CS-184: Computer Graphics

Lecture #19: More Motion Capture

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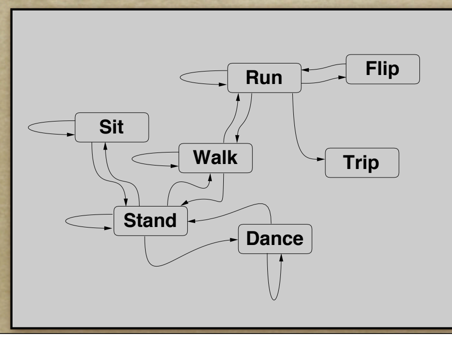
Today

- More Motion Capture

Motion Graphs

- Hand build motion graphs often used in games
  - Significant amount of work required
  - Limited transitions by design
- Motion graphs can also be built automatically



Motion Graphs

- Similarity metric
  - Measurement of how similar two frames of motion are
    - Based on joint angles or point positions
    - Must include some measure of velocity
    - Ideally independent of capture setup and skeleton
- Capture a "large" database of motions

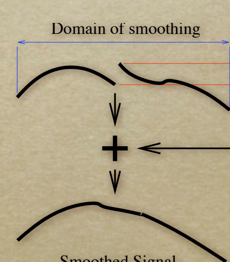
Motion Graphs

- Compute similarity metric between all pairs of frames
  - Maybe expensive
  - Preprocessing step
  - There may be too many good edges

Arikan and Forsyth, 2002

Motion Graphs

- Random walks
  - Start in some part of the graph and randomly make transitions
  - Avoid dead ends
  - Useful for "idling" behaviors
- Transitions
  - Use blending algorithm we discussed



Motion graphs

- Match imposed requirements
  - Start at a particular location
  - End at a particular location
  - Pass through particular pose
  - Can be solved using *dynamic programing*
  - Efficiency issues may require approximate solution
  - Notion of "goodness" of a solution

Motion Graphs

Interactive Motion Generation
From Examples

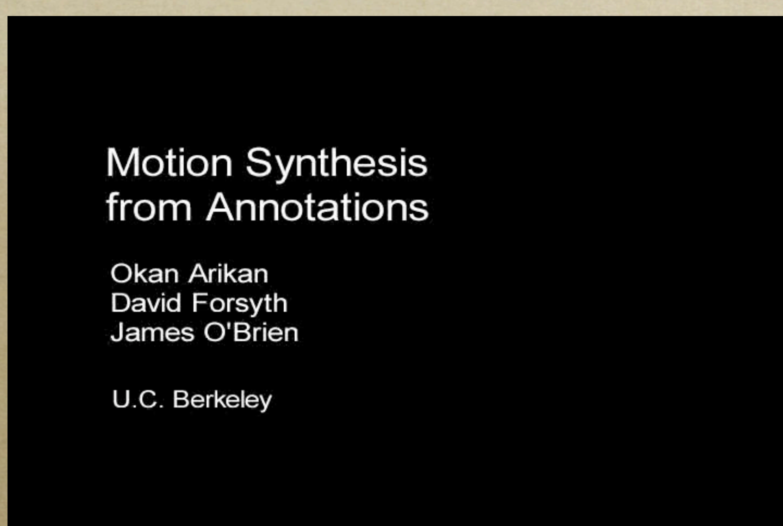
Okan Arikan
David Forsyth

Arikan and Forsyth, 2002

Graphs with Annotations

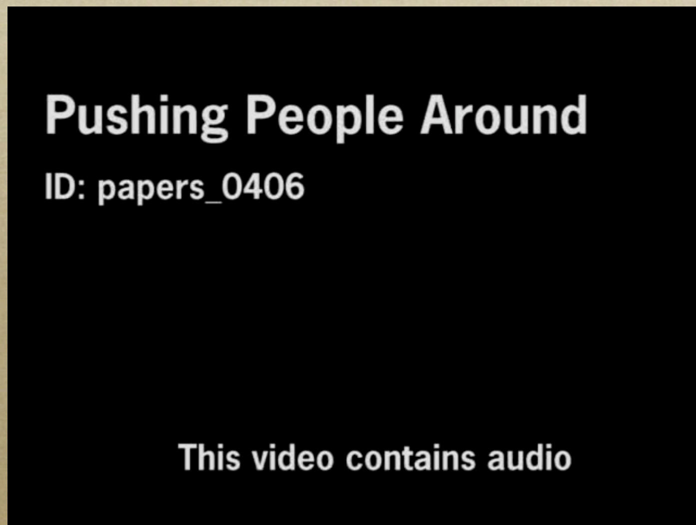
- Place semantic labels on motions
  - Example: walking, running, waving, moving-backward
  - Use include match to desired annotation in goodness
- How to place labels automatically?
  - Statistical classifiers

Graphs with Annotations



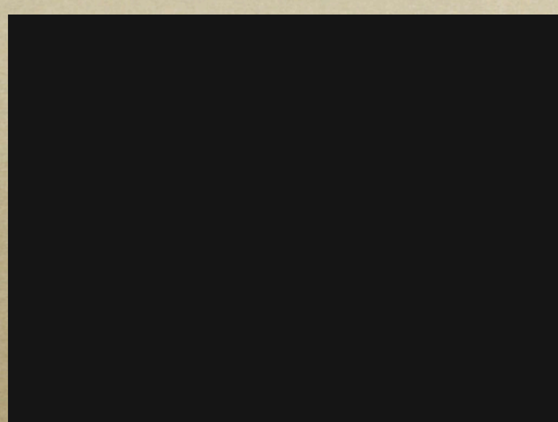
Arikan, Forsyth, and O'Brien, 2003

Supplementing w/ Simulation



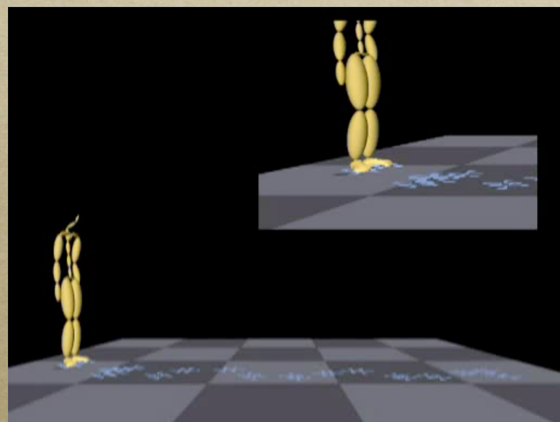
Arikan, Forsyth, and O'Brien, 2005?

Retargeting Examples



Gleicher, 1998

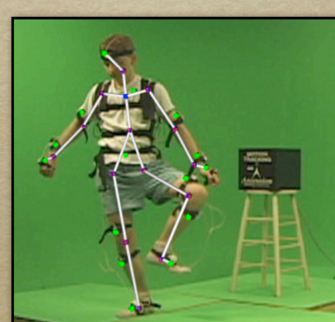
Footskate Cleanup



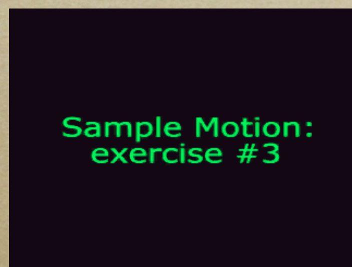
Kovar, Schreiner, Gleicher, 2002
(Excerpted)

Auto Calibration

- Skeletons constrain subjects motion
- Recorded motion retains evidence of constraints
  - Magnetic system yield simple linear constraints
  - Optical are nonlinear



Auto Calibration

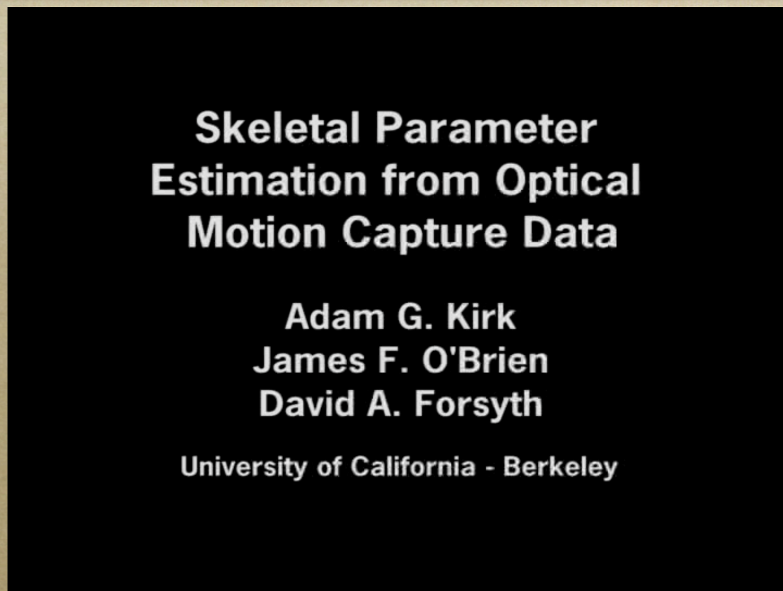


O'Brien, Bodenheimer, Brostow, Hodgins, 2000

Auto Calibration

O'Brien, Bodenheimer, Brostow, Hodgins, 2000

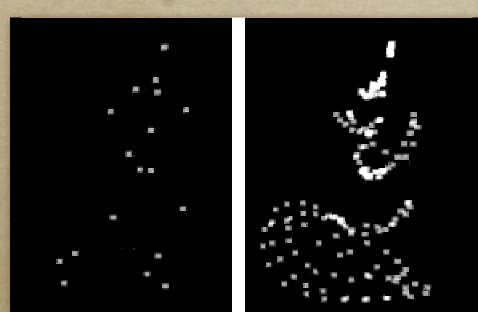
Auto Calibration



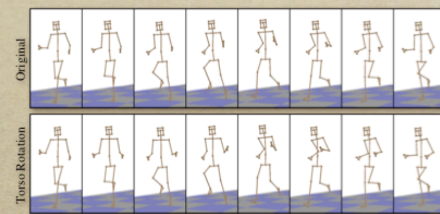
Kirk, O'Brien, and Forsyth, 2005

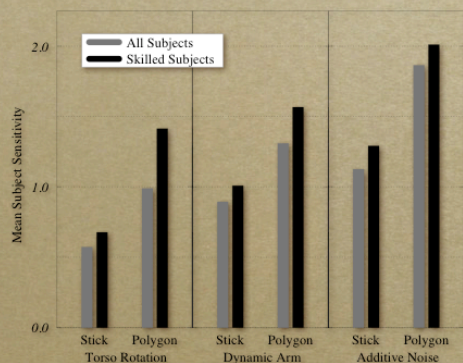
Perception Issues

- Motion can be perceived independent of geometry
  - "Biological motion stimuli" tests
- *But* geometry does impact motion perception



Perception Issues





Hodgins, O'Brien, and Tumblin, 1998

Suggested Reading

- *Retargeting motion to new characters*, Gleicher, *SIGGRAPH 98*
- *Footskate Cleanup for Motion Capture Editing*, Kovar, Schreiner, and Gleicher, SCA 2002.
- *Interactive Motion Generation from Examples, Arikan and Forsyth, SIGGRAPH 2002.*
- *Motion Synthesis from Annotations, Arikan, Forsyth, and O'Brien, SIGGRAPH 2003.*
- *Pushing People Around, Arikan, Forsyth, and O'Brien, unpublished.*
- *Automatic Joint Parameter Estimation from Magnetic Motion Capture Data, O'Brien, Bodenheimer, Brostow, and Hodgins, GI 2000.*
- *Skeletal Parameter Estimation from Optical Motion Capture Data, Kirk, O'Brien, and Forsyth, CVPR 2005.*
- *Perception of Human Motion with Different Geometric Models, Hodgins, O'Brien, and Tumblin, IEEE:TVCG 1998.*