Personalized Instruction of Physical Skills with a Social Robot

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- 3rd year PhD Candidate
- Social Robotics Lab, Yale University
- Interested in building robots that can coach physical tasks
- Started project a couple of months ago
- Canadian!

A Novice Tennis Serve

An Expert Tennis Serve

An Expert Tennis Serve – Slow Motion

Socially Assistive Robots for Coaching Physical Tasks

How do we deliver advice to effectively induce a transformation from incorrect human movements into correct human movements?

- Help children to become more physically proficient
- Children that are more physically proficient are more likely to be more physically active [1] [2]

- Assist rehabilitation patients to perform complex motor tasks

[1] Wrotniak, Brian H., et al. "The relationship between motor proficiency and physical activity in children." Pediatrics 118.6 (2006): e1758-e1765.
[2] Barnett, Lisa M., et al. "Childhood motor skill proficiency as a predictor of adolescent physical activity." Journal of Adolescent Health 44.3 (2009): 252-259.

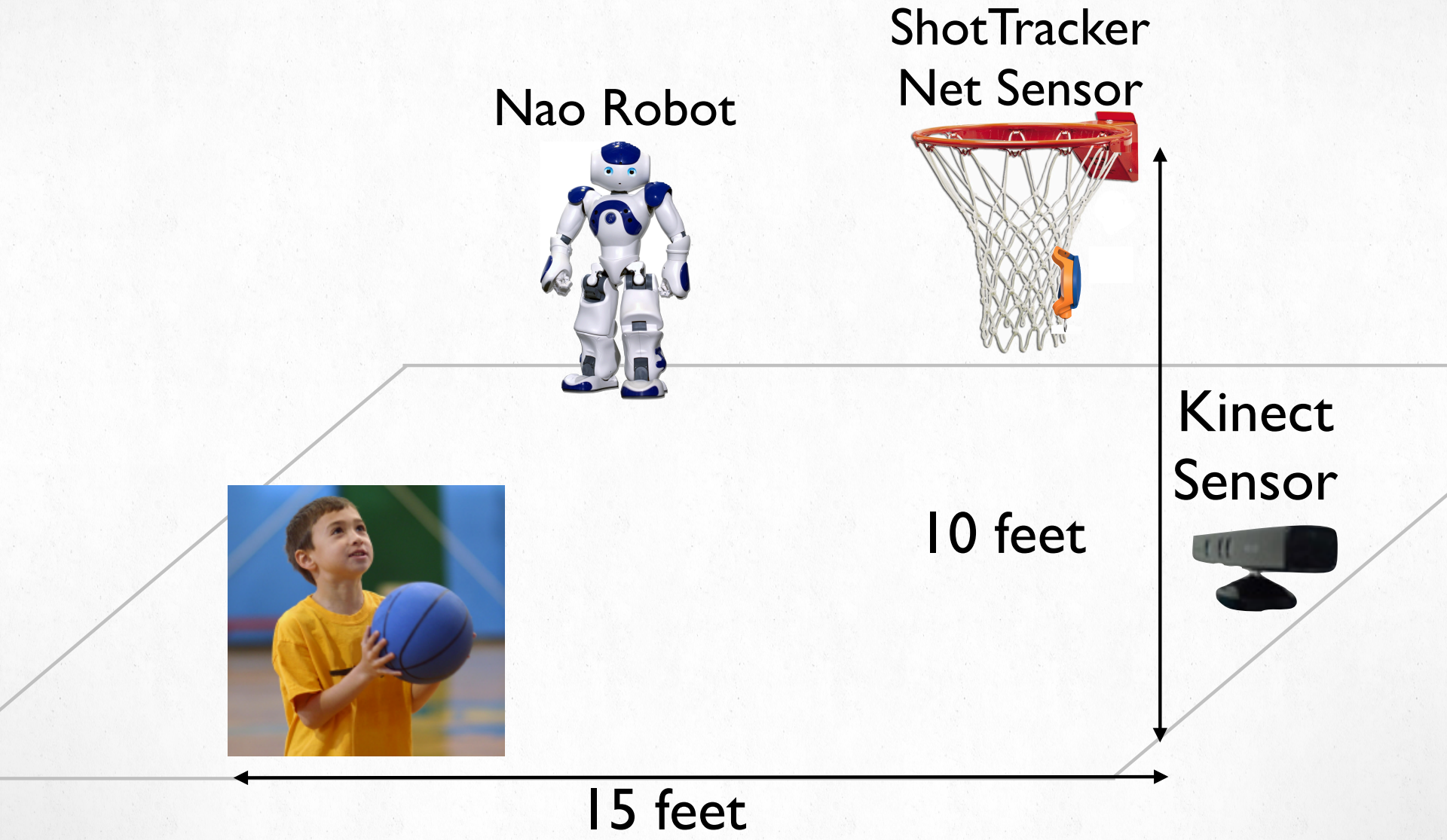
Robotic Orthoses

Socially Assistive Robots

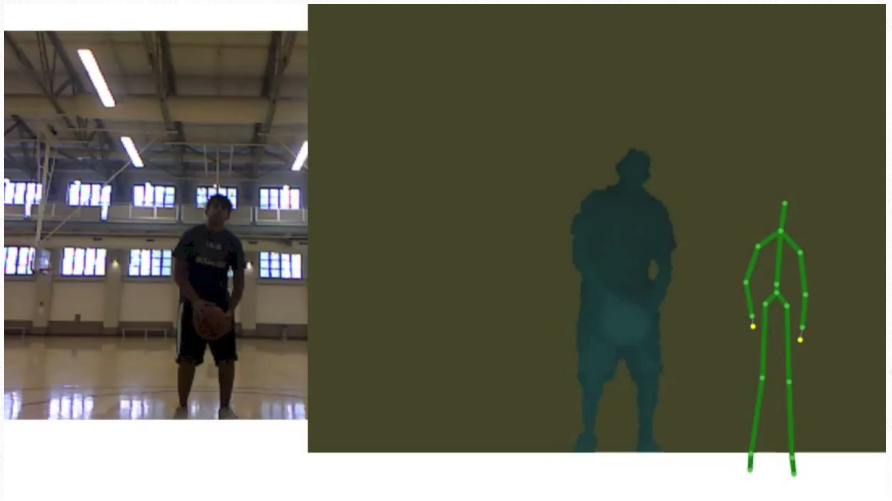
Application Domain : Teaching Children to Shoot a Basketball

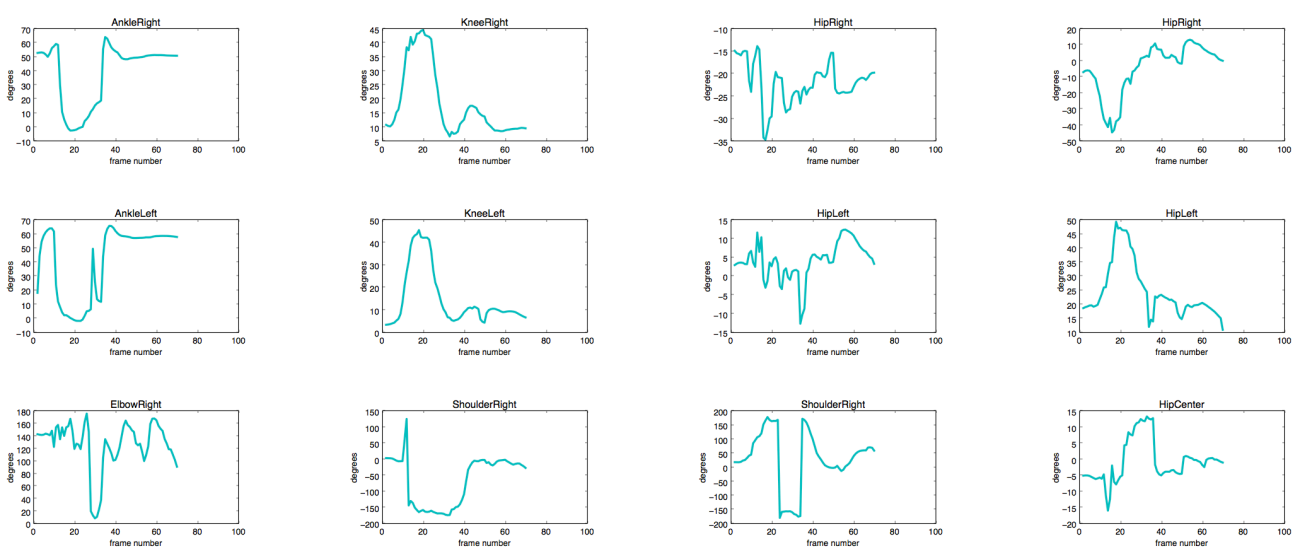
- **Reliable supervisory signal**
  - Clear score/no score
- **Simplified perception**
  - Free throw from same spot – perception system stationary
- **Automated Coachability**
  - Repetitive motion enables system to learn and give recommendations
  - Ball in hand – do not need to change motion based on a pitch, i.e. baseball

Experimental Setup

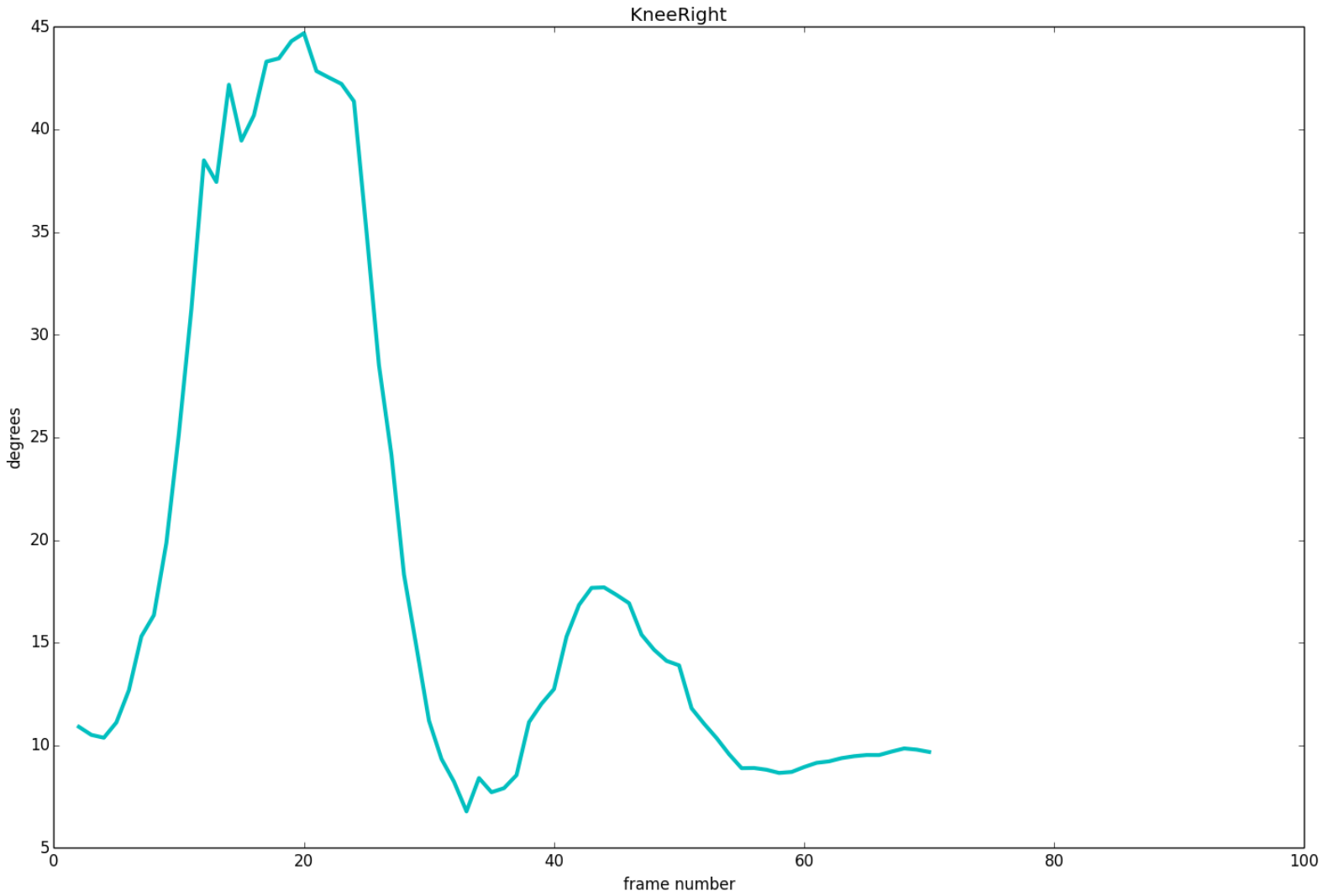


Perception of Joint Angle Time Series Using Kinect

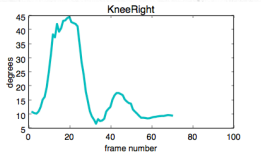


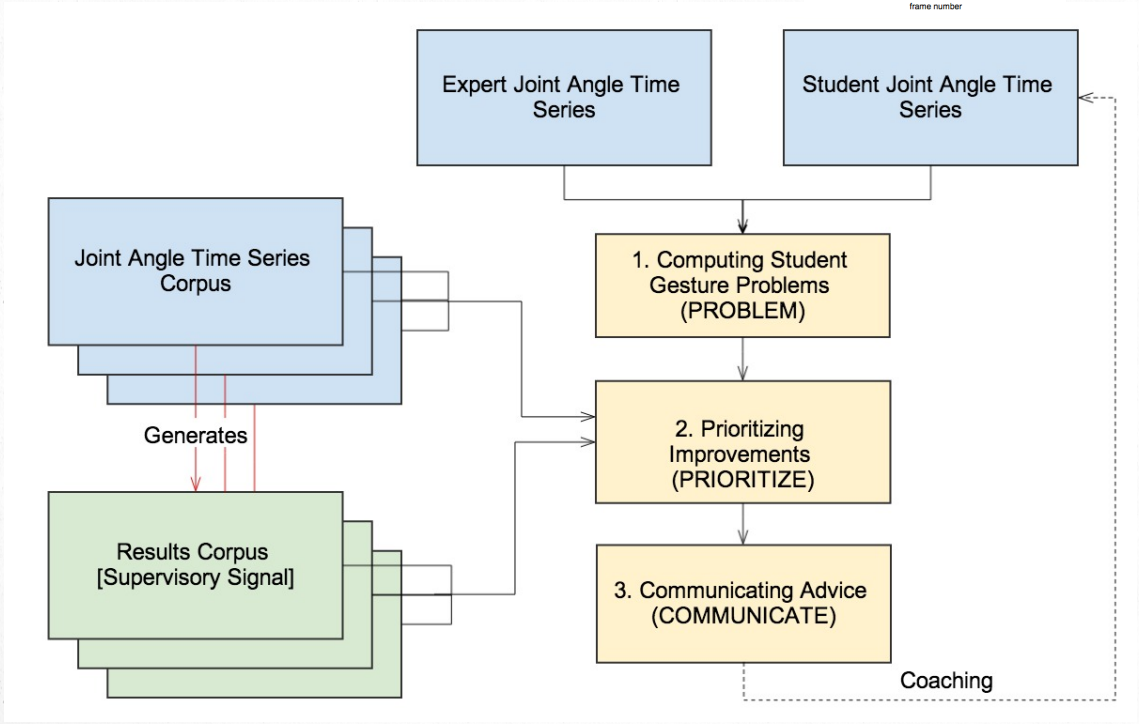


Right Knee Time Series



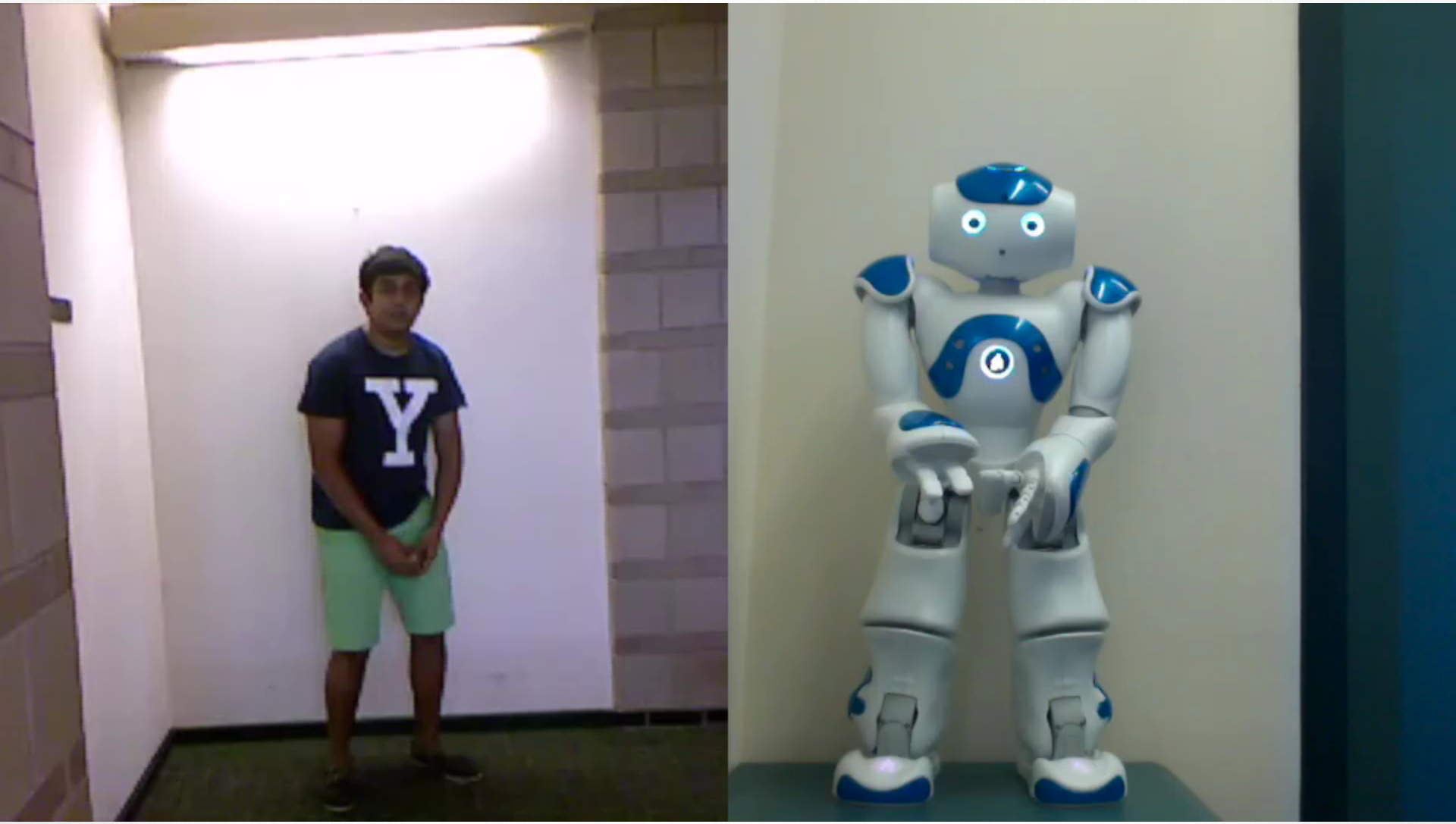
A First Pass Approach For Physical Skills with Supervisory Signals





- **Converge your shot to a reference trajectory**
- **Understand the participant and be useful, as quickly as possible**

Communicating Advice – Demonstrations



Summary

- **How do we deliver advice to effectively induce a transformation from incorrect human movements into correct human movements?**
  - Help children to become more active
  - Help rehabilitate recovering stroke and spinal cord injury patients

- **Started creating a system to coach supervised motions such as basketball**
  - Created a PROBLEM module
  - Collected data for and investigating machine learning approaches for PRIORITIZE
  - In advanced stages of creating demonstration COMMUNICATION module

Thank You