Ideomotor Learning for Robotic Manipulation

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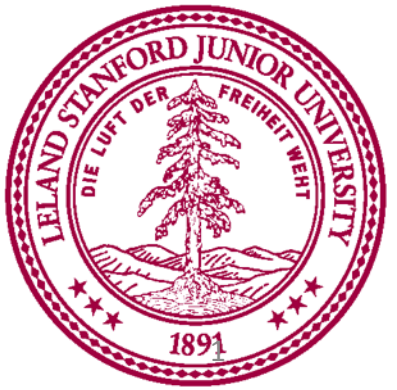
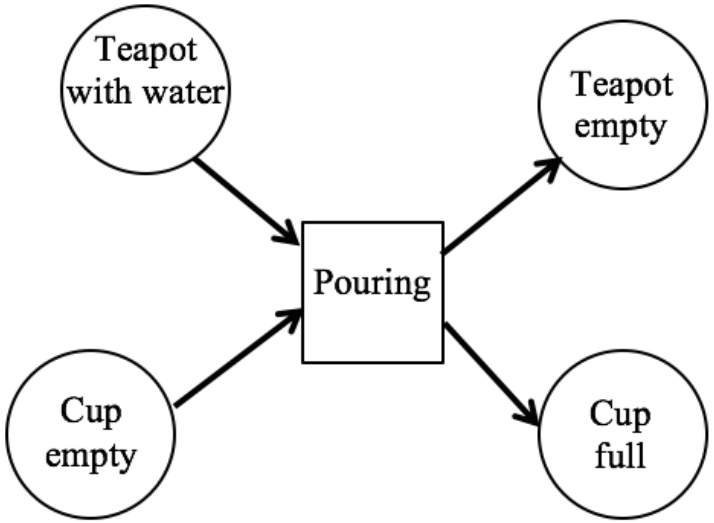
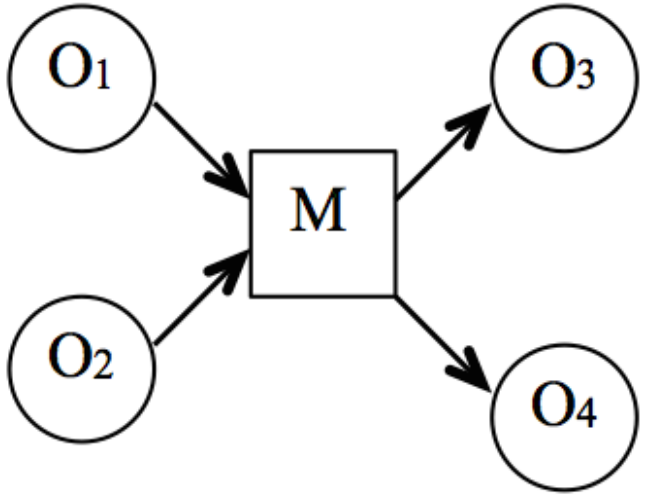
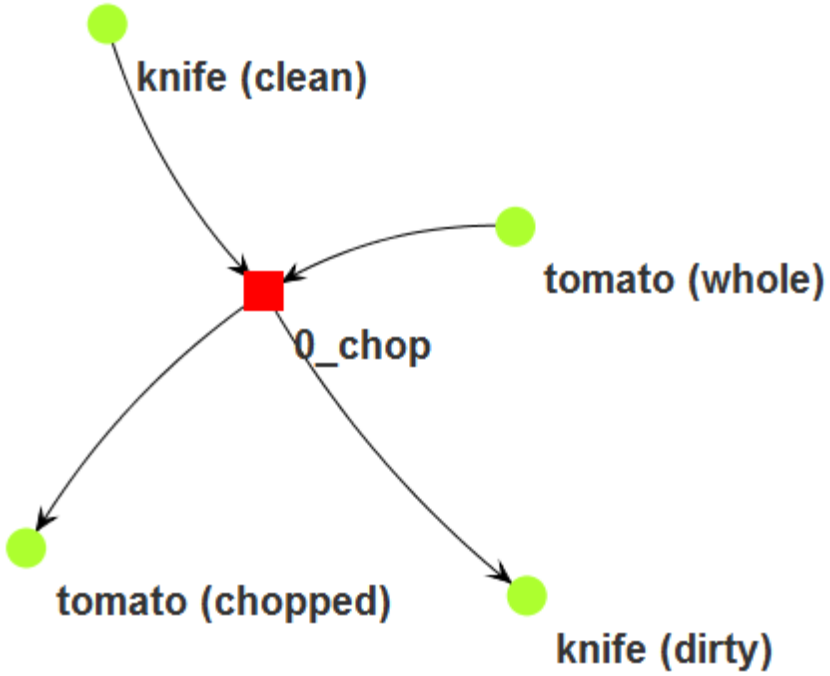


Functional Unit

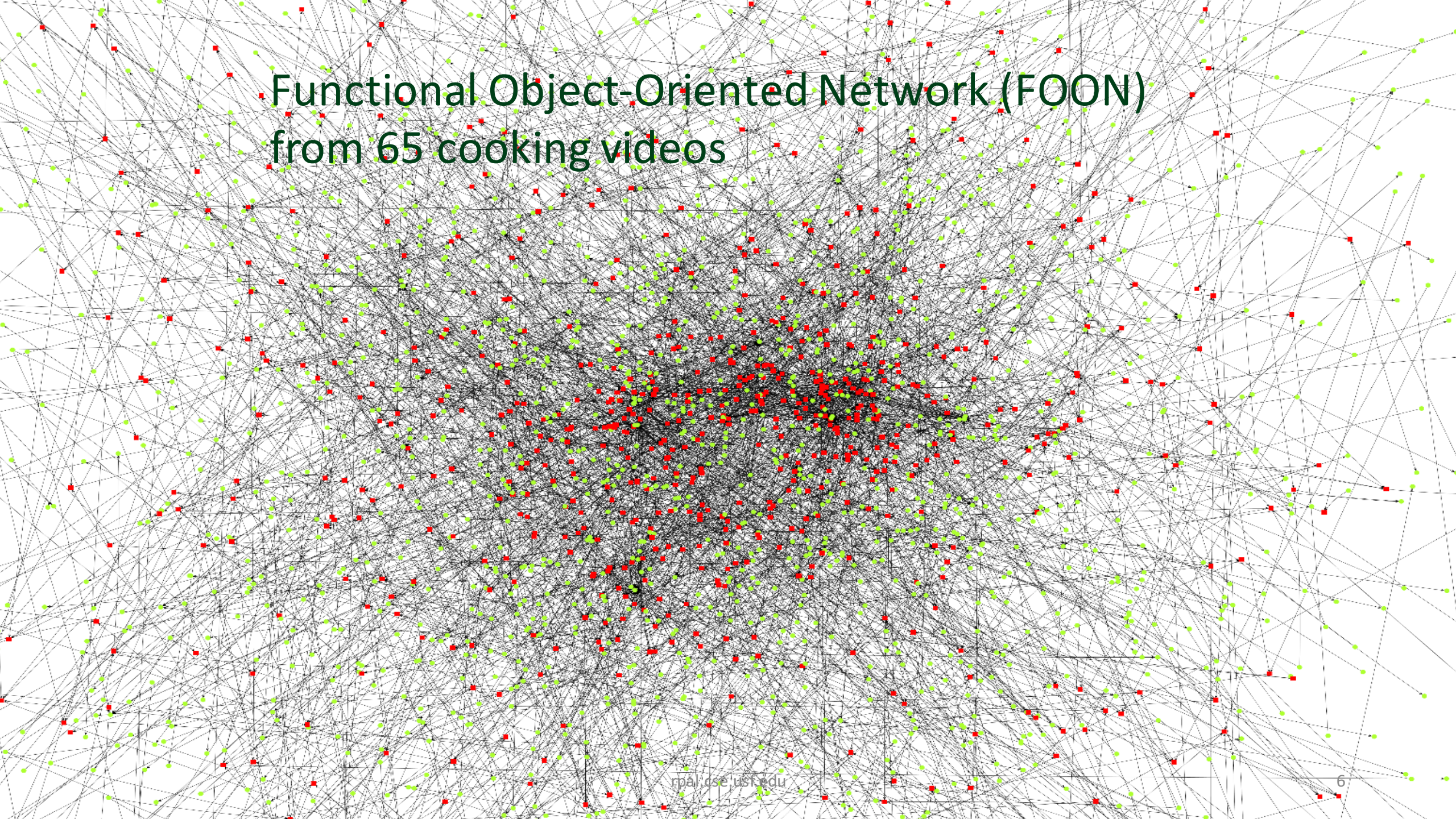




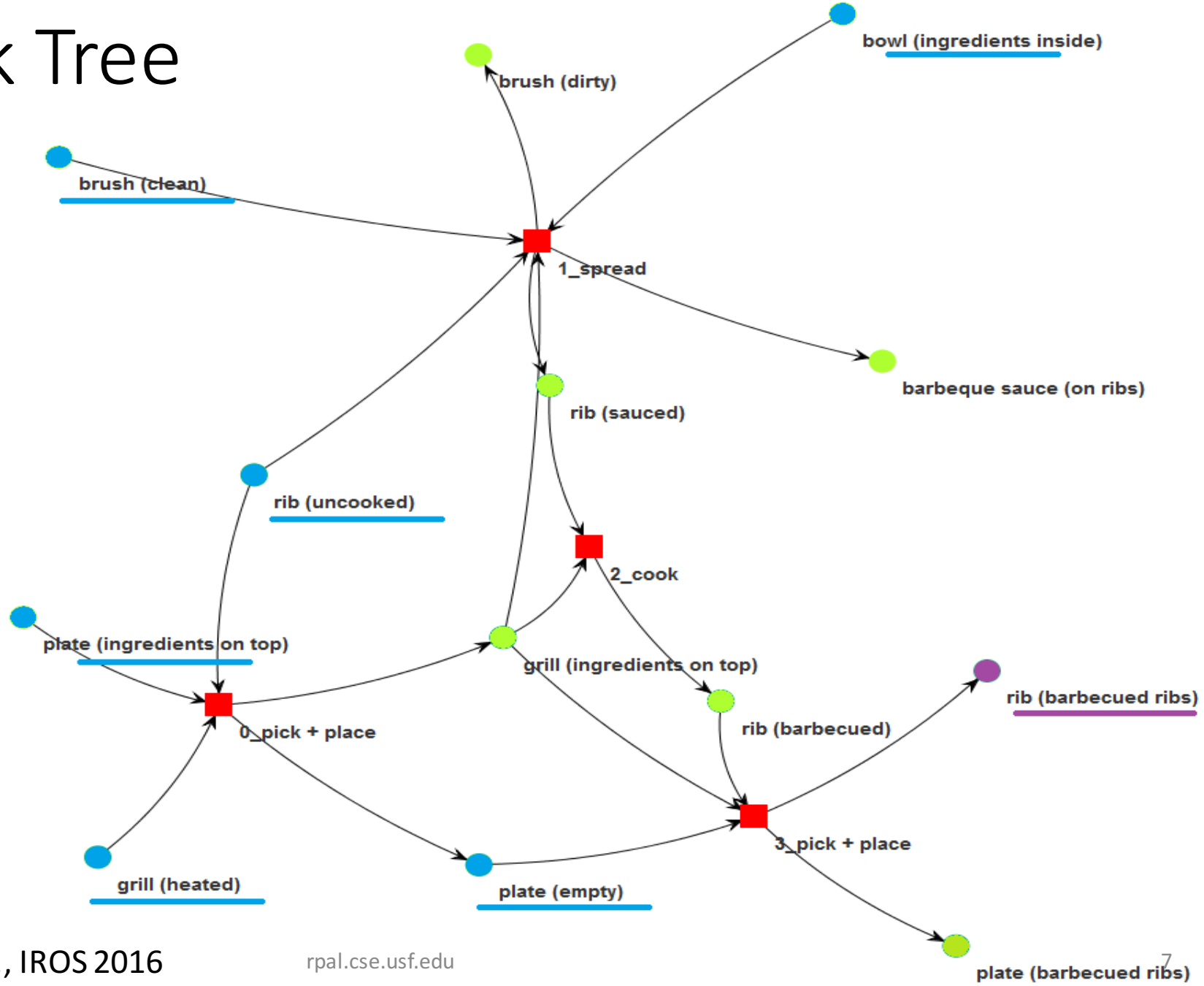


Constructing Sub-Graph, an Example

Functional Object-Oriented Network (FOON) from 65 cooking videos



Retrieving Task Tree



Sun, et al., RAS 2014; Paulius, et al., IROS 2016

Motion Trajectory Generating

$M_{robot}(t) = a_0 + a_1 f_1(t) + a_2 f_2(t)$

$$\min_{a \in R^3} \{\alpha \text{dist}[(M_{robot}(a, t), M_{demo}(t)] + \sum_{i=1}^{m} (\text{dist}[M_{robot}(a, t), C_i]) \}$$

Subject to

$$M_{robot}(t) \in [p_{\min}, p_{\max}],$$
$$\dot{M}_{robot}(t) \in [v_{\min}, v_{\max}],$$
$$\ddot{M}_{robot}(t) \in [a_{\min}, a_{\max}]$$

Demonstrated motion trajectories

Constraints: new environment, new start, new goal

Generating Manipulation Trajectory Using Motion Harmonics

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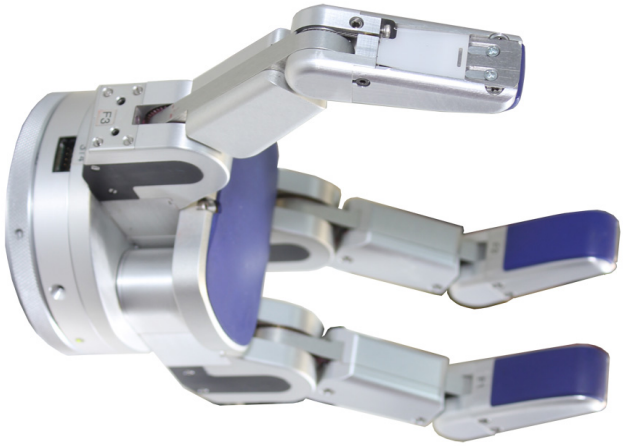
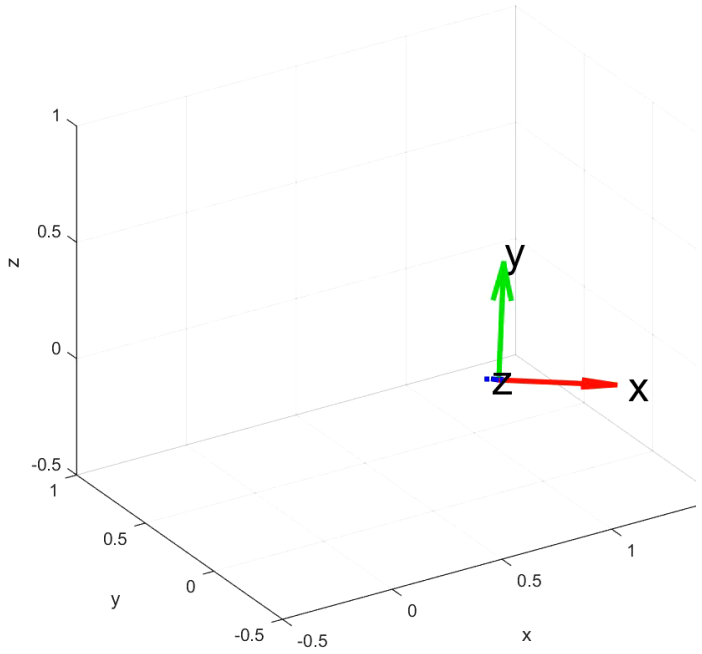
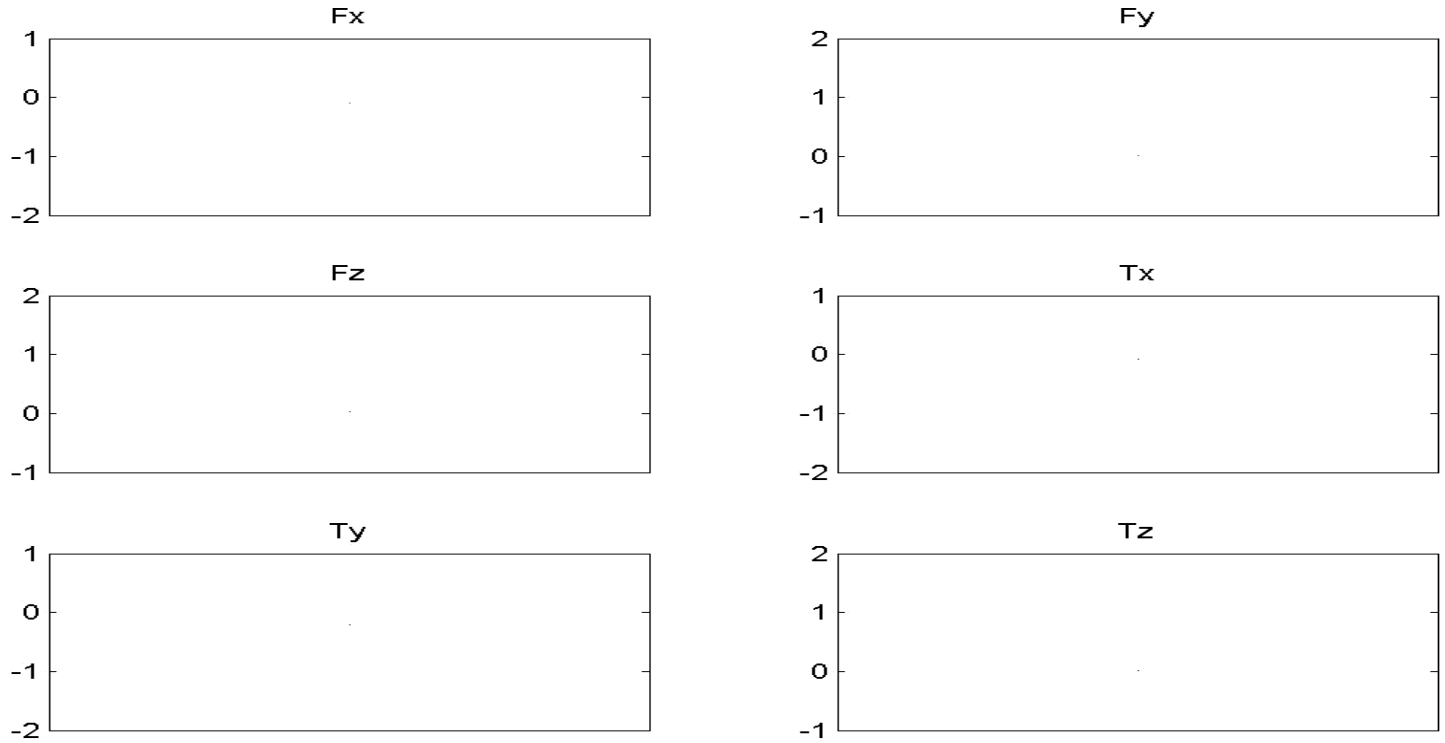
Grasp to Facilitate Manipulation

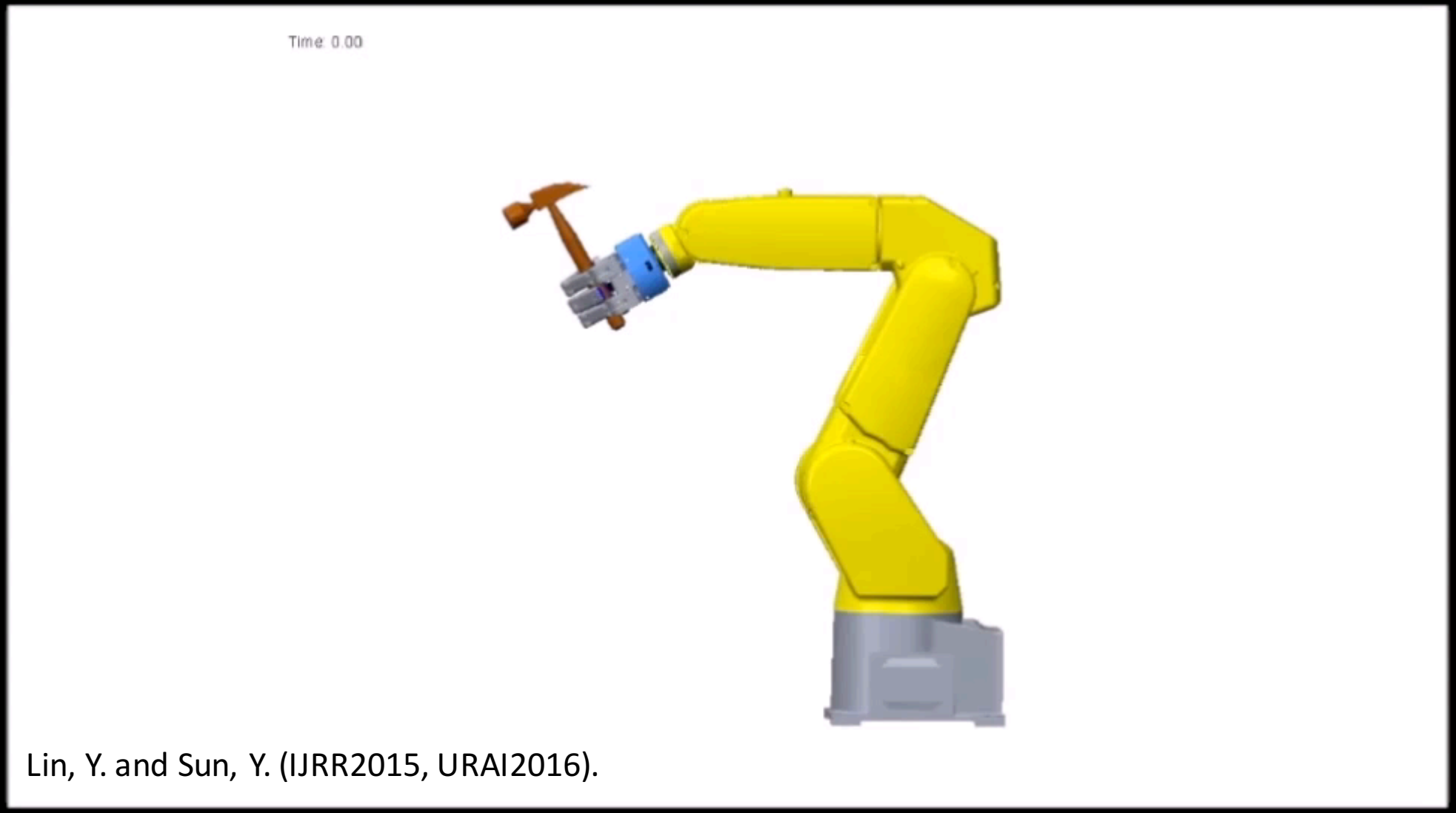




Motion

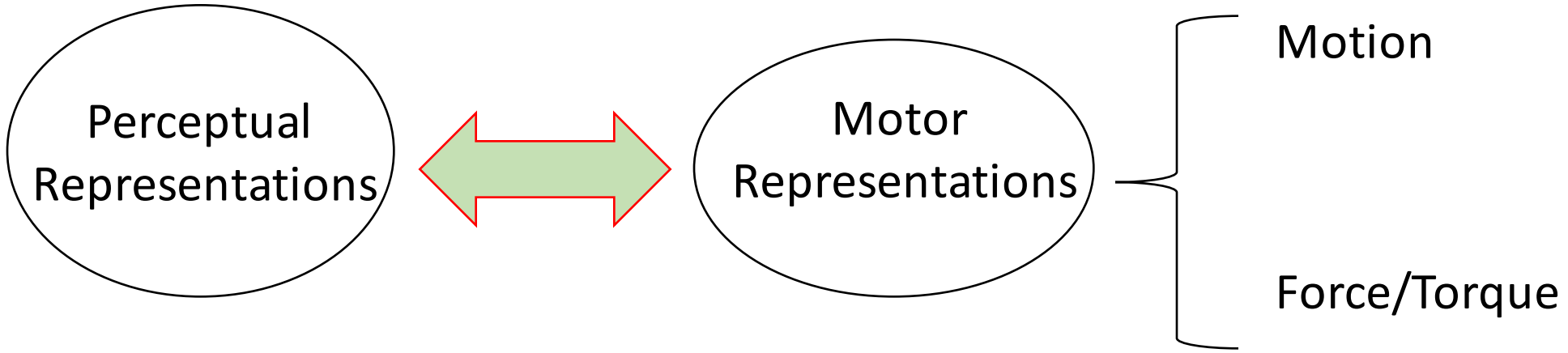


Force/Torque



Lin, Y. and Sun, Y. (IJRR2015, URAI2016).

Summary


Perceptual Representations
Motor Representations
Motion
Force/Torque

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Thank You!

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