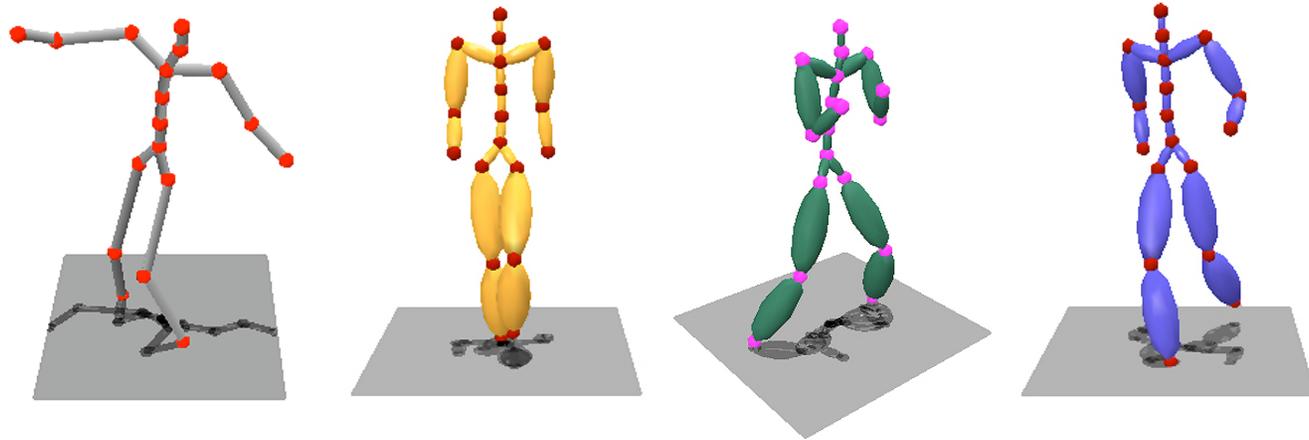


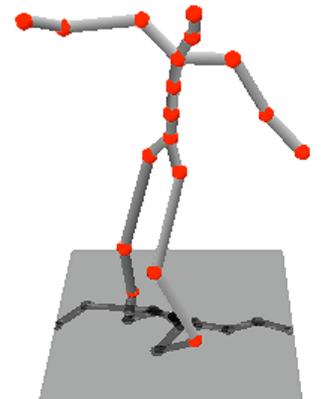
MotionVis

Donovan Parks



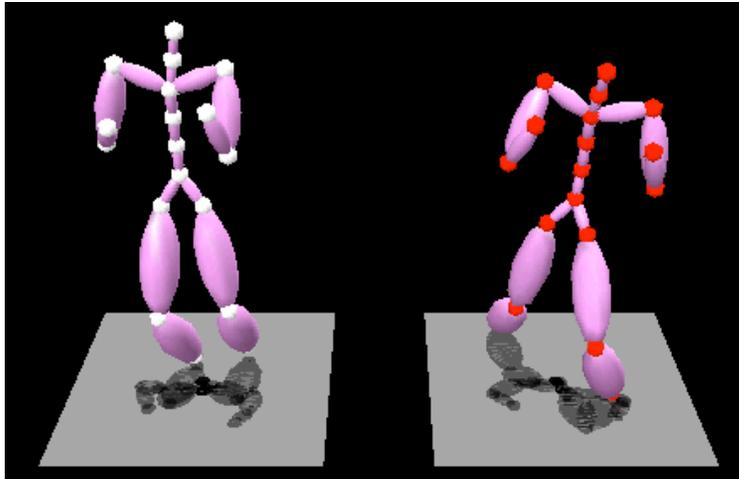
Outline

- 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



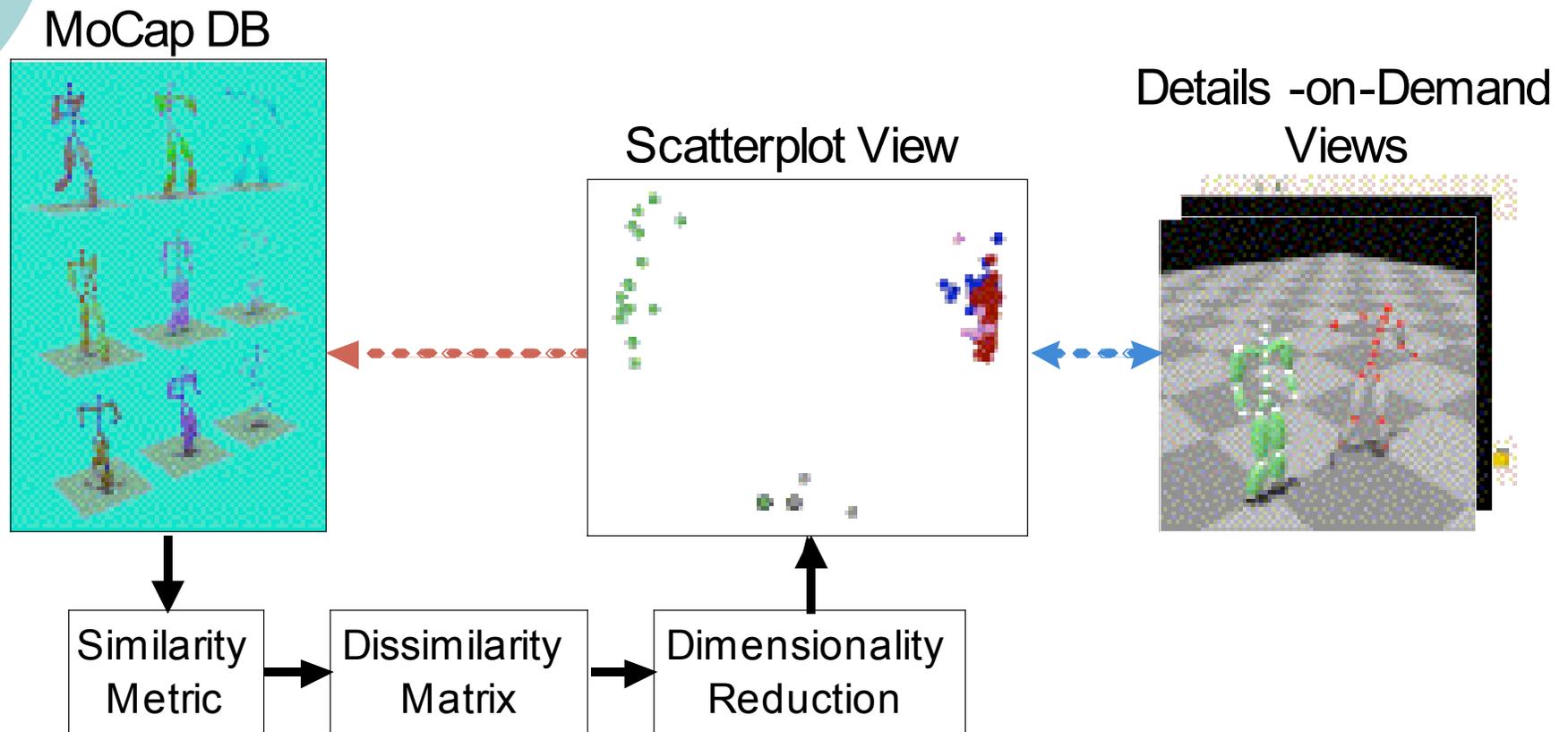


Project Goal

- 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





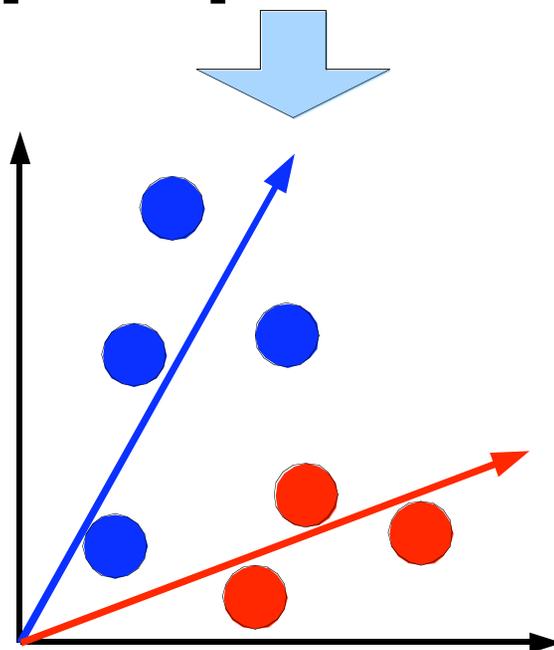
CMU MoCap Database

- 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

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



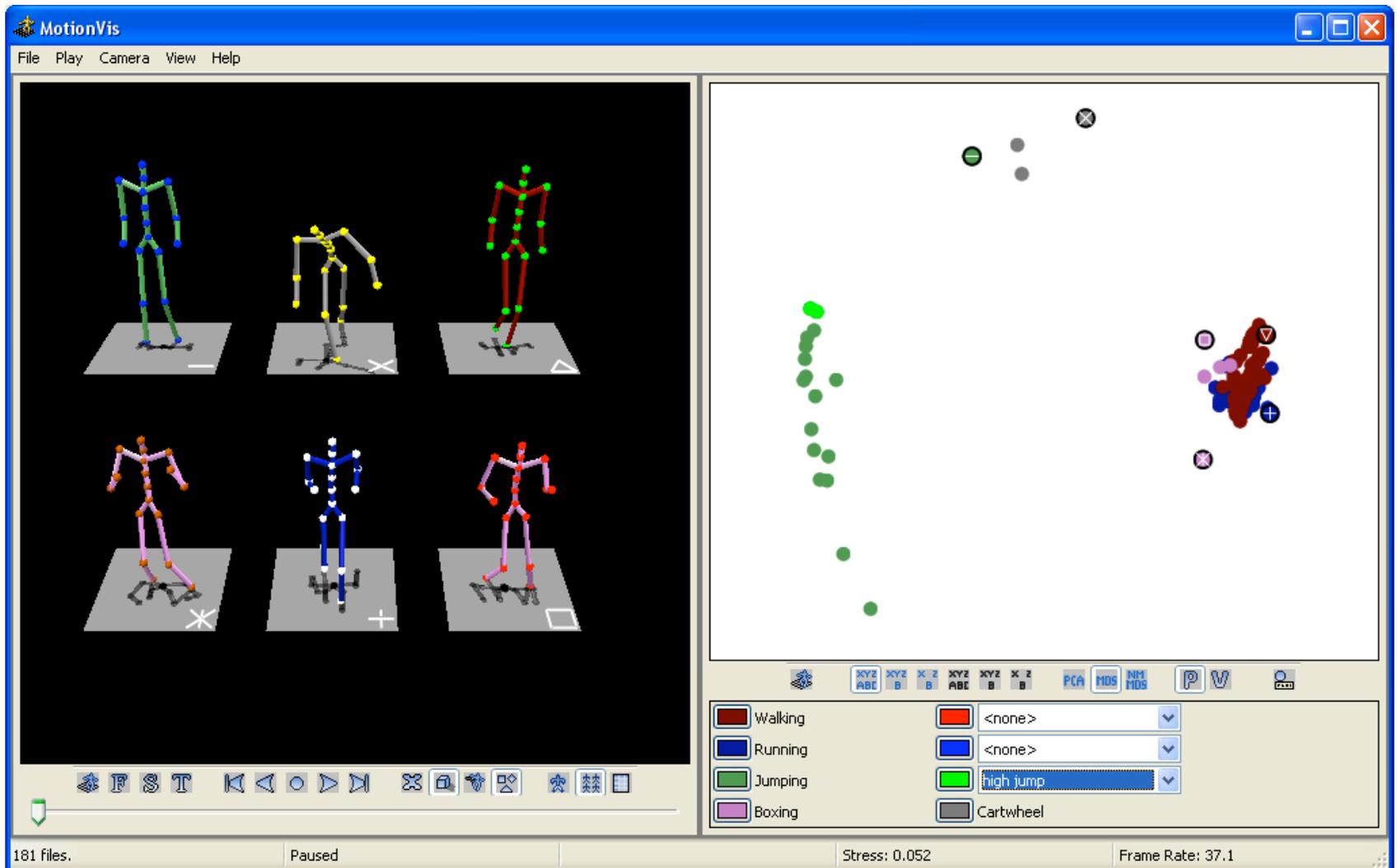


Dimensionality Reduction

- 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:
 - Chuanjun Li and B. Prabhakaran. *Indexing of motion capture data for efficient and fast similarity search*, 2006.
- Other similarity metrics:
 - Lucas Kovar and Michael Gleicher. *Automated extraction and parameterization of motions in large data sets*. ACM Trans. Graph., 23(3):559568, 2004.
 - Meinard Müller, Tido Röder, and Michael Clausen. *Efficient content-based retrieval of motion capture data*. ACM Trans. Graph., 24(3):677685, 2005.
- Related InfoVis papers:
 - Chris Roussin Rich DeJordy, Stephen P. Borgatti and Daniel S. Halgin. *Visualizing proximity data*, 2007.
 - Jonathan C. Roberts. *State of the art: coordinated and multiple views in exploratory visualization*. Proc. Conference on Coordinated and Multiple Views in Exploratory Visualization, 2007.