

Benchmarks for garment manipulation

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Research questions

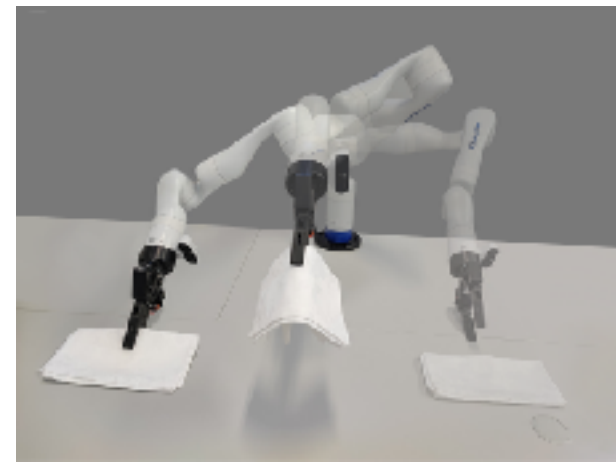
- How can **benchmark** standards be established to consistently **assess** and compare the **performance of robotic cloth manipulation tasks**?
- How to **represent cloth manipulation tasks** and model the state of cloth objects to enable decision making?

Household cloth manipulation tasks [1,3]

Development of household tasks and baselines.



Spreading a tablecloth



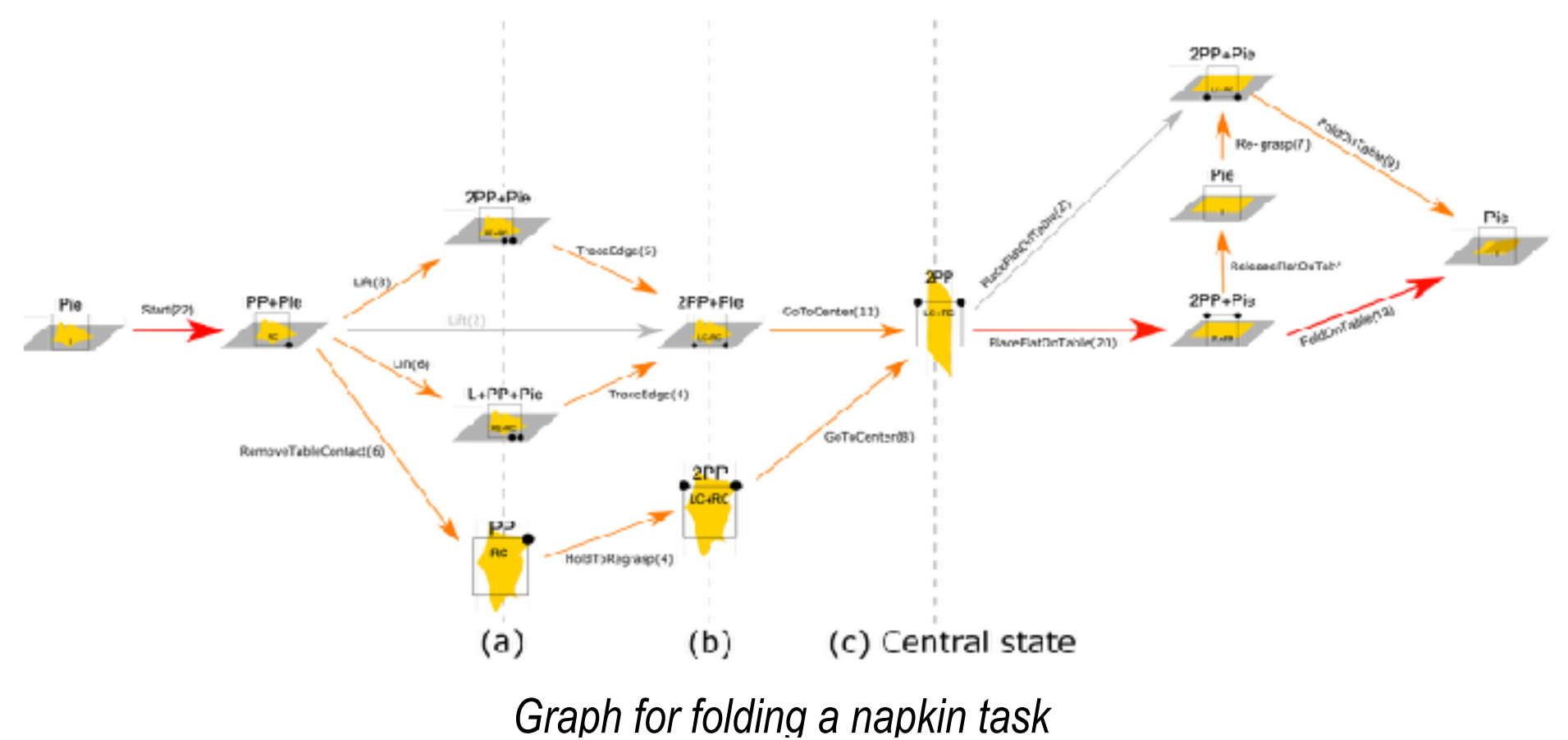
Pick, place and piling



Placing flat garments

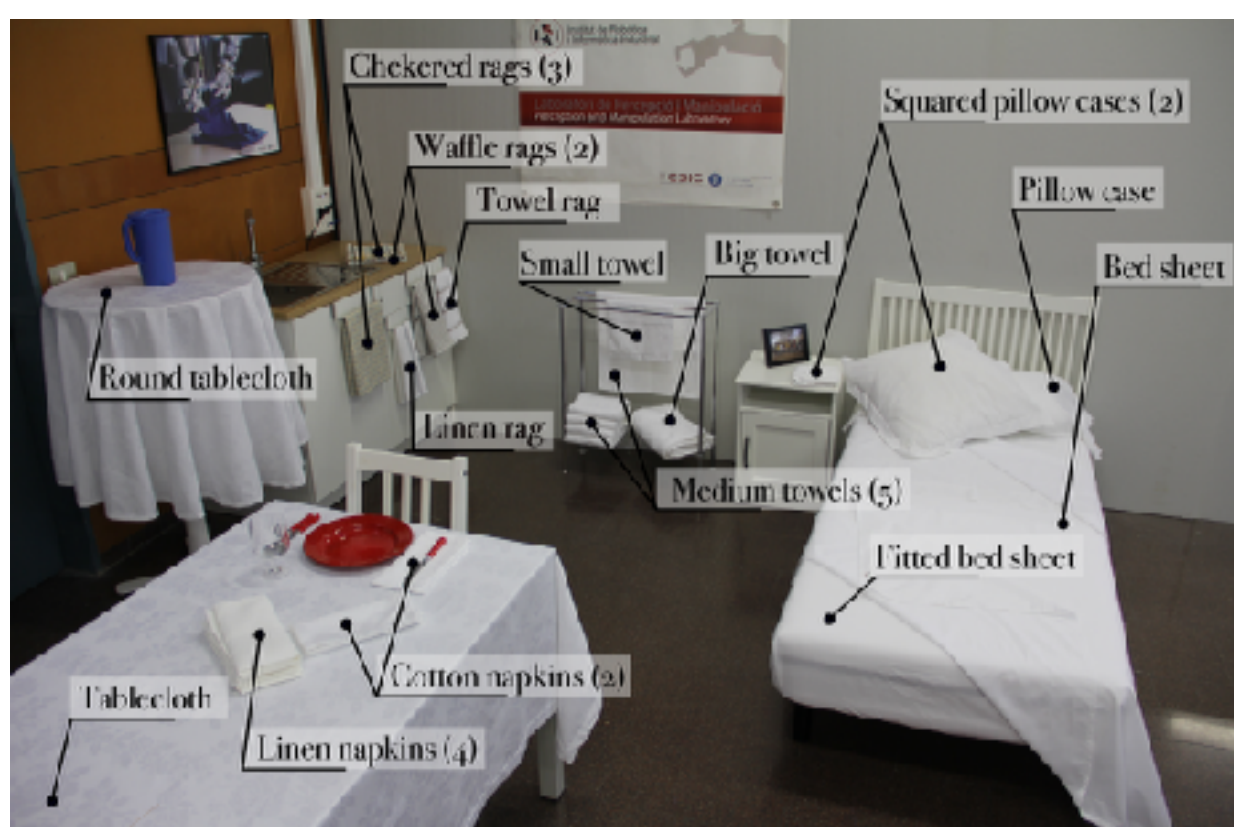
Understanding cloth manipulation [5]

Represent cloth manipulation tasks.



Standardizing textile objects [2, 6]

Standardization of objects for benchmarking.



Organization of a **competition in cloth perception and manipulation** to increase use of object set and benchmarks [4]

Characterization based on properties.

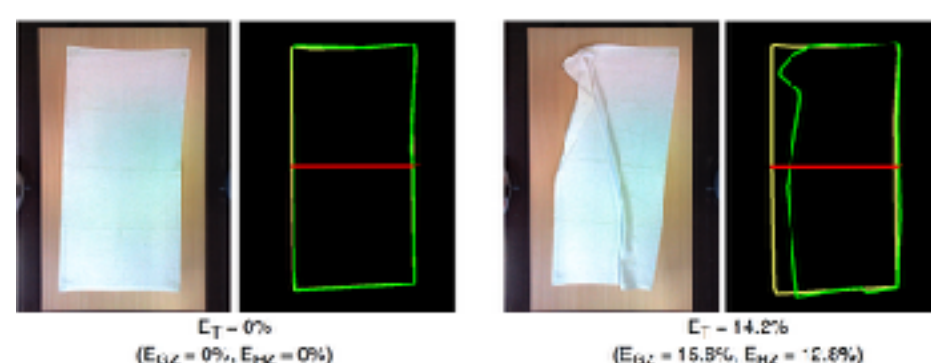


Influence of textile properties in manipulation.

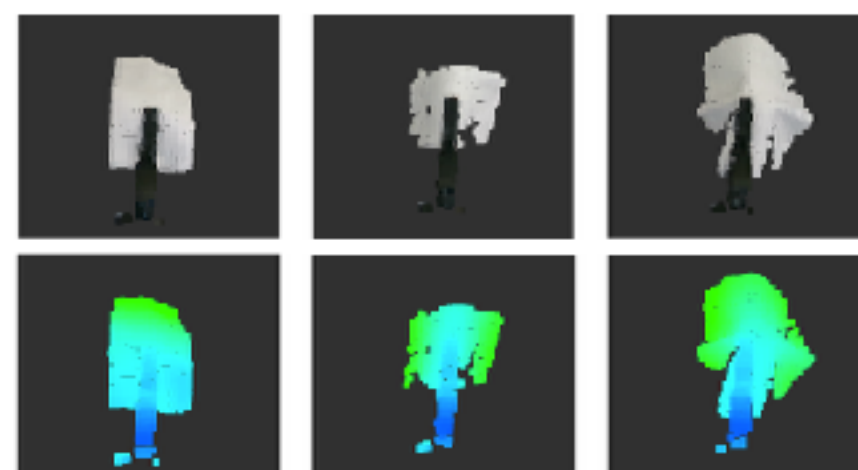


Evaluation metrics [1, 3]

Tools for **automatic evaluation** and **state estimation**.



Area computation



Cloth deformation

Benchmarks for task performance evaluation.

$$E_{\alpha} = \frac{\arctan(\frac{h_5 - h_1}{l_t})}{\pi/4}$$

$$E_t = \frac{|h_5 - h_4|}{c_t - l_t}$$

$$E_w = \frac{|h_2 - h_5|}{c_w - l_w}$$

Task-oriented quality metrics



Start date: 15/10/2019
Thesis Project defense: 22/07/2020



Research collaborations



Funding
BURG: Project PCI2019-103447 funded by MCIN/AEI / 10.13039/501100011033 and by the "European Union"
COHERENT: Project PCI2020-120718-2 funded by MCIN/AEI / 10.13039/501100011033 and cofunded by the "European Union NextGenerationEU/PRTR"



References

- [1] I. Garcia-Camacho *et al.*, "Benchmarking Bimanual Cloth Manipulation", IEEE RA-L, 2020.
- [2] I. Garcia-Camacho *et al.*, "Household Cloth Object Set: Fostering Benchmarking in Deformable Object Manipulation", IEEE RA-L, 2022.
- [3] I. Garcia-Camacho *et al.*, "Benchmarking cloth manipulation using action graphs: an example in placing flat", Workshop on Benchmarking of robotic grasping and manipulation: protocols, metrics and data analysis at IROS, 2021
- [4] I. Garcia-Camacho *et al.*, "Cloth Manipulation and Perception Competition", Workshop on Representing and Manipulating Deformable Objects at ICRA, 2022.
- [5] I. Garcia-Camacho *et al.*, "Knowledge Representation to Enable High-level Planning in Cloth Manipulation Tasks", Workshop in Knowledge Engineering for Planning and Scheduling at ICAPS, 2022
- [6] I. Garcia-Camacho *et al.*, "Standardization of Cloth Objects and its Relevance in Robotic Manipulation", IEEE ICRA 2024