Learning from Synthetic Animals

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Problem Statement

Animal CAD Models + Unlabeled Real Images

2D Pose
Motivation

Human 2D Pose Estimation

- Newell et al., 2016
- He et al., 2017

Animal 2D Pose Estimation

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Motivation

Why not annotate large scale animal datasets?

1. Impractical to annotate all animal species

2. Hard to annotate various ground truth

Our Vision: Using **CAD models** to address the problem
Our solution

Source Domain -> Synthetic Animal Dataset -> Target Domain

Domain Randomization -> Semi-Supervised Learning
Consistency-Constrained Semi-Supervised Learning

Pseudo-Label Generation (PL-Ge)

Unlabeled Real Dataset \( X_t \)

Self-Ensembling

\( T_\beta \)

\( T_\alpha \)

\( T_\Delta \)

\( f(0) \)

\( f(n-1) \)

\( f(1) \)

\( f(n) \)

\( \hat{Y}_t^{(1)}, C_t^{(1)} \)

\( \hat{Y}_t^{(2)}, C_t^{(2)} \)

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Results
Experiments 1 --- 2D Pose Estimation

Neural Network
- Stacked Hourglass [Newell et al., 2016]

Synthetic Animal Dataset
- Horses and tigers
- 8,000/2,000 training/validation

TigDog Dataset
- Horses: 8,380/1,772 train/test
- Tigers: 6,523/1,765 train/test
Experiments 1 --- Easy to extend to other categories

Elephants

Dogs

Sheep
Experiments 2 --- Generalization on VisDA-2019 dataset

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Experiments 3 --- Multi-task Learning
Learning from Synthetic Animals

1. Unsupervised domain adaptation for animal 2D pose estimation
2. Consistency-constrained semi-supervised learning
3. Better generalization on VisDA-2019 dataset
4. Synthetic Animal Dataset with 10+ animals and rich ground-truth

Code and Data are available at 
https://github.com/JitengMu/Learning-from-Synthetic-Animals