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Pose Estimation Using Local Adjustment with Mixtures-of-parts Models ⋆

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Abstract

Articulated pose estimation with mixtures-of-parts decomposes human body into several local component templates with springs connecting each other. Such a method fails in precisely estimating human pose especially due to the defects of tree models when human has the complicated pose of body. To address this problem, we propose pose estimation using local adjustment with mixtures-of-parts models. We can achieve the most suitable pose of body by the blending and selecting strategy based on the full score and the corresponding attributes of limbs and body. The experiments show that the estimation effect of human pose of our method is better than the previous method based on articulated pose estimation with mixtures-of-parts.

Keywords: Articulated Model; Mixtures-of-Parts; Pose Estimation; Local Adjustment; Blending and Selecting Strategy

1 Introduction

Pose estimation refers to as localization of components of human bodies within images. Part representation [1] and pictorial structure [2, 3] are two important tools for pose estimation. The first approach models human body as a collection of parts while the second approach represents human body as a collection of component templates with springs connecting each other. Compared with part representation based approach, pictorial structure based approach improves the preciseness of pose estimation by adding the connection between adjacent components of bodies. However, difficulties of full-body pose estimation arise from many aspects such as a large number

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of degrees of freedoms, varied clothing and body shape, change of viewpoints, and articulated occlusion.

We propose pose estimation using a local adjustment of the localization of body components. The adjustment is achieved by blending a full-body score with important attributes of components, including the non-overlapping area of components, and the HoG convolutions of components.

The main contribution of our work is that, the most suitable pose of whole body/local components (upper arms, thighs, forearms, shanks) are captured by local pose adjustment, based on the blending and selecting strategy of full score and global attributes of body/local attributes of limbs.

The remainder of this paper is organized as follows: Section 2 discusses previous work on pose estimation of human; the local pose adjustment of articulated model with mixtures-of-parts is proposed in Section 3; Section 4 gives experimental results, which show that the pose estimation of our method can perform better than the previous method [3] of articulated pose estimation with mixtures-of-parts in most cases; finally, the conclusion and future work are given in Section 5.

2 Previous Work

Many scholars propose effective algorithms to estimate pose of body in video domain or static images and we list some important methods of estimating human pose as follows.

O'Rourke and Badler [4], Hogg [5], Rohr [6] propose the classic model-based methods to address pose estimation in the video domain. The pose estimation of body of static image is becoming more and more important, tree models are efficient in pose estimation [2], but have some difficulties in pose estimation of limbs (e.g., the cases of double-counting). Loopy models require approximate inference strategies such as importance sampling [2, 7], loopy belief propagation [8], or iterative approximations [9]. Recently, branch and bound algorithms [10, 11] with tree-based lower bounds are presented to globally solve such problems. Lan and Huttenlocher [12] consider tracking the double-counting cases by using stronger pose priors. Tran and Forsyth [13] present that the above solutions maybe more susceptible to overfitting to statistics of a particular dataset.

Yang and Ramanan [3] propose a method of human pose estimation in static images based on a new part models, which is a general, flexible mixture model for capturing contextual co-occurrence relations between parts, and a spring models for encoding spatial relations. Their method is almost invalid for the complicated pose of body (e.g., double counting of limbs) due to the defects of tree structure of articulated part models with mixtures-of-parts.

This paper presents a local pose adjustment method of articulated models with mixtures-of-parts based on tree structure. We achieve the better estimation effect of human pose than the method of [3] in most cases, by the blending and selecting strategy of full score and corresponding attributes of body and limbs.

3 Local Pose Adjustment Based on Articulated Model with Mixtures-of-parts

As [3], we let I be an image, let $l_i = (x, y)$ be the pixel location of part i and let t_i be the mixture type of part i, where $i \in \{1, \ldots, K\}$, $l_i \in \{1, \ldots, L\}$, and $t_i \in \{1, \ldots, T\}$ ($K = 26$ and $T = 6$ in