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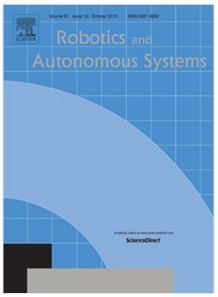

Grasp point localization, classification and state recognition in robotic manipulation of cloth: An overview

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Grasp Point Localization, Classification and State Recognition in Robotic Manipulation of Cloth: an Overview

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Abstract

Cloth manipulation by robots is gaining popularity among researchers because of its relevance, mainly (but not only) in domestic and assistive robotics. The required science and technologies begin to be ripe for the challenges posed by the manipulation of soft materials, and many contributions have appeared in the last years. This survey provides a systematic review of existing techniques for the basic perceptual tasks of grasp point localization, state estimation and classification of cloth items, from the perspective of their manipulation by robots. This choice is grounded on the fact that any manipulative action requires to instruct the robot where to grasp, and most garment handling activities depend on the correct recognition of the type to which the particular cloth item belongs and its state. The high inter- and intraclass variability of garments, the continuous nature of the possible deformations of cloth and the evident difficulties in predicting their localization and extension on the garment piece are challenges that have encouraged the researchers to provide a plethora of methods to confront such problems, with some promising results. The present review constitutes for the first time an effort in furnishing a structured framework of these works, with the aim of helping future contributors to gain both insight and perspective on the subject.

Keywords: deformable object manipulation, robotic vision, clothing, cloth state recognition, garment classification, grasp point localization

1. Introduction

Robots intended to be increasingly versatile should include the capability of manipulating deformable objects. In particular, being able to handle cloth items should become a standard requirement for robots for full deployment in domestic environments, in assistive robotics, in service scenarios like hotels and hospitals, and of course also in industrial laundry or garment manufacturies. However, robotic manipulation of fabrics has to face the intrinsic difficulty of dealing with a highly flexible material, thus with an enormously varying appearance. This means that a specific cloth item –a garment piece, for example– exhibits a practically infinite range of possible shapes, from a canonical extended flat shape up to a completely crumpled state, with intermediate states of varying wrinkledness, as well as a vastity of folded states, not to speak from partial or total reversal (parts of the cloth turned inside out). To this intra-garment variability one has to add the im-