Garment Perception and its Folding Using a Dual-arm Robot

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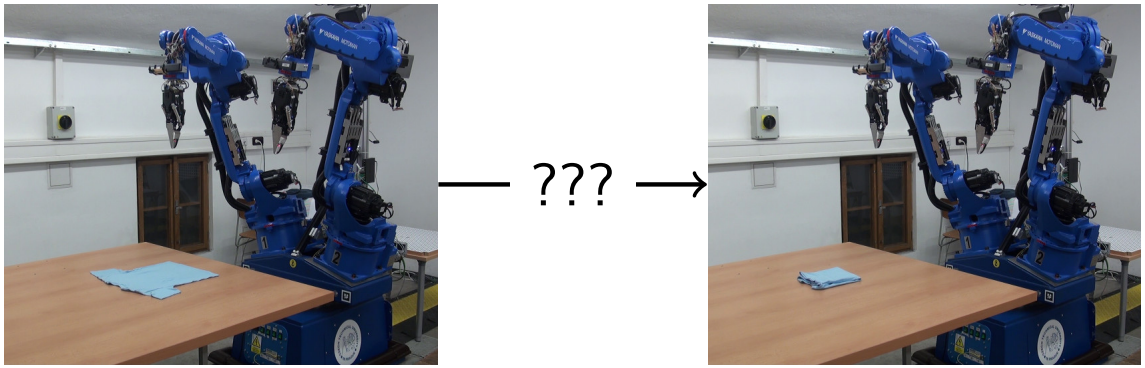
Problem

- There is a **dual-arm robot** and a piece of **spread garment**. How do we **make the garment folded**?



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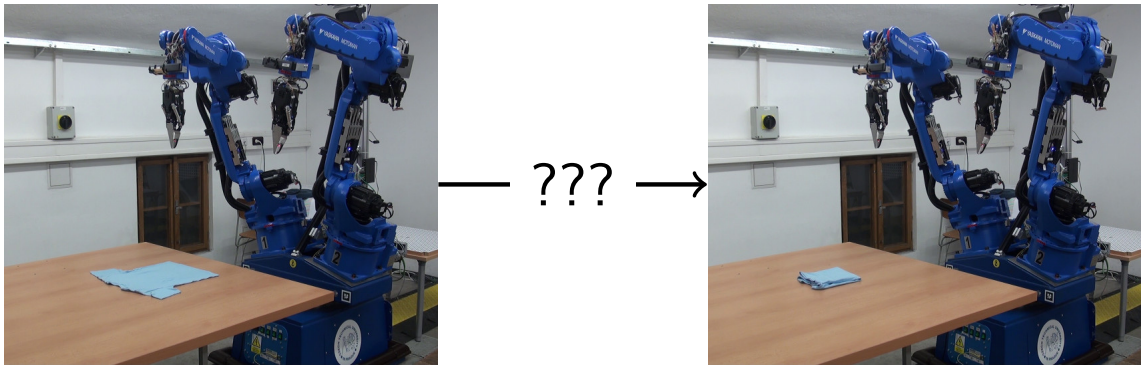
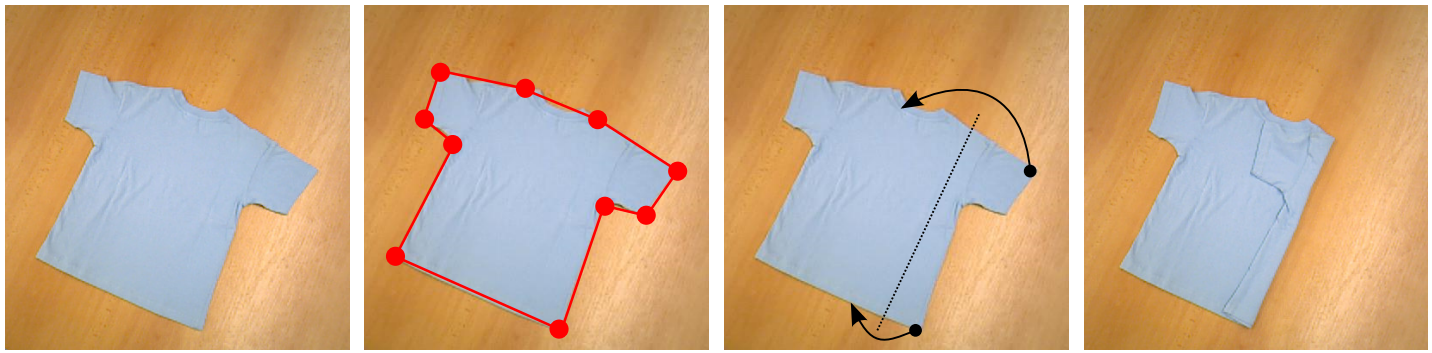


- More precisely: The input is a **single image** of the **garment spread** on a table. We want to **estimate its pose** and **plan a series of folding moves** to be performed by the robot.



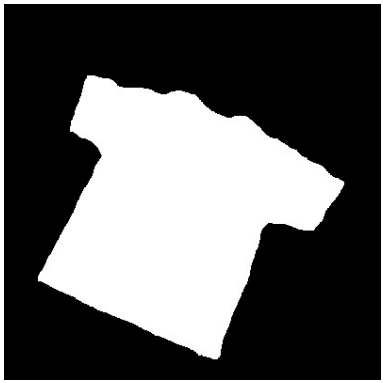
Related work

- J. van den Berg, S. Miller, K. Goldberg, P. Abbeel. **Gravity-Based Robotic Cloth Folding**. WAFR 2010.
- S. Miller, M. Fritz, T. Darrell, P. Abbeel. **Parametrized Shape Models for Clothing**. ICRA 2011.
- S. Miller, J. van den Berg, M. Fritz, T. Darrell, K. Goldberg, P. Abbeel. **A Geometric Approach to Robotic Laundry Folding**. IJRR 2012.

Visual perception

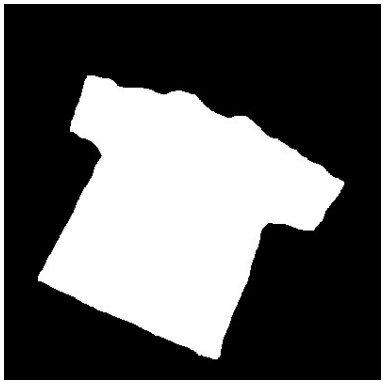
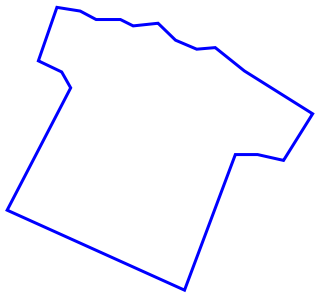
- The input is a **single RGB image** of the garment.

Visual perception



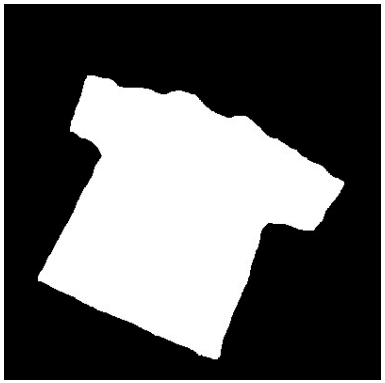
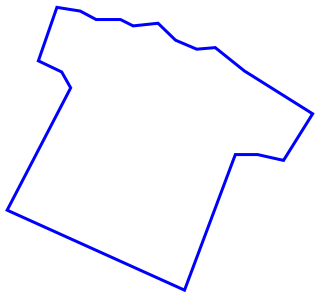
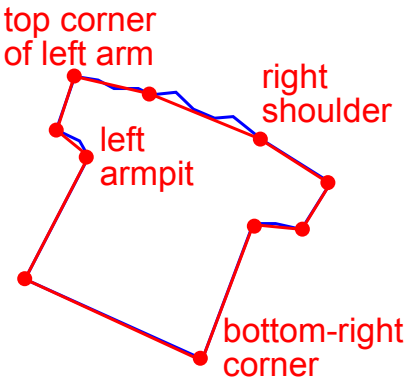
- The input is a **single RGB image** of the garment.
- The image is **segmented** using a modified grabcut algorithm with fully automatic initialization.

Visual perception

- The input is a **single RGB image** of the garment.
- The image is **segmented** using a modified grabcut algorithm with fully automatic initialization.
- The garment **contour is extracted and simplified** using dynamic programming.

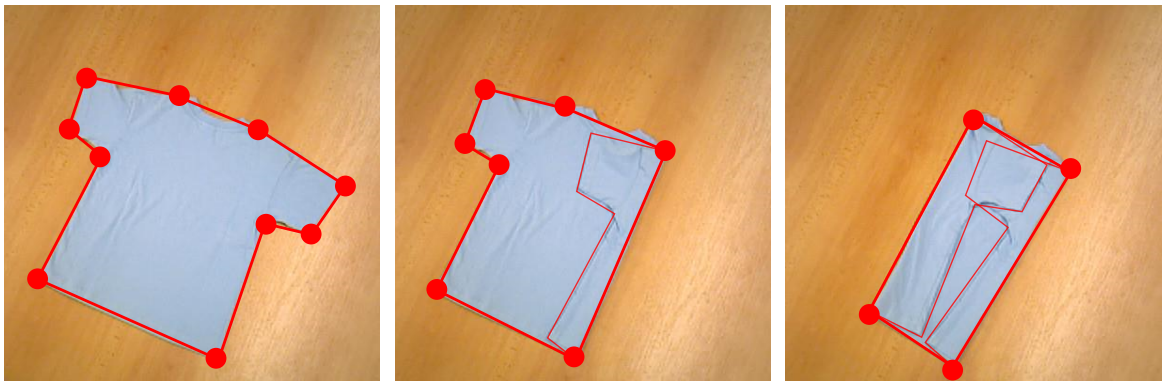
Visual perception

- The input is a **single RGB image** of the garment.
- The image is **segmented** using a modified grabcut algorithm with fully automatic initialization.
- The garment **contour is extracted and simplified** using dynamic programming.
- The contour is **matched to a polygonal model** whose **properties are learned** from training data. The matching algorithm is based on dynamic programming.

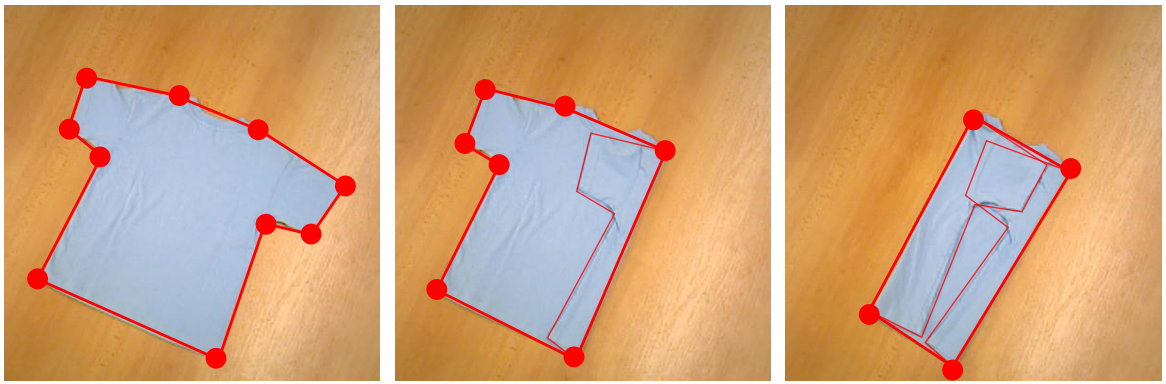
Visual perception

- Pose of the garment is **checked after each single fold** by matching its contour to a **folded polygonal model**.



Visual perception

- Pose of the garment is **checked after each single fold** by matching its contour to a **folded polygonal model**.



- We achieve **state of the art results** in terms of the garment pose estimation **accuracy and time performance**.

Video (sped up 6x)