2/20/03

Dealing With Motion Data ≡

Sensor (RAW DATA)

⇓ CLEANUP ≡ GAP FILLING, NOISE REDUCTION

← GET WHAT REALLY HAPPENED

Clean Data

⇓ SKELETAL CONVERSION

Skelletal DATA ← GET RIGHT FORM

⇓ MOTION EDITING

USEFUL DATA ← GET WHAT YOU WANTED

MOTION CAPTURE PIPELINE

① CLEANUP

Deal with sensor IMPERFECTIONS

GENERALLY A SEPERATE PROCESS

Could do on skeletons

Noise ← unwanted signal

① randomness

② randomness drowns out signal

③ drop out

2 is worse than 3

All DATA HAS NOISE!

SENSOR ERRORS

MARKER ERRORS (SLIDING AROUND)

Computing ERRORS

Imprecision / Inaccuracy

ISSUES WITH NOISE
- CAN'T IDENTIFY IT (unless drop off)
- CAN'T REALLY KNOW SIGNAL
  - unless you knew what the signal is
  - or you can characterize it

GAPS
SMALL - FILL IN w/ INTERPOLATION
MEDIUM - Neighboring MARKERS
LARGE - ARTISTIC - MAKE UP DATA

Filling Gaps with Skeleton
Chicken and egg problem
Marker redundancy
tradeoffs

Noise Reduction
In Marker DATA ← issues of filtering rotations
What is noise? ← "blindness" of pure signal

Noise vs. High Frequencies] intuitions of frequency in motion
No! ←
What does LPF really do

Smart LPF ← speed adaptive

A word on Kalman Filters

don't know future - so predict

1 2 t

↓

Need next frame

$$\hat{x}(t+1) = x(t) + \Delta t\, \dot{x}(t)$$

$$\hat{x}(t+1) = ?$$ ← state space

Linear Predictor

what happens when you get "real" answer

$x(t+1) \neq \hat{x}(t+1)$

which do you trust?

- model is imperfect
- sensor is imperfect

Kalman Filter ≡ linear predictor $x(t+1) = M x(t)$
linear observation model
gaussian noise model

simple

provably optimal ← not necessarily good, just the best you can do with a limited information

Blindness of pure-signal approaches
- do changes have any "real meaning"
- really need more info

  Heuristics
  - Visual Artifacts
  - What kinds of change can you see

Hueristic 1

HF are noticeable - perception
important - crispness

$\therefore$ don't want to distort HF
can't add or subtract
make LF changes

In practice $\equiv$ Motion Displacement Maps
Add LF