

Development of a Support System for Holding Chopsticks Correctly

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Abstract— Chopsticks are tools that can easily handle food and are widely used in Asian countries. Chopsticks have functions equivalent to those of knives and forks, such as "grabbing", "cutting", "scooping" and so on. Also, properly holding of chopsticks is considered as one of manners. In order to fully use the functions of chopsticks, it is necessary to have chopsticks correctly. However, in Japan, the proportion of people who can hold chopsticks correctly is decreasing, and many adults who are over 20 years old can not possess chopsticks correctly. Therefore, in this research, we will develop an appropriate usage support system for chopsticks for adults who want to hold chopsticks correctly. In this system, the correctness of how to use chopsticks can be judged from the two situations of how to hold chopsticks and how to move them.

Keywords— Movement analysis, Movement support, How to have it chopsticks

I. INTRODUCTION

Conventional practical methods of holding chopsticks include a correcting method of using orthodontic chopsticks and rubber bands, and a method of imitating by referring to animation. However, in the case of using tools, there is a possibility that chopsticks cannot be used without tools. Also, in practicing watching movies, there is a lack of criteria for checking whether their usage is correct. Therefore, in this research, we use a camera image to judge whether how to hold chopsticks and how to move chopsticks is correct, and develop a system that gives necessary guidance.

In IWAIT 2017[1], we proposed a method to judge whether chopsticks were handled correctly. As a way to hold chopsticks, we detected the position of hands and fingers from the image of the hand holding chopsticks. We detected how to hold chopsticks from the image of the hand holding chopsticks using color extraction. We used green chopsticks which are complementary colors of our hands, and detected fingers with color markers. We detected fingers with different color markers on each finger. Also, compared how to hold chopsticks with the correct way to shoot in advance. The comparison points are three points of "finger position", "finger angle", "position of fulcrum when holding chopsticks".

II. DETECTION WHEN MOVING CHOPSTICKS

It is important that not only how to hold chopsticks but also how to move chopsticks. We took the still photography continuously from when we closed chopsticks until when we opened chopsticks. We made a colored marker with fingerstall. This marker can detect the shape of the finger more correctly and can also

detect the angle of the finger. And this new rubber marker has the advantage that it is less slippery than the previous paper marker.

The movement of chopsticks is inferred from the image which moved chopsticks. We photographed the state of moving chopsticks in stages and detected fingers from the image. Figure 1 shows the detection of fingers when chopsticks are held closed, Figure 2 shows the detection of fingers when holding chopsticks in parallel, and Figure 3 shows the detection of fingers when chopsticks are held open. We added a rectangle on original images to show the detection situation of each finger.

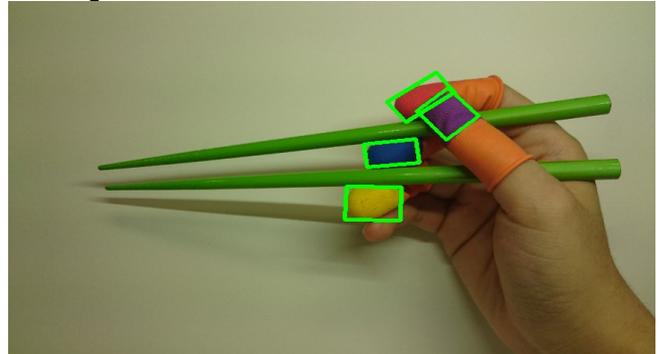


Fig.1 Detection when holding chopsticks closed

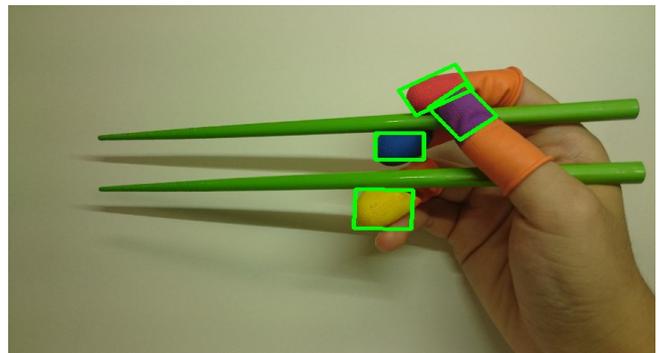


Fig.2 Detection when holding chopsticks in parallel

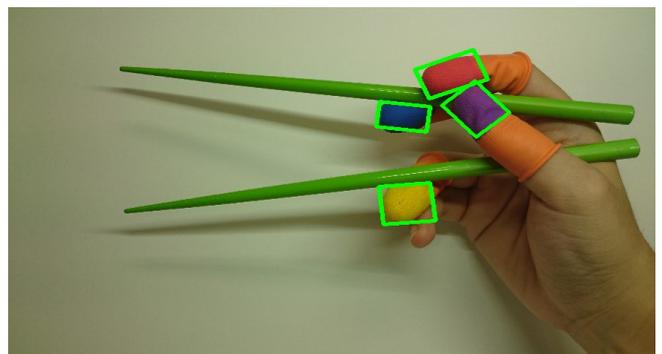


Fig.3 Detection when holding chopsticks opened

As a result, the system was able to detect fingers using color extraction in various situations. Those rectangles are used to obtain the three values for holding evaluation as described above

Figures 1 to 3 show examples in which chopsticks are correctly held. Next, a case where it is not properly held will be described.

Figure 4 is the image when chopsticks are closed, the image when chopsticks are held in parallel is shown in figure5, and the image when chopsticks are opened is shown in Figure 6. Compared to the reference image, the position of the middle finger is lower, and the ring finger is away. Comparing Figure 3 and Figure 6, we can see that chopsticks can not be opened widely if chopsticks are held wrong way.

We can find that the position of the finger and the interval between the chopsticks were wrong in moving chopsticks from the two images taken.



Fig 4. First person holding chopsticks closed



Fig 5. First person holding chopsticks in parallel



Fig 6. First person holding chopsticks opened

From this result, in order to clarify the difference in movement of chopsticks, we found that it is necessary to

investigate the position and angle of the finger and the interval between the upper and lower chopsticks.

III. DISPLAY OF CORRECT WAY TO HOLD CHOPSTICKS

When there is a difference compared with the correct holding method, the system displays correct way of holding. Figure7 shows a state in which the correct way to hold chopsticks is displayed visually. By displaying the positions and angles of fingers with corresponding color curves and displaying the position of the fulcrum with chopsticks in green circle, we can clarify the difference in holding way. In the future, we display the numerical value to make the difference easy to understand.

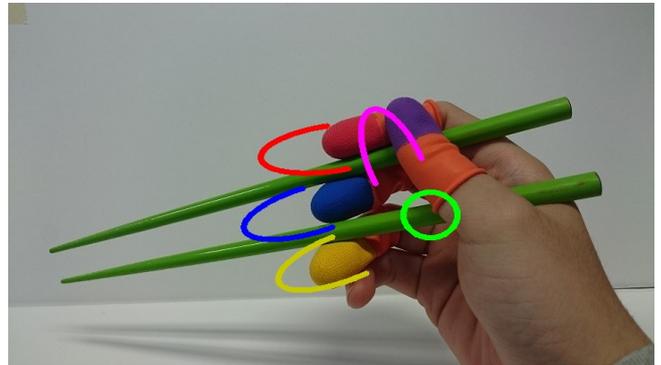


Fig 7. Display of correct way to hold chopsticks

IV. CONCLUSIONS

In this paper, we photographed how to move the correct chopsticks and how to move the wrong chopsticks, and compared the two images taken. From the result of the comparison, we found that the important factors when moving chopsticks are the position and angle of fingers, and the spacing between upper and lower chopsticks. In addition, we changed the marker to fingerstall and detected not only the position of the finger but also the angle of the finger.

In order to judge how to move chopsticks, we photographed when we closed chopsticks until when we opened chopsticks. Finally, when examining how to hold chopsticks and having a difference with the correct way of holding, we displayed the correct way to hold chopsticks.

In the future we will gather samples of how to hold more chopsticks from various people. We obtain the positions and angles of fingers and the spacing of upper and lower chopsticks from the collected samples and show that three factors are important. We devise and implement a display method to clarify how chopsticks move is different from the correct example. Finally, we will conduct an evaluation experiment of this system by having various people actually use the system.

REFERENCE

- [1] K. Yamakawa, Y. Tashiro, and T. Saitoh, "Development of a Support System for Right Directions of Chopsticks," 2017 Proc. of International Workshop on Advanced Image Technology (IWAIT 2017), Penang, Malaysia, Poster 2B-14, (3pages), January 2017.