Hybrid Discriminative-Generative Methods and Applications for Human Pose Reconstruction from Monocular Imagery

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Abstract

Estimating 3D human pose from monocular images is an important and challenging problem in computer vision with numerous applications including human-computer interaction, human activity recognition, biomechanical analysis, and security. Existing state-of-the-art methods utilize statistical learning models that are inherently limited because they require sufficient training data that does not often include uncommon pose articulations or subject proportions. In addition, these methods often return non-optimal, global results and cannot easily leverage anthropomorphic, kinematic, and other physics-based constraints. However, prior model-based search can be computationally prohibitive due to the combinatorially large set of plausible joint combinations. We combine statistical learning-based approaches with a prior part-based model into a hybrid constrained optimization that leverages strengths of both approaches. The method guarantees a plausible human pose while also resolving local ambiguities among body parts. Qualitative evaluation of the proposed methods on human pose datasets show improvement in reconstruction accuracy compared to current state-of-the-art methods.