected using the depth curves in y plane including the glabella and the center of forehead and lips.

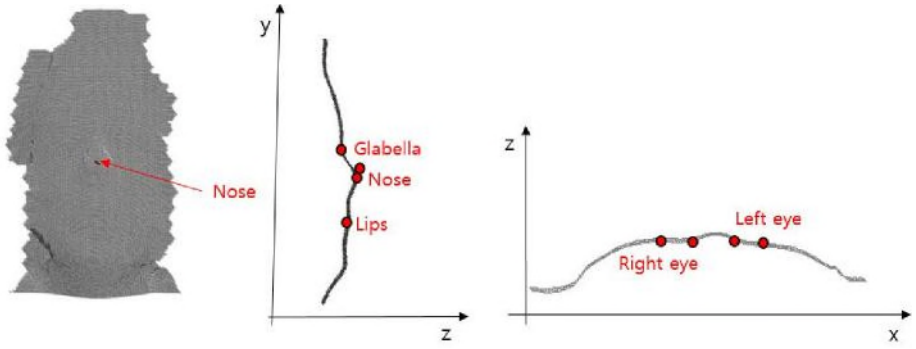

Fig. 2. Facial component detection

4 Result

A depth sensor is suitable for recognition human in an interactive media art in a dark exhibition. Extraction of facial components is necessary to use the information of the depth data from the sensor. The human and background points are separated by using the distance of the sensor. The head and body points are separated by using the information of human shape. The face surface is generated to connect neighbor points. A nose tip are extracted from face surface and forehead, eyes and lips are detected from surface by using depth curve in x- and y-coordination based on the nose tip. Facial component detection can used in the human recognition and gender- and age-based classification system. In future research, front face reconstruction is applied to facial component detection in order to recognize the pose facing in various direction.

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