CHAPTER 5 EXPERIMENTAL RESULTS AND ANALYSES

In this chapter, some experimental results and analyses of the proposed system for human posture estimation and human action recognition are presented. The proposed system has been implemented in the Microsoft Visual C++ 6.0 and runs under the Microsoft Windows XP operating system. The experimental machine is a Pentium4 2GHz PC with 512 MB RAM. The input image sequences are color, and image size is 640×480. The sampling rate is 10 per second. Section 5.1 discusses the experimental results and analyses of human posture estimation. In section 5.2, the experimental results of human action recognition are described.

5.1 Experiments of Human Posture Estimation

To test the proposed method for human posture estimation, we used 300 person silhouettes taken from four different persons. These silhouettes consist of:

- 52 standing,
- 37 stooping,
- 44 sitting with crooked legs,
- 46 squatting,
- 35 kneeling,
- 41 sitting with stretched legs, and
- 45 lying down/prone postures.

The total accuracy rate is 86.7%, and the accuracy rate for each posture is shown in Table 1. In general, Errors in posture estimation can be grouped into two types:

Table 1
The Accuracy rate for each posture (%)

	Standing (57)	Stooping (37)	Sitting with crooked legs (44)	Squatting (46)	Kneeling (35)	Sitting with stretched legs (41)	Lying down/prone (45)
Standing	100(57)	40.54(15)	0	0	0	0	0
Stooping	0	59.46(22)	0	0	0	0	0
Sitting with crooked legs	0	0	84.1(37)	0	0	0	0
Squatting	0	0	15.9(7)	100(46)	31.43(11)	0	0
Kneeling	0	0	0	0	68.57(24)	0	0
Sitting with stretched legs	0	0	0	0	0	82.93(34)	0
Lying down/prone	0	0	0	0	0	17.07(7)	100(45)

1. The inter-postures in a transition from one main posture to another main posture

Consider an example of the transition from standing to stooping (see Fig. 5.1), the inter-posture (Fig. 5.1(b)) is classified as a standing posture with the proposed method for posture estimation, but is generally considered as a stooping posture by human. Therefore, this inter-posture is misclassified.

2. Ambiguous postures

Fig 5.2(a) shows an ambiguous posture. This posture is classified as a squatting posture, but it is more similar to a kneeling posture.

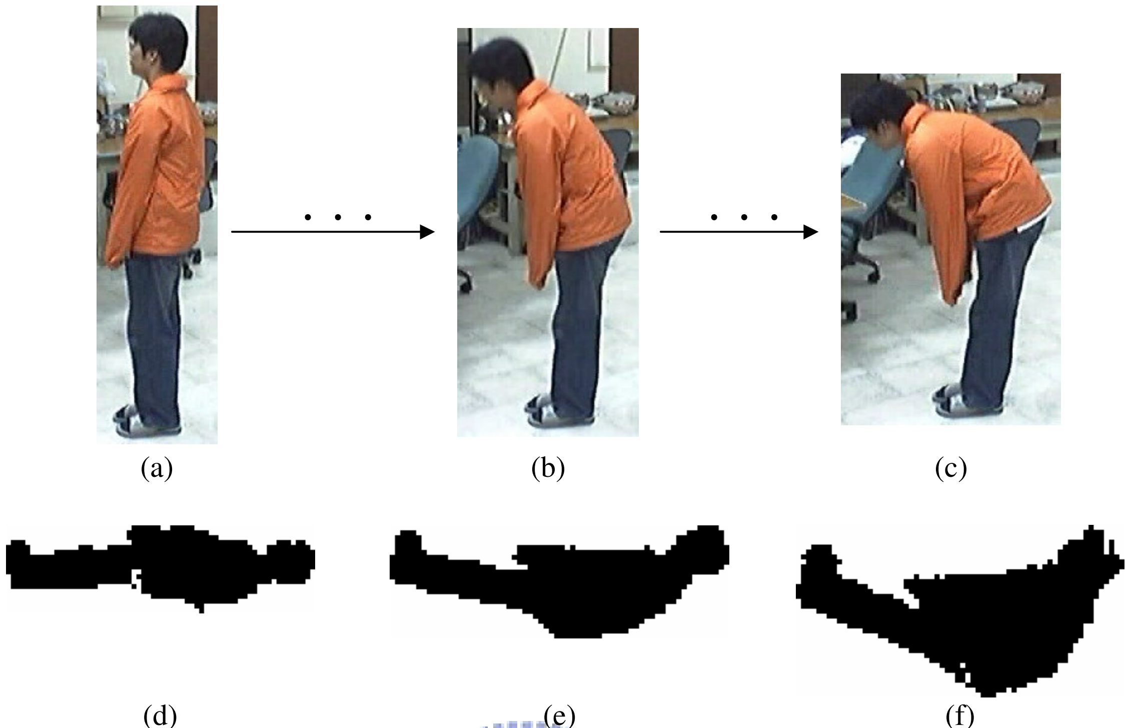


Fig. 5.1 An example of error type 1. (a) Standing. (b) Inter-posture. (c) Stooping. (d) The normalized silhouette of (a). (e) The normalized silhouette of (b). (f) The normalized silhouette of (c).

Fig. 5.2 An example of error type 2. (a) An ambiguous posture. (b) The normalized silhouette of (a). (c) The average normalized silhouette of squatting 45°. (d) The average normalized silhouette of kneeling 45°.

5.2 Experiments of Human Action Recognition

To test the proposed approach to human action recognition, we used four image sequences.

- Sequence 1 (1,501 images) contains a person performing some normal human actions.
- Sequence 2 (2,043) also contains a person performing some normal human actions, but the person and actions are different from those of sequence 1.
- Sequence 3 contains a dangerous human action that is kneeling suddenly and then lying down (see Fig. 5.3).
- Sequence 4 contains a dangerous action that is falling down (see Fig. 5.4).

The experimental results of these four sequences are as follow.

- Sequence 1

  Some human postures are classified incorrectly, as section 5.1 describes. The misclassification does not affect the human action recognition.

- Sequence 2

  The result is similar to that of sequence 1.

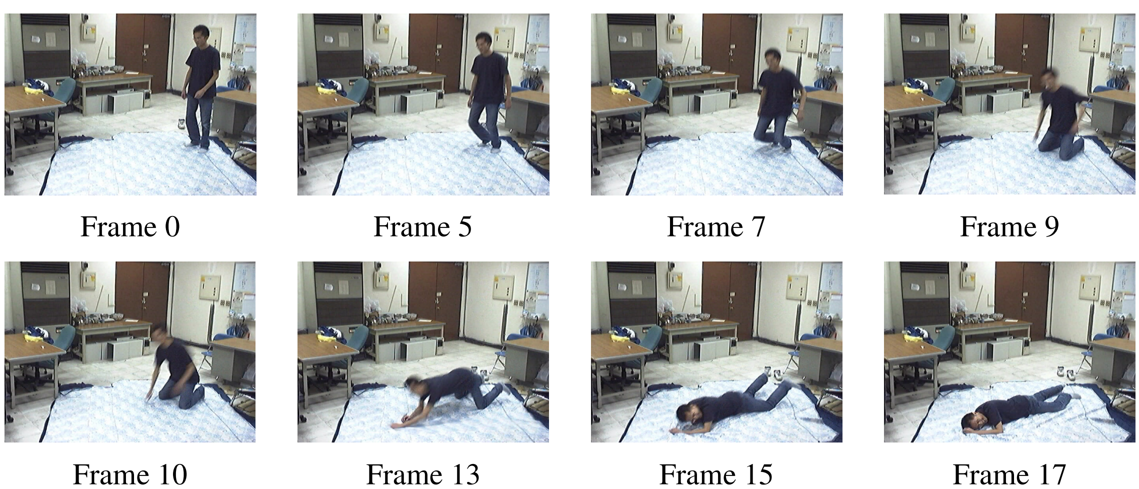
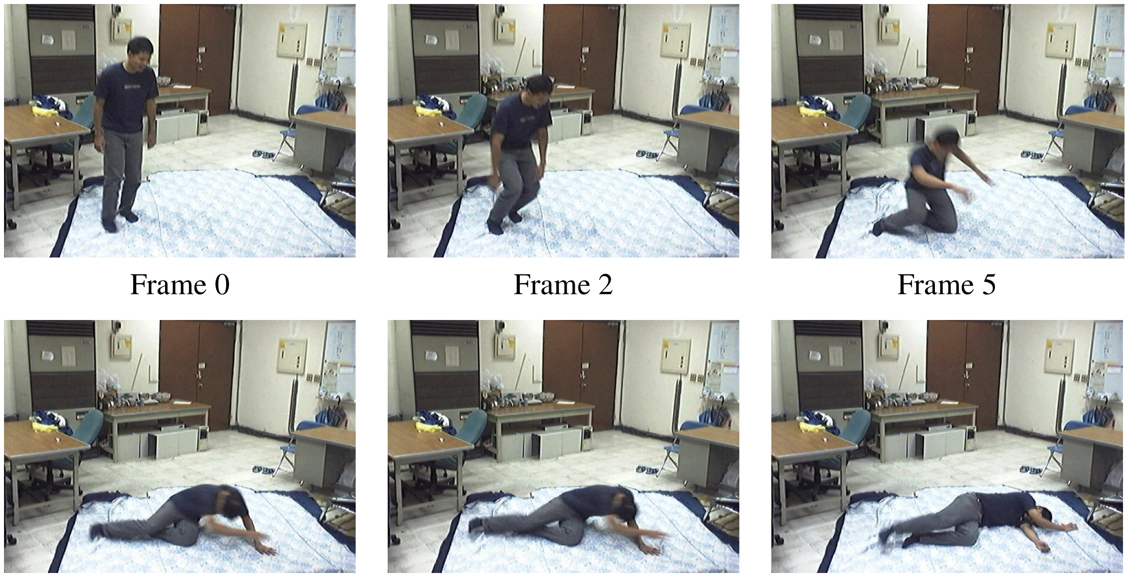


Fig. 5.3 A dangerous human action that is kneeling suddenly and then lying down.



Frame 0 Frame 2 Frame 5

Frame 7 Frame 9 Frame 11

Fig. 5.4 A dangerous action that is falling down.

- Sequence 3

  The dangerous action can be detected.

- Sequence 4

  The result is as same as that of sequence 3.