Data adjustment methods of a low-priced data glove

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1 Introduction

A data glove is one of devices which are used in the field of virtual reality. We must use a data glove which has many sensors to capture a variety of human hand motions. However it is expensive and a low-priced data glove does not have enough sensors to capture hand data correctly. There are researches about a data adjustment method with low-priced glove [1], it used finger angle correlations only for the grip motion. In this paper, we propose two data adjustment methods. One is based on object shape knowledge which is held [2], another is based on a hand motion pattern estimation [3]. In our experiment system we chose three representative motions to hold; **grip** for a cube/cylinder type object, **nip** for a thin object, and **pinch** for a small object held by a thumb and an index finger. Then we calculate all finger joint angles from each hand motion pattern which is surveyed in advance. Using our new methods, we can adjust finger joint angles from just five sensors of a glove.

2 Object knowledge method

When we hold an object, our hand motion pattern is usually affect with a shape of the object. Thus we can estimate a hand motion pattern from an object shape knowledge. We supposed an object shape to be a rectangular solid in an experiment system. From a preliminary survey we decided basic sizes of an object and made six appropriate hand motion patterns for each size object. When the object is not any basic dimension, an interpolated motion is made as shown in figure 1. Although these patterns are assumed that a hand confronts the object directly, a hand does not always confront directly it. In this case we also make an interpolated hand motion pattern. Then we obtain equations for the pattern which is suitable for an unknown size object and a hand motion. Using this equations, we calculate proper angles of all finger joints.

3 Finger relation method

The hand motions can be expressed with difference of finger angles. It means that each hand motion has each relations among angles of fingers during operation. Therefore we can estimate a hand motion pattern using these relations. For a preliminary survey, we sampled the angles of five finger sensors and all joints for the representative motions, then we matched sensor value relation to each motion which can obtain all angles. However a hand does not behave according to exact representative motions actually. So an interpolated relation is made for the motion among the representative motions. Then we obtain the equation for the present motion and calculate proper angles of all finger joints.

4 Conclusion

Figure 2 shows differences of grip and pinch operation on the system based on our methods. Although sensor angles of index finger are the same, calculated angles of all joints are different as shown in CG images. As a result of evaluation experiments, both methods are effective to capture different hand motions. In the future, we should improve these methods to adopt other hold styles, and to integrate each other. We have also researched about VBDG (vision based data glove) which capture a hand motion from camera image of the hand. We are going to combine these adjustment method and VBDG together.

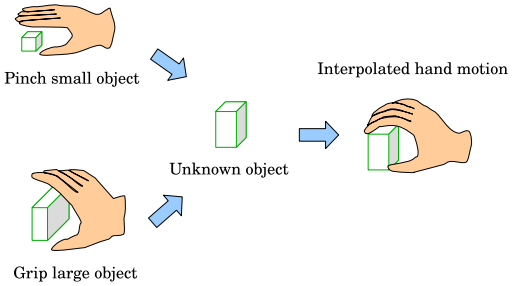

Figure 1: Interpolate hand motion

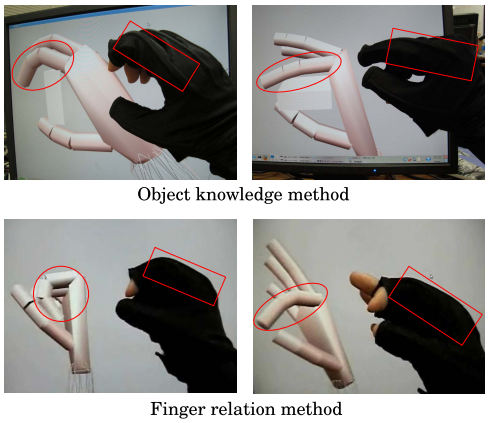

Figure 2: Difference of two hand motions

References

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[3] S. Hamaguchi and K. Funahashi. A data adjustment method of low-priced data-grove based on hand motion pattern estimation. In *Proceedings of the* 16*th Annual Conference of the Virtual Reality Society Japan*, 33D-6 (DVD-ROM, in Japanese), 2011.

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