Towards Cloth-Manipulating Characters

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Abstract

Cloth manipulation is a common action in humans that current animated virtual characters are not able to perform due to its complexity. In this paper we focus on dressing-up, which is probably the most common action involving cloth. We identify the steps required to perform the task and describe the systems responsible for each of them. Our results show a character that is able to put on a scarf and react to cloth collision and over-stretching events.

CR Categories: I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism—Animation

Keywords: Object Manipulation, Cloth Simulation

1 Introduction

Object manipulation is an important research area in character animation that involves the character and the object being manipulated. Most of the approaches to manipulate objects are designed to work with rigid bodies, whose behavior is quite predictable. In contrast, deformable objects are completely unpredictable making it a difficult problem as shown by the scarce literature. Most state of the art in cloth manipulation can be found in robotics, where research has focused on specific tasks such as folding [Lakshmanan et al. 2013] or clothing assistance [Tamei et al. 2011].

In this paper we present a first approach to an animation engine capable of manipulating cloth and reacting to events such as collisions or overstretching.

2 Character Dress-Up System

The overall dress-up system is described in Fig. 1. First, a character must get within a given reach distance from the piece of cloth to manipulate, which requires a locomotion system.

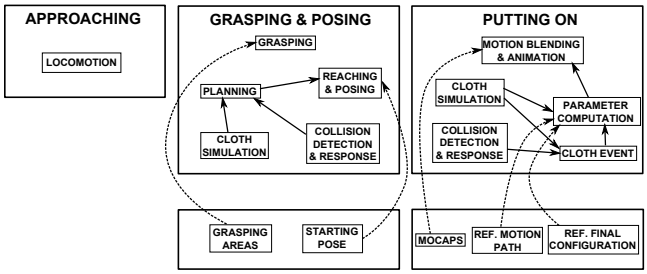

Figure 1: *Schematic overview of dressing-up process: sequence of steps, systems involved and data required by each of them.*

Next, the character must grasp the cloth and reach the initial pose from which the putting on phase will start. Grasping and posing involve planning to adapt the hand motion to the dynamically changing surface of the cloth, as well as a reaching system. The cloth simulation and collision detection and response must be handled by a physics simulator. In addition, valid grasping areas and initial poses must be defined for each different type of cloth.

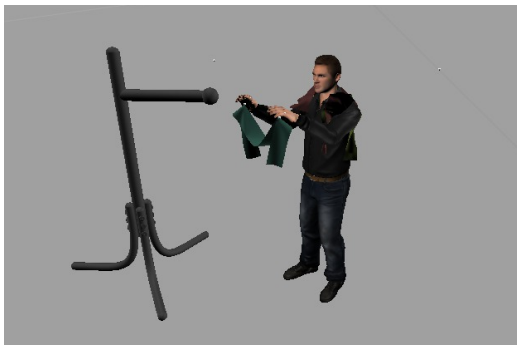

Figure 2: *Character wearing two scarfs and trying to put on another one.*

Starting from the initial pose, parameterized captured motions are blended and sequenced based on feedback from the cloth, such as collision or over-stretching events. The parameters are computed at runtime depending on this feedback as well as the distance from a reference path. Finally, the correctness of the final configuration must be evaluted by measuring the distance to a reference one.

3 Results and Conclusions

Fig. 2 shows an animated character that is able to put on scarves with different properties and dynamic behaviors and react to events, such as collisions with the head. We have used Bullet [1] as the physics engine and Smartbody [Shapiro 2011] for the locomotion, reaching and posing, grasping and motion blending.

Compared to the scheme in Fig. 1, the system used in this example lacks several features. No grasping or posing planning has been used since a simple trial and error approach works. No reference motion path is needed for a scarf, and the final configuration is assumed to be correct if the motion has finished.

This system represents a first approach towards making clothing an active participant in real-time character animation. Cloth has a direct effect on the characters based on its properties and its use in the simulation: heavy coats could make a character move slower, while tight skirts could limit the movement in the legs. Behaviors could also be affected, for example by gaze lines interruptions.

References

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[1] http://bulletphysics.org/wordpress/