

DeepRob

Discussion 9
Prelude to Object Tracking
University of Michigan and University of Minnesota



Next Time: Object Tracking

- Seminar 5: Recurrent Networks and Object Tracking

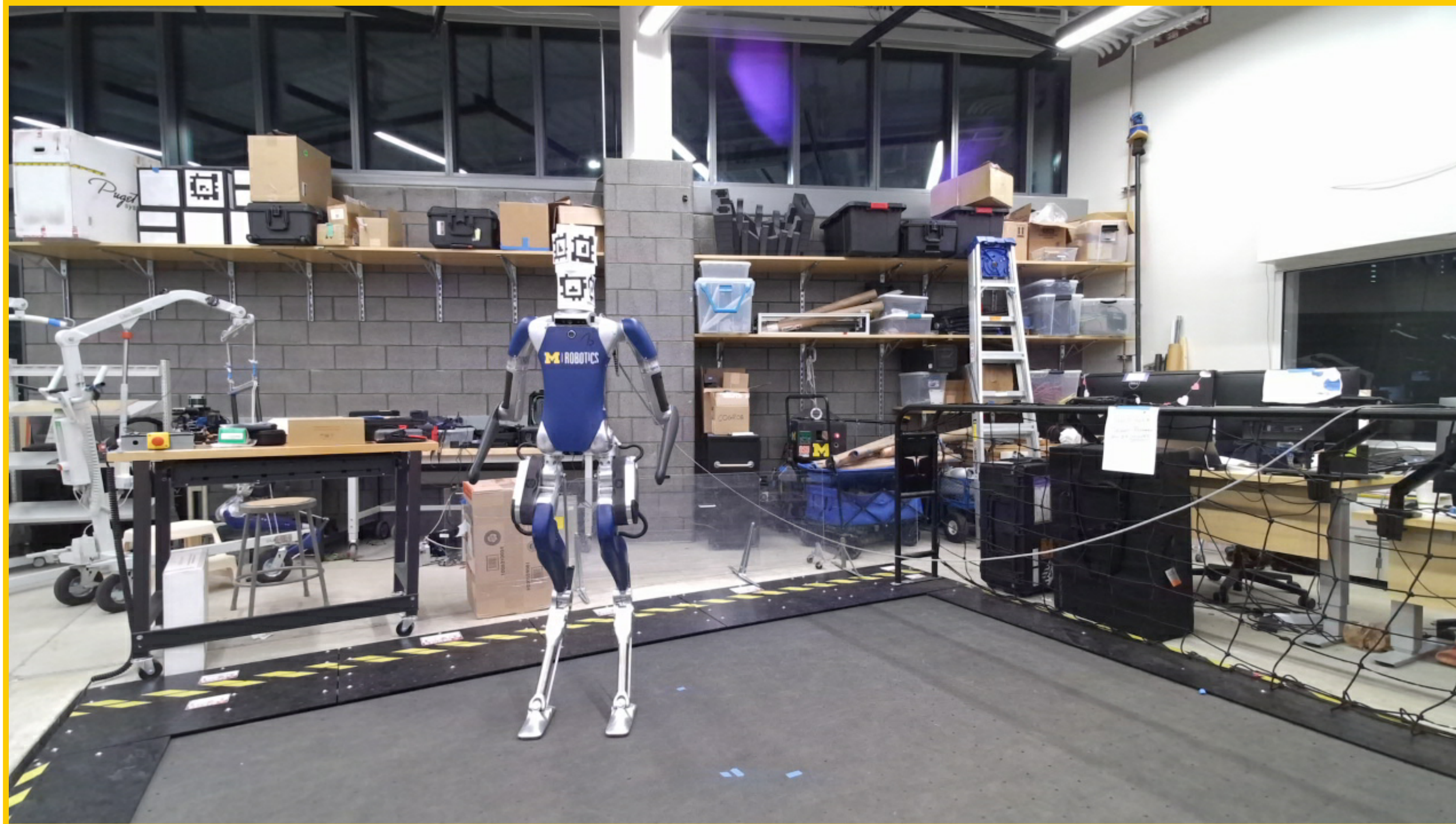
1. [DeepIM: Deep Iterative Matching for 6D Pose Estimation](#), Li et al., 2018
2. [PoseRBPF: A Rao-Blackwellized Particle Filter for 6D Object Pose Tracking](#), Deng et al., 2019
3. [6-PACK: Category-level 6D Pose Tracker with Anchor-Based Keypoints](#), Wang et al., 2020
4. [XMem: Long-Term Video Object Segmentation with an Atkinson-Shiffrin Memory Model](#), Cheng and Schwing, 2022

- Seminar 6: Visual Odometry and Localization

1. [Backprop KF: Learning Discriminative Deterministic State Estimators](#), Haarnoja et al., 2016
2. [Differentiable Particle Filters: End-to-End Learning with Algorithmic Priors](#), Jonschkowski et al., 2018
3. [Multimodal Sensor Fusion with Differentiable Filters](#), Lee et al., 2020
4. [Differentiable SLAM-net: Learning Particle SLAM for Visual Navigation](#), Karkus et al., 2021



Last Time: Rigid Body Objects



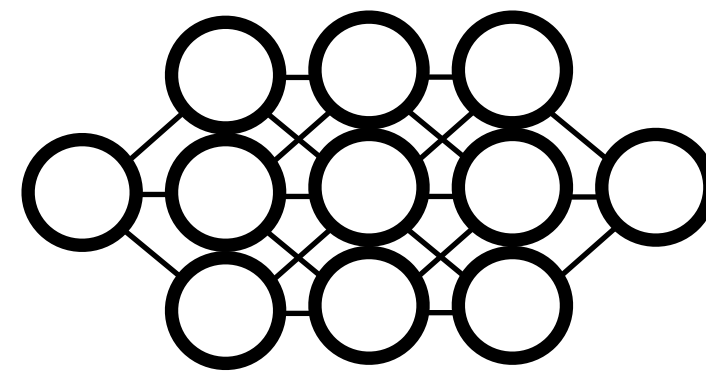
Data courtesy of [Anthony Opipari](#), [Liz Olson](#), [Grant Gibson](#), and [Arden Knoll](#)

Last Time: Rigid Body Objects

Image



Deep
Network



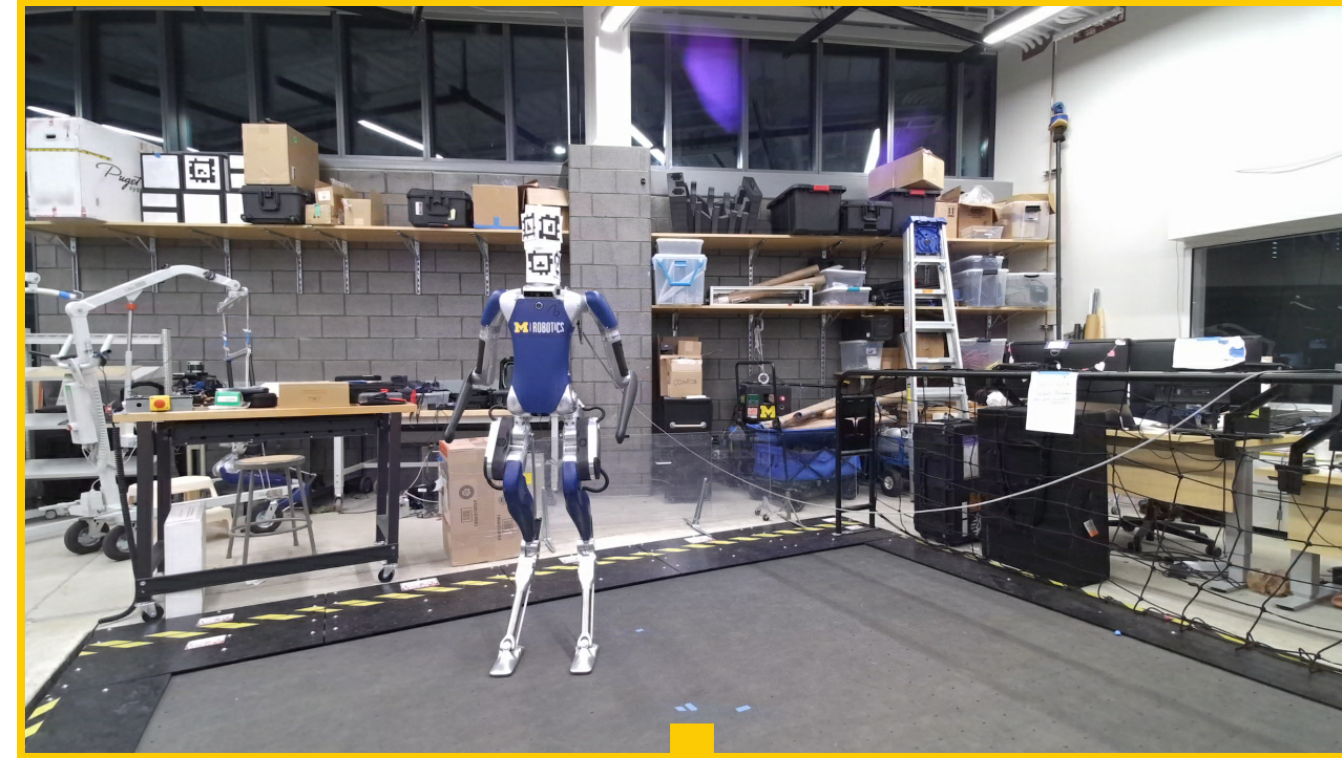
Object
Representation



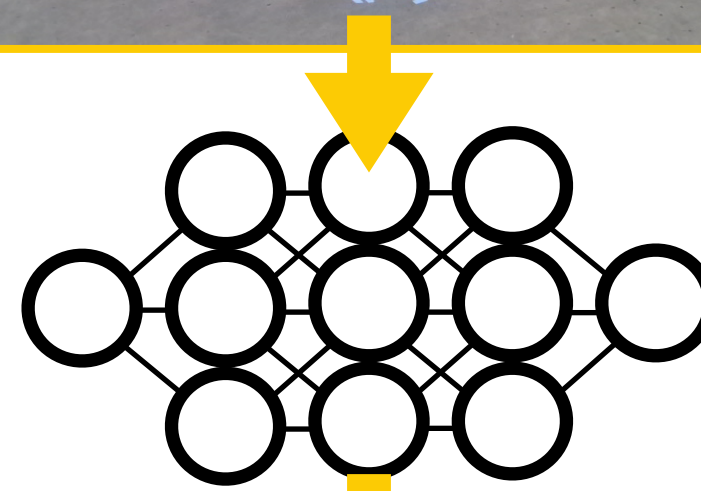
Data courtesy of [Anthony Opipari](#), [Liz Olson](#), [Grant Gibson](#), and [Arden Knoll](#)

Extending Deep Learning to Sequences

Image



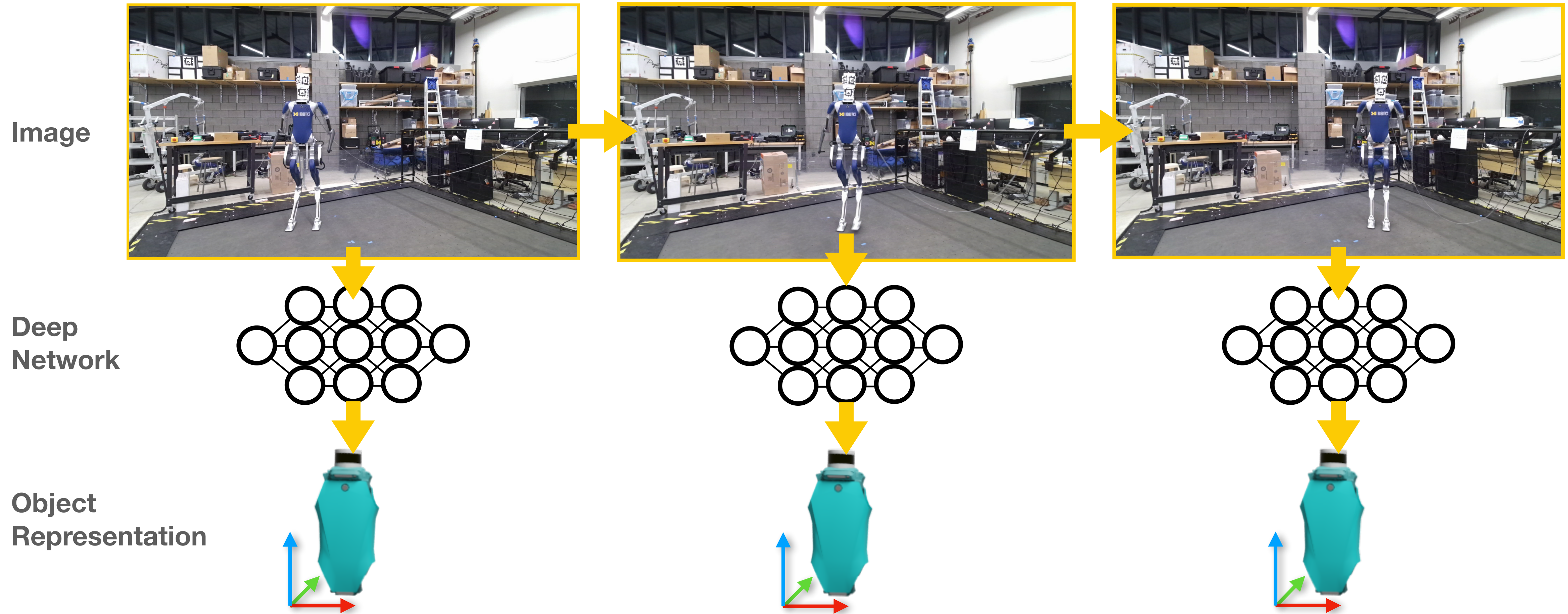
Deep
Network



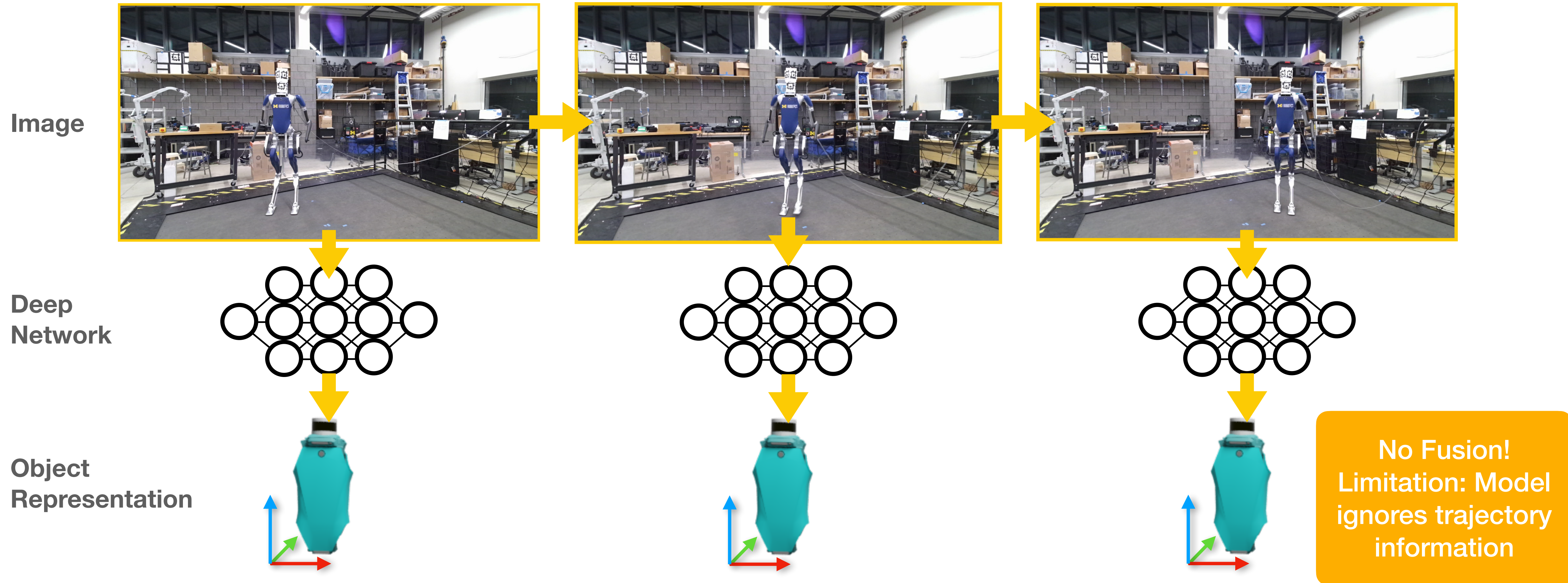
Object
Representation



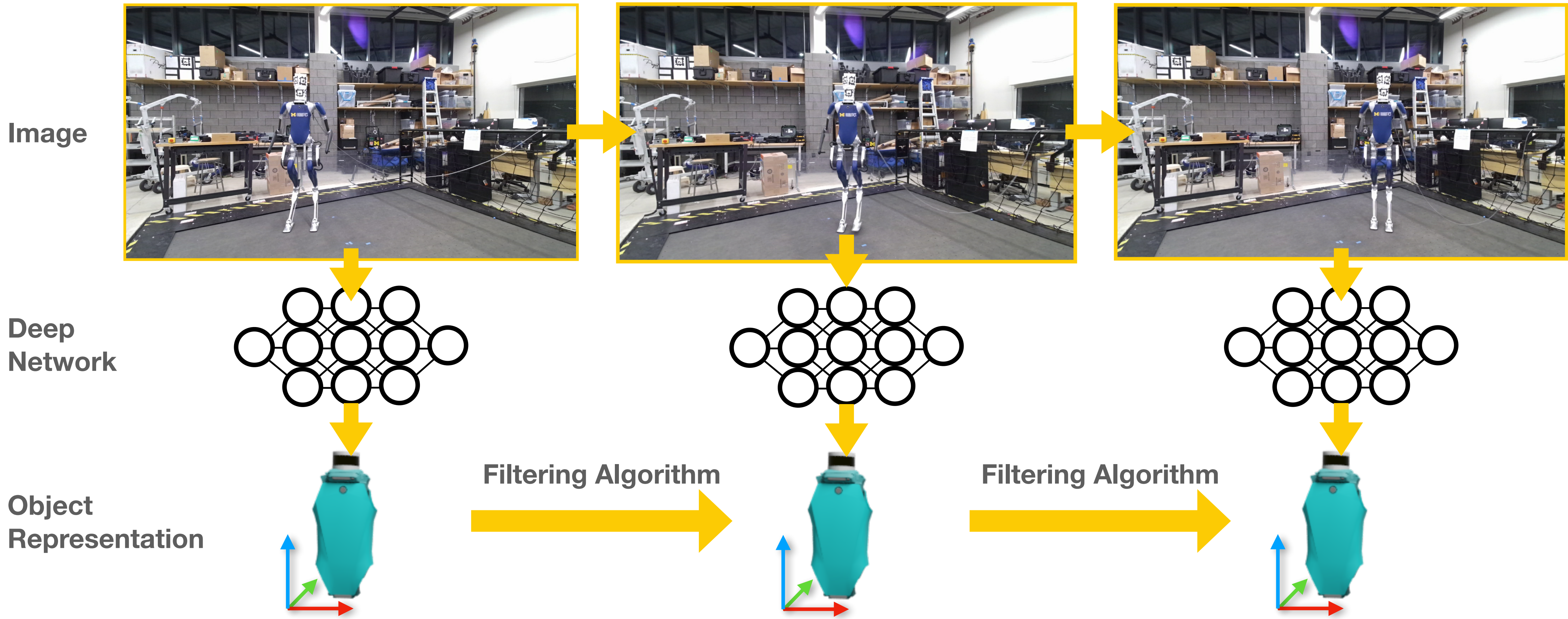
Extending Deep Learning to Sequences



Idea #1: Frame-by-Frame Estimation

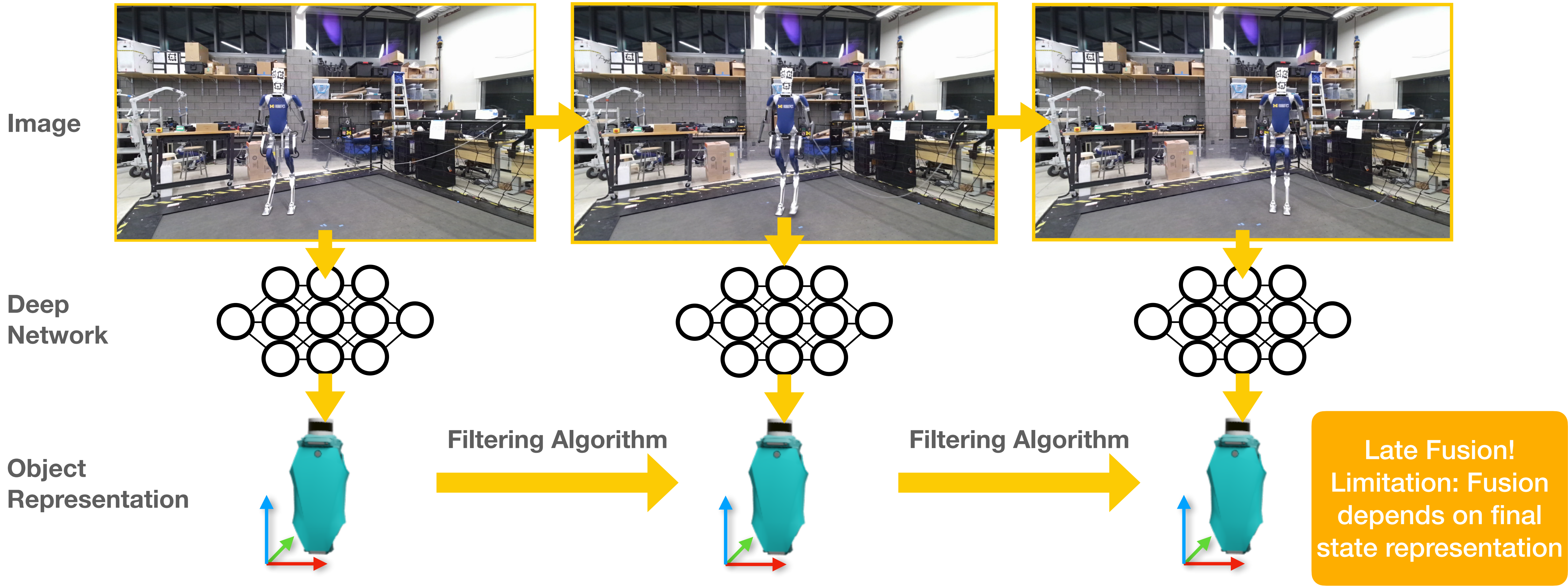


Idea #2: Filter Network Outputs



Data courtesy of [Anthony Opipari](#), [Liz Olson](#), [Grant Gibson](#), and [Arden Knoll](#)

Idea #2: Filter Network Outputs

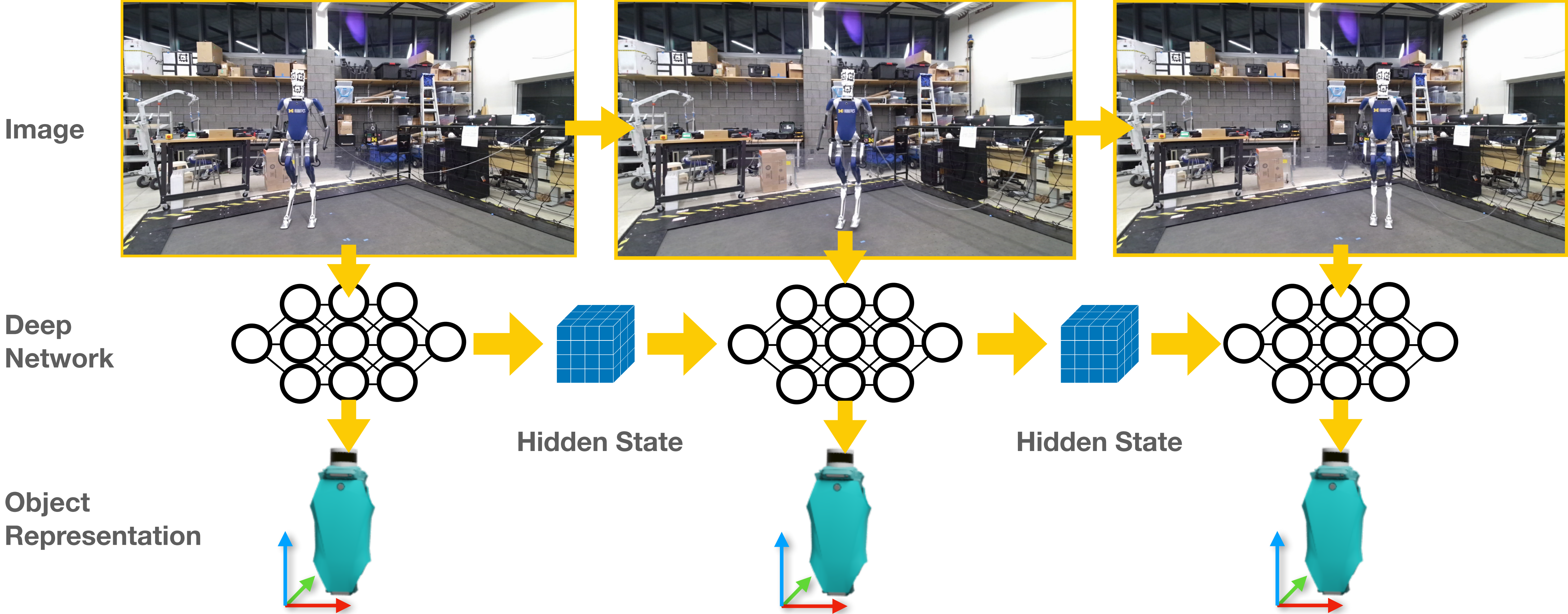


Late Fusion!
Limitation: Fusion depends on final state representation



Data courtesy of [Anthony Opipari](#), [Liz Olson](#), [Grant Gibson](#), and [Arden Knoll](#)

Idea #3: Recurrent Networks



Data courtesy of [Anthony Opipari](#), [Liz Olson](#), [Grant Gibson](#), and [Arden Knoll](#)

Object Tracking: Roles for Recurrent Networks

- 6DoF pose tracking
 - How to track the position and orientation of objects?
- Articulated human and robot pose tracking
 - How to track an object that is deformable or has known structure?
- Recurrent networks for robot odometry
 - How to use recurrent networks to model robot position over time?
- Recurrent networks for SLAM
 - How to localize and map a robot's environment with recurrent networks?



Next Time: Object Tracking

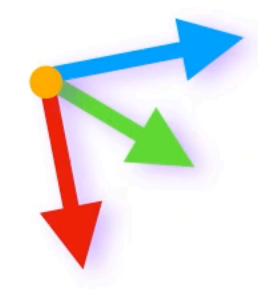
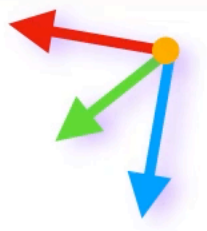
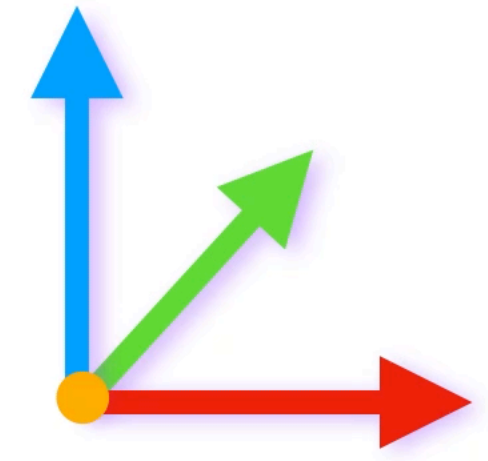
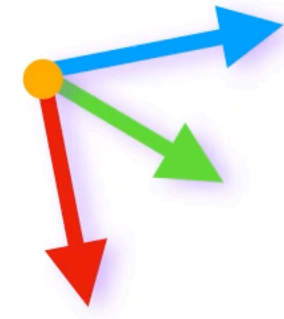
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