* ABSTRACT
* INTRODUCTION
  + MOTIVATION
    - Human operators for teleoperation
      * Cite doik and others
    - Rehabilitation and health monitoring for elderly
      * Low cost visual postural feedback with Wii balance board and microsoft kinect
      * Cite some of the people cited by venture and gonzalez
    - Designing safety equipment for jets and cars etc. (cite airforce)
  + RELATED WORK
    - Past work in Human teleoperation of humanoid robot
      * Doik Kims group
        + Online footprint imitation of a humanoid robot by walking motion parameterization
        + Others??
    - Venture et al
      * Motion based ID of human body inertial parameters
        + Use force plates and tracking cameras to record force and position of person. Use least squares formulation to get values of inertia, mass, etc.
        + Problems

Requires expensive setup

Not guaranteed to return feasible assignments

* + - * Optimal estimation of human body segments dynamics using realtime feedback
        + Uses realtime feedback to suggest movements to the user to improve the conditioning number of the matrix, resulting in better signal to noise ratios
      * Positive Definite Matrix
        + Approximate link with set of points that represent the convex hull of the link. Do optimization.
        + Requires complex optimization over hundreds of variables riddled with local minima.
        + Still has restrictions of expensive setup
    - Gonzalez
      * Estimation of Mass with Kinect and Wii Balance Board
        + Use Static Equivalent Chain model and Kinect and Wii balance board. Use LSE to get a set of coefficients to predict the Center of Mass given joint positions
        + Does not give mass and center of mass coordinates.
      * Online Identification and Visualization of the SESC via Constrained Kalman Filter
        + Use an EKF with constraints to learn the parameters online.
        + EKF is not guaranteed to converge to the right answer and may diverge.
        + Still does not give mass and center of mass
    - Fundamental problem with getting center of mass and mass from static observations.
    - Other
      * Estimating human body segment parameters using motion capture data
        + Does optimization over force using euler-lagrange. Didn’t work for complex systems, no reason that this optimization would actually be a consistent estimator
    - Other methods
      * MRI
      * Studies about the properties of people
        + Adjustments to McConville et al
        + Airforce
        + Japanese ones
        + Intertial Properties of human trunk of males determined from MRI
    - Would be great if we could incorporate all of these studies.
  + OUR CONTRIBUTIONS
    - Drawbacks of other methods
      * Venture requires expensive force plates and tracking cameras to get high enough fidelity to get dynamic force measurements
      * Gonzalez only predicts center of mass which is not sufficient for teleoperation
      * Gonzalez may be sensitive to noise/require preprocessing…
      * Existing approaches do not leverage wealth of knowledge available in the literature
    - Our contributions
* EXPERIMENTAL SETUP AND DYNAMICS MODEL
  + DYNAMICS MODELLING
  + MOTIVATION FOR PROBABILISTIC FORMULATION
* ALGORITHM
  + BRIEF REVIEW OF BAYESIAN STATISTICS
  + MCMC
  + Particle filter for online estimation
* EXPERIMENTS AND RESULTS
  + EXPERIMENTAL SETUP
    - Tables for parameter distributions used
  + RESULTS
    - Compare to Gonzalez method
    - Compare masses and Center of masses to literature
  + SIMULATED ROBOT BALANCING?
* DISCUSSION
  + Could also use optimization techniques such as Bayesian optimization
* Other things I may need to do to make it sufficient
  + Simulation of robot
  + Add coloring to joints to make online exploration
  + Particle filter
  + More human subjects