Expressive Dance Motion Generation

Narumi Okada[†i] Kazuki Okami[†] Tsukasa Fukusato[†] Naoya Iwamoto[†] Shigeo Morishima[†ii]

[†]Waseda University

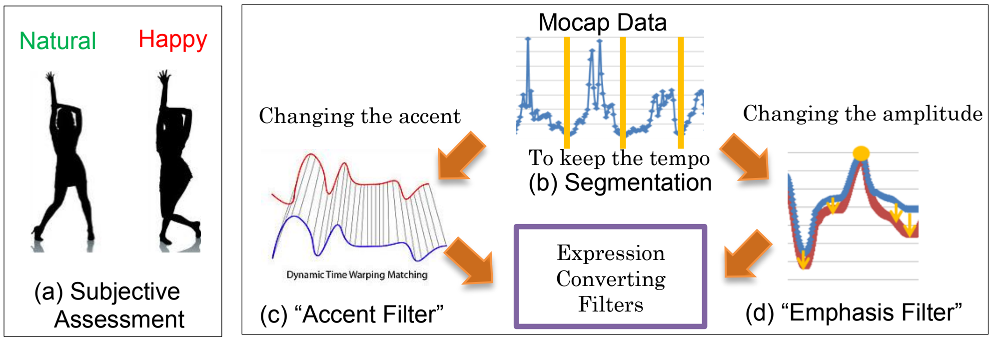

Figure 1: Overview of Our Method

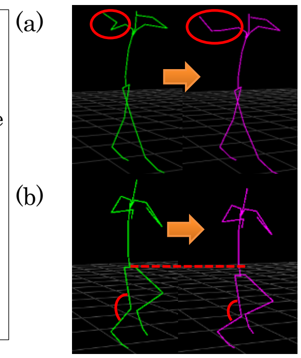

Figure 2: Result

1. Introduction

The power of expression such as accent in motion and movement of arms is an indispensable factor in dance performance because there is a large difference in appearance between natural dance and expressive motions. Needless to say, expressive dance motion makes a great impression on viewers. However, creating such a dance motion is challenging because most of the creators have little knowledge about dance performance. Therefore, there is a demand for a system that generates expressive dance motion with ease. Tsuruta et al. [2010] generated expressive dance motion by changing only the speed of input motion or altering joint angles. However, the power of expression was not evaluated with certainty, and the generated motion did not synchronize with music. Therefore, the generated motion did not always satisfy the viewers.

Therefore, we propose a method that transforms arbitrary dance motion into more expressive motion by filtering in accent and power. Original dance motion is divided into segments and converted to expressive dance to keep the original tempo. The expression conversion rule is extracted by analyzing motion capture data from training dance motions that include neutral and expressive motions labeled by subjective assessment.

2. Expression Converting Filters

Our proposed method is composed of 4 steps as shown in Figure1.

(a) Subjective Assessment: We examined the criteria that viewers use to judge expression. Then, we use the dance motion that was captured by a motion capture system. The contents of the data are standard motion and motions that express pleasure depending on the dancer's individual performance, which we call "Natural" and "Happy", respectively. As a result, we proved the benefit of the data and found that viewers focused on accent and dynamic motion. We also analyze the performer's knee movements because they are usually synchronized with the tempo of music.

(b) Segmentation: We divide a series of dance motion into several segments to generate "Accent Filter" depending on Weight Effort [Shiratori et al. 2006] which is defined as the minimum points of the following equation.

$$W(f) = \sum_{i=1}^{N} \gamma_i \sum_{j=\{x,y,z\}} |\theta_{ij}(f) - \theta_{ij}(f-1)| \qquad (1)$$

where i stands for each joint, N is the number of joints, f is the frame number, θ is degree of each joint, and γ is the weight.

(c) "Accent Filter": In order to find the timing pattern when the accents appear, we synchronize "Natural" with "Happy" by DTW (Dynamic Time Warping). We up-sample the motion data from 120 fps to 1200 fps by B-spline curve in order to avoid the discontinuous correspondence. Simultaneously we define upper limit of the joint angular velocity in DTW process to avoid the collapse of motion. By observing the correspondence between "Natural" and "Happy", the filters are categorized into two types, accelerating in the first part then slowing down at the last part of segment and slowing down at first then accelerating at the last.

(d) "Emphasis Filter": We define a converting filter of the amplitude of motion. According to the local minimum points of the degree angle of the knees in "Natural" and "Happy", we calculate the average ratio among the dynamic range of joint angles. Then, we altered the angle on the basis of the ratio that is calculated by linear interpolation between the minimum and maximum points.

3. Results and Conclusions

As the results of open test by applying expression converting filters to arbitrary dance, we can get motion as shown in Figure2. With the "Accent Filter", the generated motion has sudden slow and rapid changes in movements (see Figre2 (a)). The center of gravity showed greater movement after applying the "Emphasis Filter" (Figure2 (b)). The whole of dance seems vibrant and lively, since we divide a series of motion into segments, to keep the tempo uniform.

Consequently, our method enables to easily generate expressive dance motion by applying filter to non-expressive captured dance data. Our future work approaches a practical application in contents production. So, we are developing a system that generates dance motion to fit the music mood, and allows users to choreograph the character's expressive dance motion.

References

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†i e-mail narumi-pink@fuji.waseda.jp

†ii e-mail shigeo@waseda.jp

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