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Extraction of emotional information from music for Virtual Dance Collaboration System

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Contents

Background

- Motion Capture
  - Entertainment
  - Medical care
  - Biomechanics
- Digital Archiving and Information Technology application to dancing
  - Quantitative analysis of traditional dance motion
  - 3D character animations of traditional performing arts using virtual reality (VR)

Quantitative analysis of *Nihon-buyo* motion

Animation of *Noh* in VR

Related works on interaction with body motion

"Just Follow Me"

User can practice dance through watching a ghost-like virtual dancer displayed in the VR space

U. Yang, et al. : Implementation and Evaluation of "Just Follow Me" : An Immersive, VR-Based, Motion-Training System

"Movement-based interactive dance performance"

Music and graphics images on the stage are modified in real-time according to the dancer's motion

J. James, et al. : "Movement-based interactive dance performance"

Objectives: Virtual Dance Collaboration

- Collaboration system based on body motion
  - Requirements:
    - Recognition of body motion
    - Generation of reactions
    - Representation of reactions
- Realize virtual dance collaboration
  - Optical real-time motion capture
  - Immersive VR environment
  - Recognition of body motion
  - Generation of reactions

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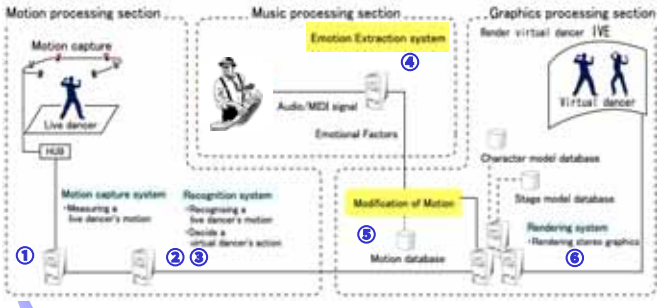
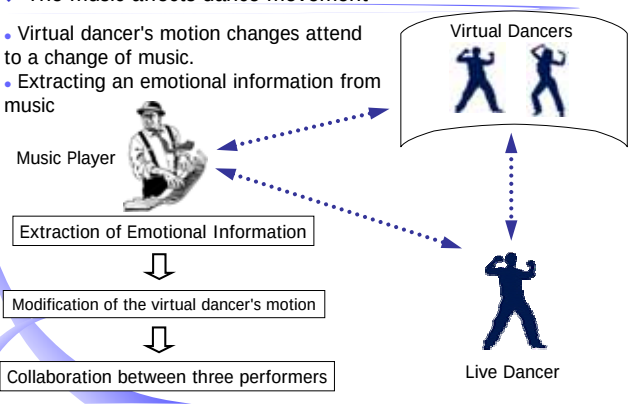
Configuration of the system



① Input live dancer's motion
② Recognizing a live dancer's motion
③ Determine a virtual dancer's reaction
④ Extraction of emotional information from music
⑤ Modify virtual dancer's reactive motion
⑥ Rendering stereoscopic character animation

Collaboration between 3 performers

- The music affects dance movement
  - Virtual dancer's motion changes attend to a change of music.
  - Extracting an emotional information from music



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5. Conclusion and Future Works

Fundamental Research of Extraction of Emotional Information from Music

Hevner classified the adjective that expressed emotions of music into 8 groups.

Classify the similar groups into 4 groups (Group1 – Group4)

K. Hevner: Experimental Studies of the Elements of Expression in music, American Journal of Psychology, Vol.48, pp.246-268(1936)

Recording in UBC

- Song: "March" by J. Clarke
- 8 kinds of emotions (C1 – C8)

Feature values for extraction of emotion

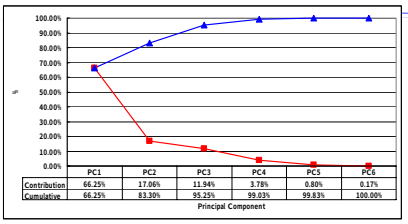
Feature parameters

- Mean of Velocity (Power of Sound)
- Standard Deviation of Velocity
- Mean of Brightness (Harmonic overtone element)
- Standard Deviation of Brightness
- Mean of number of keys pushed in 3 seconds (Speed)
- Mean of Duration of one key

6 Feature values ⇨ Analyze by PCA

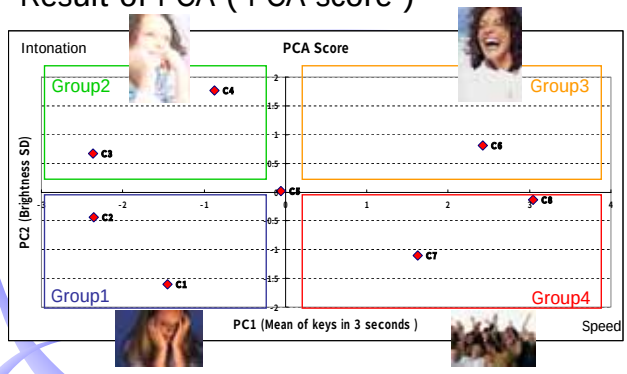
What is the most effective element for expression of emotion in music ?

Result of PCA (Factor loadings)



	PC1	PC2	PC3
Mean of Velocity	0.961	-0.135	0.061
Standard Deviation of Velocity	-0.603	0.448	0.655
Mean of Brightness	0.902	0.146	0.319
Standard Deviation of Brightness	0.262	0.883	-0.388
Mean of number of keys pushed in 3 seconds	0.962	-0.018	-0.017
Mean of Duration of one key	-0.939	-0.057	-0.176

Result of PCA (PCA score)



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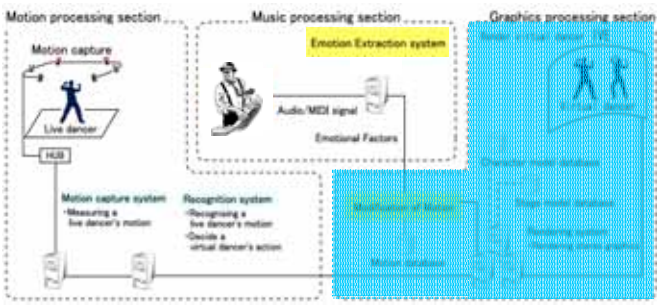
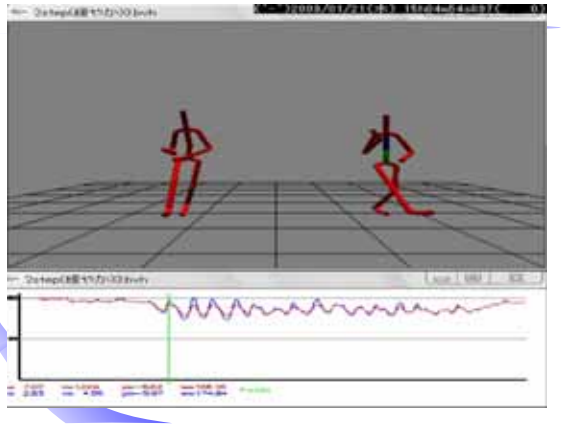
Modification of Virtual dancer's motion



Experiment of motion modification



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Conclusions and Future Works

- Conclusions
  - Extraction of emotional information from music
  - Modification of virtual dancer's motion
- Future works
  - Recognition
    - Recognition algorithm based on HMM
  - Real-time Extraction of Emotional Information
    - Find the best feature values
  - Motion modification
  - Collaboration
    - Virtual dancer models
    - Prediction algorithm of virtual dancer's reactive motion

Acknowledgements

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Thank you for your attention !

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