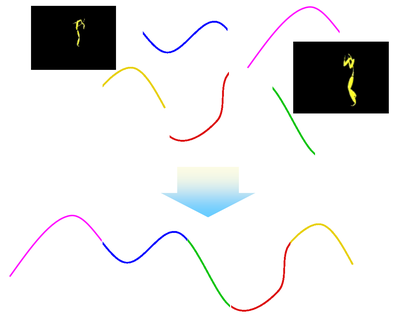
Fast Algorithms for Mining Co-evolving Motion Capture Sequences

School of Computer Science
Carnegie Mellon
Parallel Data Laboratory

Lei Li Advisor: Christos Faloutsos
leili@cs.cmu.edu

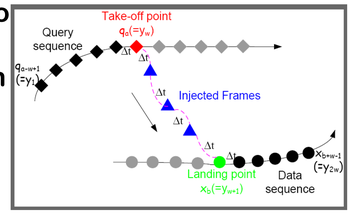
Natural Motion Stitching



How to assess the goodness of the stitching?

Laziness Score

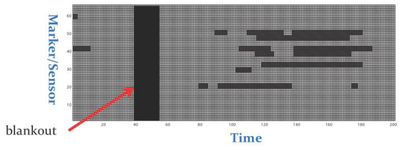
Conjecture:
less human effort → more natural
Proposed: use LDS to estimate position, velocity, acceleration
Then compute effort



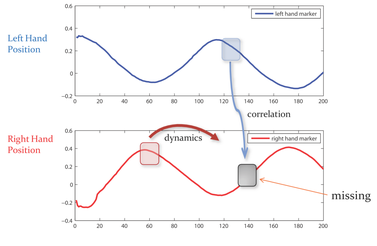
Lei Li *et al.* Laziness is a virtue: Motion stitching using effort minimization. Eurographics 2008,

Handling Occlusions

Occlusion:

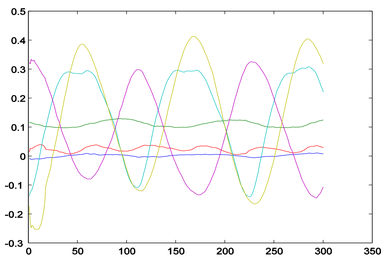


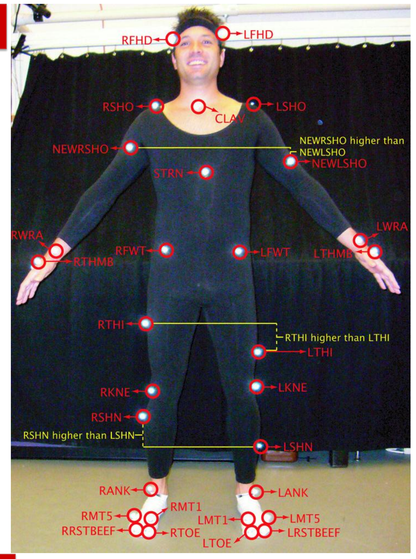
Intuition:



Scenario

Motion Capture:
- Markers on human actors
- Cameras used to track the 3D positions
- Duration: 100-2000 frames (120 fps)
- 93 dimensional body-local coordinates after preprocessing (31-bones)



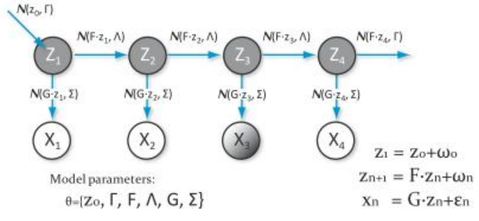


Application

- Movie and Animation (e.g. Shrek)
- Computer Game ($57B, 2009)
- Assistive Devices (e.g. cooking robot)

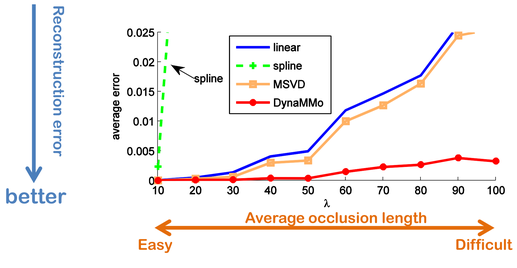
Base Model

Linear Dynamical Systems w/ or w/o missing



DynaMMo

Proposed method: maximize expected log-likelihood of observed data

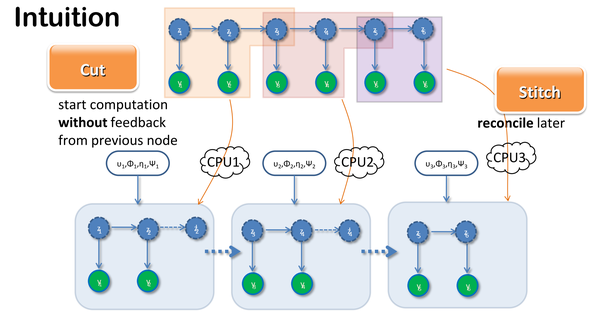


Problems

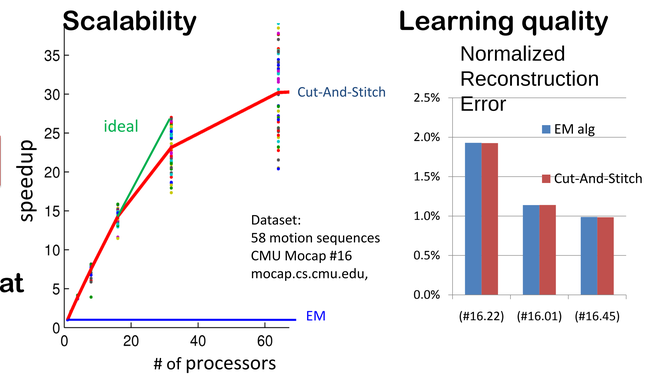
1. Natural motion stitching
2. Missing values
3. Summarization, Segmentation & Forecasting
4. Scalable Learning & Mining

Parallel Learning

Intuition



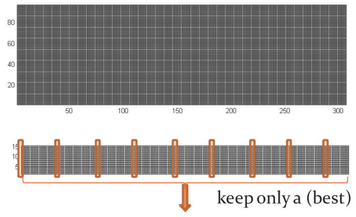
Cut-And-Stitch



Lei Li *et al.* Cut-and-stitch: efficient parallel learning of linear dynamical systems on SMPs. KDD '08

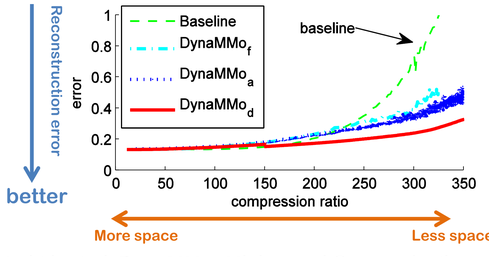
Compression & Segmentation

Intuition:

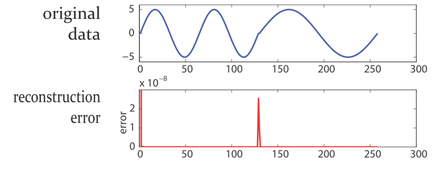


The same idea could be used in segmentation and forecasting

Compression



Segmentation



Lei Li *et al.* DynaMMo: Mining and Summarization of Coevolving Sequences with Missing Values. KDD '09