MotionVis

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Outline

○ Project motivation and goal
○ Details of projects
○ Video showing results
○ Future work and conclusions
Motivation

- Large motion capture DB’s widely used in the film and video game industries.

- This has created a desire to be able to search these databases for logically similar motions.
Project Goal

○ Numerous similarity metrics have been proposed:
  • Which of these should be preferred?
  • What are their respective strengths and weaknesses?
  • How can a given metric be improved?

○ Develop an environment for analyzing the structure of a motion capture DB under a given similarity metric
Project Overview

- InfoVis environment for visualizing MoCap DB under a given similarity metric
CMU MoCap Database

- Publicly available database of MoCap data (mocap.cs.cmu.edu)

- Project considers a subset of the CMU database
  - 110 walking sequences
  - 45 running sequences
  - 18 jumping sequences
  - 5 boxing sequences
  - 3 cartwheel sequences
Li’s Similarity Metric

- Treat each frame as a point in high-d space
- Hypothesis: Similar motions will have a similar principal axis as determined by PCA
- Angle between principal axes is used as the similarity measure

\[ m_1 = \begin{bmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \\ x_4 & y_4 \end{bmatrix}, \quad m_2 = \begin{bmatrix} x_1 & y_1 \\ x_2 & y_2 \\ x_3 & y_3 \end{bmatrix} \]

Li and Prabhakaran (2006)
Dimensionality Reduction

○ Three dimensionality techniques considered:
  ● PCA / Classic MDS (linear, fast)
  ● Metric MDS (nonlinear, slow)
  ● Non-metric MDS (rank order, slow)

○ With 2 dimensions:
  ● Classic MDS has a stress of ~0.08
  ● Metric MDS has a stress of ~0.05
  ● Non-metric MDS has a stress of ~0.03
Visual encodings
Future Work

- Fix various short-comings of current implementation
- Consider other MoCap similarity metrics
- Dealing with data that has an intrinsic dimensionality > 2
Conclusions

- Environment for aiding understanding of a MoCap-based similarity metrics

- Provides information about a similarity metric that is hard to obtain from:
  - analyzing numerical results
  - existing visualization environments
Literature

- **Implemented similarity metric:**

- **Other similarity metrics:**

- **Related InfoVis papers:**