Notes

- Final exam in LSK 460 (Thursday, December 9, 8:30am)
- Project proposals must be approved today by 4pm
  - I'll be in my office almost all day if you need to talk to me
  - Proposals can be informal, but must:
    - Be recorded (in email or on paper)
    - State clearly the two methods you are implementing and what you're doing with them

Using Mocap Data

- From high level we've seen mocap process, some of the problems that must be solved
- Last class: how to do the most fundamental clean-up operation (removing footskate)
- This class: how to reuse the data for new motion
  - Related to assignment 3

Motion Graphs

- Main references:
  - Kovar, Gleicher, Pighin, "Motion Graphs", SIGGRAPH 2002
  - Lee, Chai, Reitsma, Hodgins, Pollard, "Interactive Control of Avatars Animated with Human Motion Data", SIGGRAPH 2002
  - Arikan, Forsyth, "Interactive Motion Generation from Examples", SIGGRAPH 2002
    - With slightly different notion of a motion graph, but same basic philosophy

Motivation

- Mocap data is wonderful in capturing subtle detail, perfectly natural movement, etc.
- But it's painful to edit it directly
  - Except for small and smooth changes (e.g. footskate cleanup) it's really hard to avoid destroying the subtlety and plausibility
  - Common artist perception: easier to just throw the mocap data out and start from scratch…
- So instead reuse data as recorded (with only very small and smooth changes)
  - But cut and splice to make it do what you want
  - Think remixing

Manual approach

- Carefully plan out ahead of time what motion clips you need
  - E.g. running, running left, running right, stopping, starting, snapping a football, throwing, catching, tackling, falling, …
- Record them all several times
- Edit by hand to allow the transitions you need

Transition Points

- First stage: figure out where you can transition from one clip to another
- I.e. determine how close two poses are
  - What's important in distance metric?
    - Global position and orientation? Probably not: ignore
    - Joint angles? How to weight them: should a finger tip count the same as hip?
      - Avoid weight issue: use Euclidean distance between actual point locations on skeleton (with optimal rigid transform)
      - Perhaps weighted with mass of limbs
    - Velocities? Accelerations?
      - Avoid issue by comparing not just single frame poses, but a "window" of nearby frames
- Then look at matrix of distances, local extrema indicate possible transitions

Constraints, annotations

- Additional information in the mocap data:
  - Constraints (e.g. foot plants)
  - What context the motion is in (e.g. normal walking vs. martial arts, or happy vs. sad…)
- May need this in deciding transitions
  - Avoid changing constraints awkwardly
  - Stay in one context, or purposefully switch to another
- Also need to keep constraints for later cleanup (e.g. footskate)

Making the transition

- Just like warping from video morphing
- Over a certain time interval (somewhere between 1/3 and 2 seconds) blend pose data
  - Smooth blend fraction function
  - Linear interpolation between root positions and spherical linear interpolation between limb orientations
    - In an aligned coordinate system!
- Decide on the right instant to change constraints if necessary…

The motion graph

- Each arc (directed edge) is a motion clip
- Nodes are poses: starts and ends of clips, transition poses
- May be large and irregularly structured
  - Assignment 3 paper is about fixing the structure to something simple
- Could have problems
  - Dead-ends
  - "Sinks"
- Look for largest strongly-connected subgraph, throw out the rest
  - More complex if you consider context annotations

Graph traversal

- Be careful with coordinate systems
- Global position and orientation recorded with the data is irrelevant
  - When we transition into a new clip, need to align with where we're coming from
- As you go, enforce constraints (foot plants) in new coordinate system