Real-time Hands Tracking Using Feature Point Gathering Based on KLT Tracker for Man-Machine Interface

Ryosuke ARAKI and Takeshi IKENAGA
Waseda University, Tokyo, Japan
E-mail: ravelle-music@suou.waseda.jp Tel/Fax: +81-3-5286-2350

I. Introduction

Intuitive man-machine interfaces based on gestures with a touchpad device have become common. Furthermore, a vision based gesture recognition system like Kinect is gradually spread. Conventional works, however, use complex input devices (plural cameras, sensors, and so forth) or need to wear some devices like hand globes that is limitation for man-machine interface.

This paper proposes a real-time single-input both hands tracking algorithm for intuitive man-machine interfaces. By applying feature-point gatherings into the KLT (Kanade-Lucas-Tomasi) tracker, a kind of an optical flow, non-rigid objects like hands can be traced with high accuracy and low complexity under a complex background.

II. Proposed Method

The main steps of the proposed algorithm to detect feature-point gatherings and analyze hand-area motion are as following.

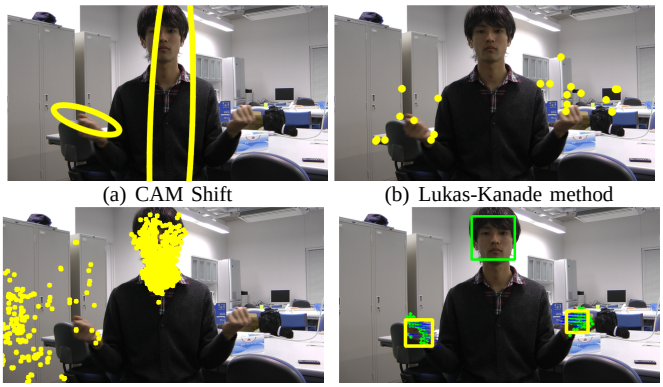
1) Creating a mask image based on a hue histogram
2) Labeling feature points to gather them
3) Detecting the object motion from motion vectors and gathering movements

In the first step, a face area is detected with Haar-Like feature algorithm and a mask image is created by a hue histogram in the face area. For reducing complexity, KLT Tracker is just applied for the mask image to detect feature points. If the distance between the points is less than the threshold, they are classified into the same gathering. Finally, hand area motions are based on not only motion vector directions of KLT Tracker but also movements of the feature-point gathering.

Since the proposed algorithm don't require any pre-learning steps and is very robust for environments (e.g. a complex background) and situations (e.g. partial occlusion), it can easily apply to the practical system.

III. Experimental Results

Test sequences (640 × 480, 60 fps) that cover a wide variety of scenes (e.g. complex backgrounds and shape changes) are used for evaluations using desktop PC (CPU: Intel Core i7 P870（2.93 GHz）, Memory: 8 GB) . As shown in Fig. 1, the proposed algorithm can trace both hands with higher accuracy than three well-known conventional algorithms (CAM shift, Lukas-Kanade method, Particle Filter) . Fig. 2 shows the X-position result of hand tracking. Furthermore, the processing performance attains 10-15 fps that makes possible to track typical both hands actions in real-time.



(a) CAM Shift (b) Lukas-Kanade method
(c) Particle Filter (d) Proposal Method

Fig. 1. The images of hand tracking result.

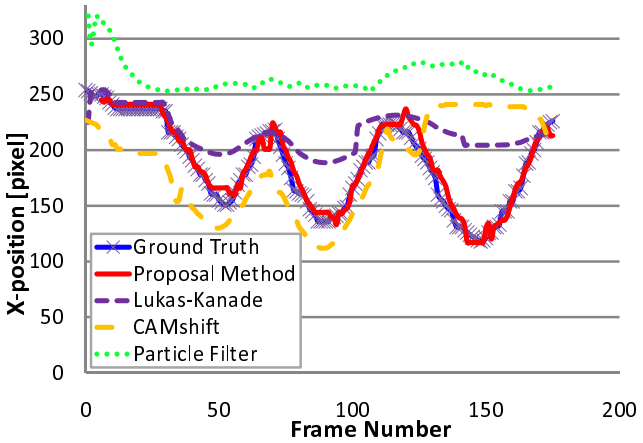


Fig. 2. X-position graph of hand area.

IV. Conclusions

This paper proposed a tracking algorithm using feature point gathering based on KLT tracker and showed that both hands can be traced precisely for various scenes in real-time. Since it gives the positions of both hands, it will make a contribution to creating a practical intuitive man-machine interface.

Acknowledgment

This work was supported by KAKENHI(23300018).

References

[1] C. Tomashi and T. Kanade: "Detection and Tracking of Point Feature," in *Carnegie Mellon University Technical report CMU-CS-91-132*, 1963.