GarmentNets: Category-Level Pose Estimation for Garments via Canonical Space Shape Completion

Cheng Chi and Shuran Song

Challenges for Garment Perception

- Infinite DoF
- Severe self-occlusion
- Thin structure

The key idea of GarmentNets is to formulate the pose estimation problem as a shape completion task in the canonical space. This canonical space is defined across garment instances within a category, therefore, specifies the shared category-level pose.

Key idea

The normalized coordinate is obtained by scaling garments of the same category (worn by T-pose human) to a unit cube.

3D Shape Representation with 3D Winding Number Fields

The winding number field (WNF) is defined as the integral of solid angles over a surface for every point in R^3. The holes of the surfaces are encoded in the magnitude of spatial gradient.

Comparison of Shape Completion Results (Right). The magnitude of spatial gradient is used to predict surface openings in WNF. TDF: truncated unsigned distance function, TDF: truncated signed distance function.

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Qualitative Results on Unseen Garment Instances (Simulation).

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Tab 1. Shape Completion Error. The error is measured using Chamfer distance (cm) under the canonical pose. OCC: occupancy grid, TDF: truncated signed distance function, TDF: truncated unsigned distance function and Ours: winding number field.

Tab 2. Pose Estimation Error. While NN achieves comparable Chamfer distance (cm), the pose estimation error (Dn) is significantly higher, indicates that the retrieved mesh does not share similar configuration as the input.

GarmentNets Pipeline

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Results

Qualitative Results on Unseen Garment Instances (Real-world Data). We validate our algorithm on realworld garments where the garments is lifted by the robot arm and the point cloud captured with iPhone 12 Pro Max.

Tab 1. Shape Completion Error.

Tab 2. Pose Estimation Error.

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