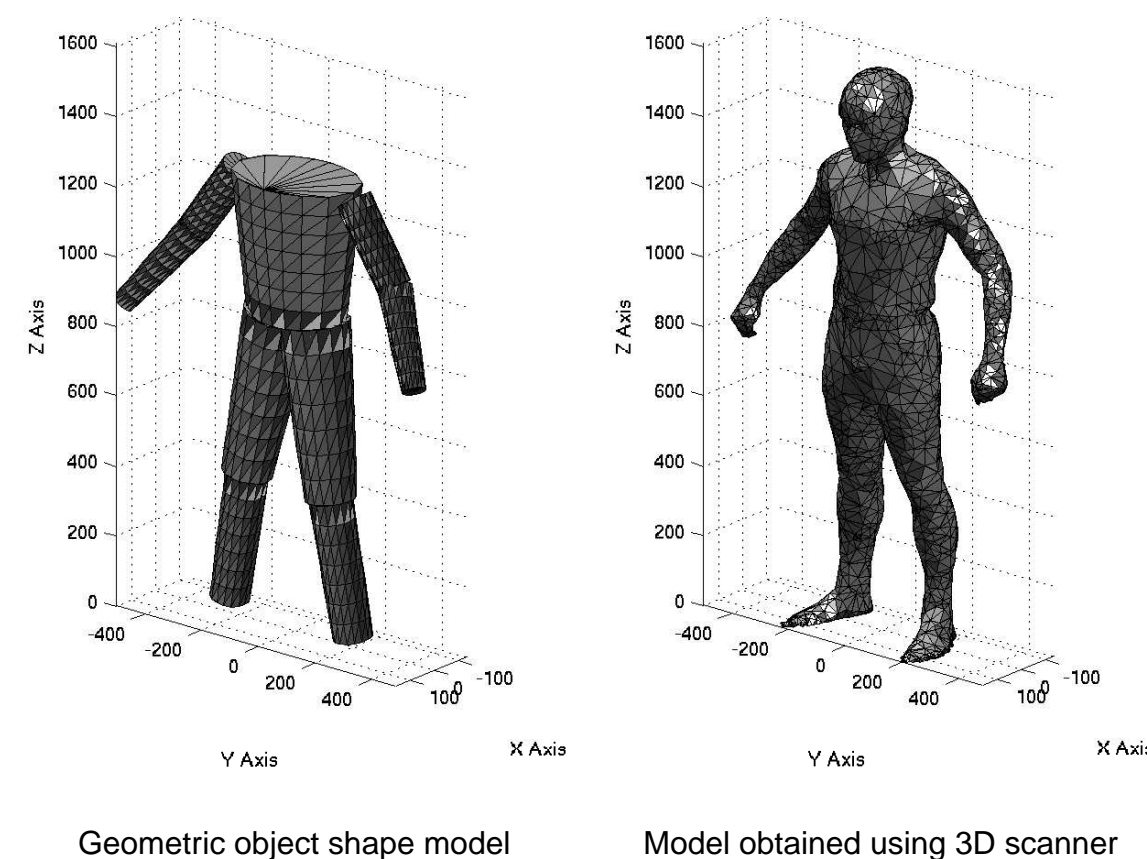


Summary

- Use human body shape (geometric objects) and motion (kinematic chain) models.
- Multiple Cameras to overcome occlusion and kinematic singularities.
- Use visual cues such as pixel flow to track pose.
- Working on integrating edge information in pose tracking algorithm.

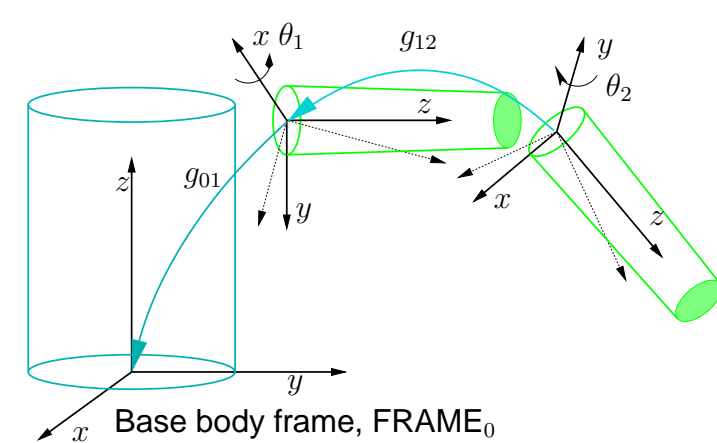
Body shape model

- Simple rigid geometric shapes to describe shape of human parts (ellipsoids or truncated elliptical cones).
- Shape model chosen depends on the representation aspect and also ability to determine intersection with rays.
- Aim to use an accurate 3D model obtained from 3D scanner.



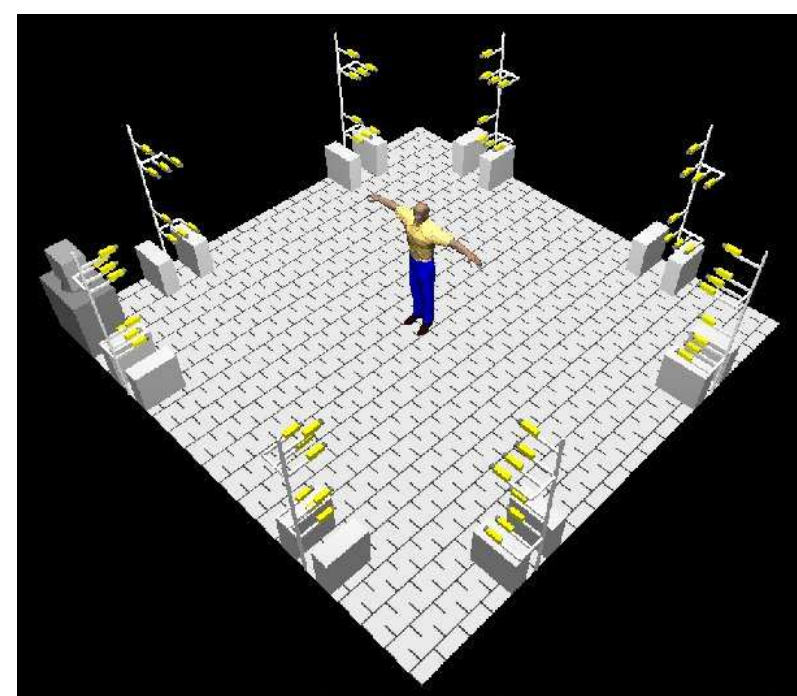
Body motion model

- Allow 6-Degree of Freedom (DoF) motion for base body.
- Limbs and head modelled as parts connected to trunk (base body) in a kinematic chain.



Multiple Camera Capture at KECK Lab

- Originally 64 cameras (16 rigs with 4 cameras each).
- Gray-scale images (484x648) captured at up to 85 fps.
- We aim to use one camera from each rig.
- Complete view from all angles.
- Currently working on an automated, accurate calibration method.

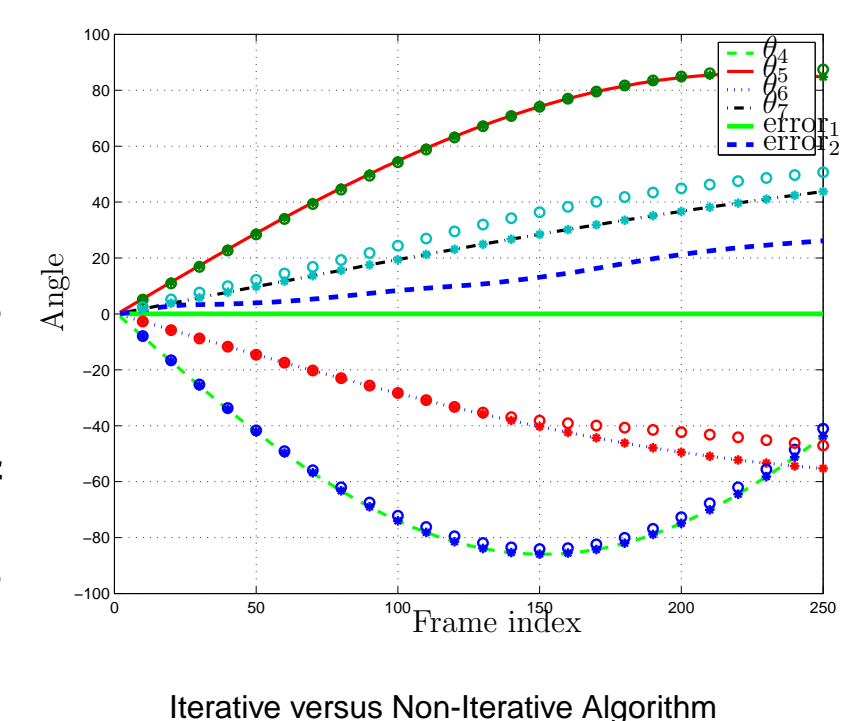


Tracking Algorithm

- Perform optical flow on images to obtain pixel displacement.
- Associate each pixel with corresponding body part using current pose parameters.
- Formulate pixel velocity as a linear function of the 3- motion parameters.
- Solve for 3- motion parameters.

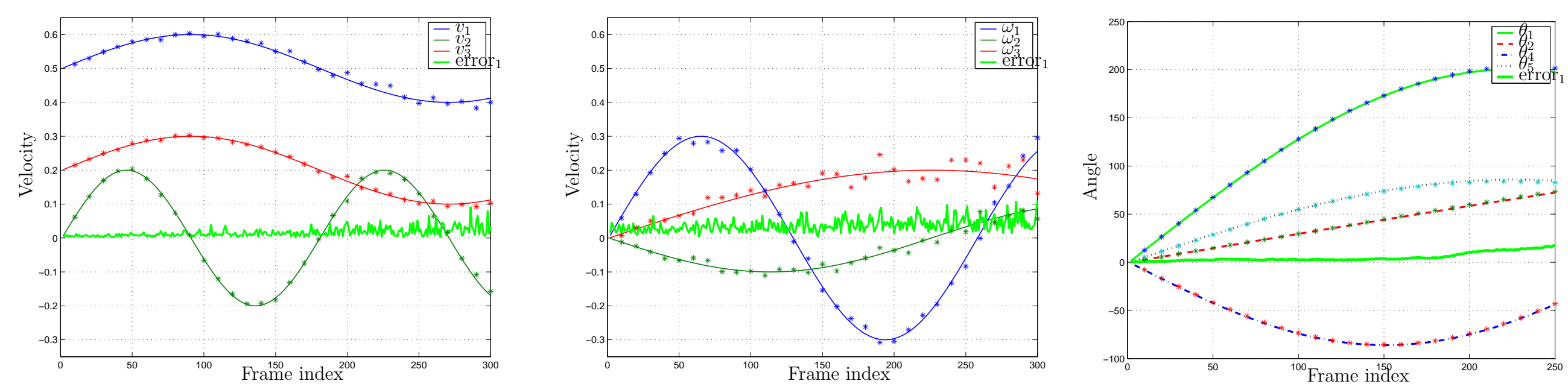
Features of the Algorithm

- Minimum number of parameters to describe motion.
- Camera models use perspective projection.
- Uses multiple cameras effectively (number of unknowns does not increase with number of cameras).
- Iterative algorithm to use pixel displacement instead of pixel velocity (difficult to obtain unless velocity model is assumed).



Performance on Noisy Simulated Data

- Results provided below use data obtained from simulation.
- Model comprising of trunk, upper arm, forearm and palm (with DoFs 3, 2 and 2).
- 72 points per body part and 3 cameras used.
- Gaussian noise added to measured displacement.



True and estimated parameters (Base body translational velocity, Base body rotational velocity, and Joint angles)

Future extensions

- More flexible model for joints and motion and shape.
- Integrate use of other cues (such as edges) to refine pose estimate.
- Use stochastic motion models (Kalman filter) to exploit temporal motion relationships.
- Use body shape and structure for segmentation and impose constraints optical flow computation.¹

¹Poster created using L^AT_EX.