MoCap - Motion Capture

Uses:

1. Animation (Feature animation for a humanlike character ex. Antz, Avatar movie)
2. Video Games (Character animation for game character – sports moves)
3. Robot Control (Human robot – ASIMO)

What is MoCap:

Capturing motion of the subject (could be anything from a talent to cloth, fluid etc) by means of special cameras that track markers placed on subject's body.

List of Games that use MoCap:

1. NBA Live
2. Lord of the Rings
3. Tony Hawk's Skater
4. GTA
5. EA Sports Cricket …etc

More on MoCap:

1. Approximation to human body
2. Skeleton is generated from data (most commercial system do this)
3. The system outputs joint angles and XYZs which later transferred to a articulated model *
4. Skeleton has about 60 degrees of freedom
5. Speed 120 or 240 fps
6. Manual Labor - need to configure system and tweak parameters in order to get quality results.
7. Mostly done procedurally.

Error Cause:

1. Joints come apart – skeleton is not consistent if markers are misplaced.
2. Links grow and shrink – ideal the links should be rigid.
3. Bad contact point – Foot slide problem.
4. Must maintain root and angles.

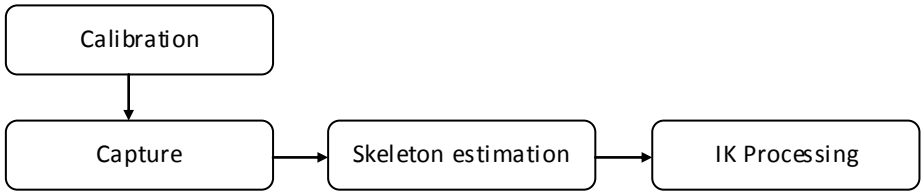
Off-Line:

1. Processing done after the capturing data – filtering , Euler angle correction, IK etc..
2. Good for feature films.
3. Can produce library of motion
    a. Choose among them
    b. Blend between them
    c. Modify on the fly

On-line:

1. This is done in real time
2. Konami games

Production pipeline:



What is captured?

1. Dynamic motion
2. Scale – large or small faces (ICT Light stage for facial mocap)
3. Non-rigid object – cloth –very challenging (active research area), more no of markers, difficult to manage.
4. Props – ping pong ball, fly fishing, sword – (often causes problem)
5. Fluid motion, explosion – very hard to do.

Technology:

1. Passive markers – do not emit signals of any kind
2. Active markers – emit signals.
    a. $180K
    b. High resolution camera 240 Hz, 1000 x 1000 pixel
    c. IR or visible light
    d. 6 character with 30 markers each
    e. Not done outdoors
    f. Space limit
3. Magnetic
    a. Strapped with wires
    b. Heavier sensors
    c. Wires on body limit motion
    d. Captures both position and orientation
    e. No cameras
    f. $70K (2k for each addition marker)
    g. Slower 80 fps
    h. Sensitive to EMI/ metal – hard to debug.

4. Exoskeleton:
    a. 500 fps
    b. Need to wear skeleton
    c. Restrictive motion
    d. Truly real time
    e. Need separate technology to position root

Technology Issues:

1 Resolution / range of motion
2 Calibration
3 Accuracy
4 Capture rate
5 Occlusion
6 Correspondence – to determine which marker is which.
7 Marker placement

Research topics

1. Marker placement – should be close to bones.
2. Capture deforming chain than rigid body
3. Retargeting – transferring motion to another skeleton (crowd animation)
4. Constraint satisfaction
5. Generalization of data
6. Interfaces for controlling human.

Note:

Forward Dynamics:

Calculating position from given forces, torque.

Inverse Dynamics:

Calculating force, torque given a position from a previous position.

Articulated model:

Collection of rigid bodies connected with joints.