Learning from Synthetic Animals

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Problem Statement

Animal CAD Models

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Unlabeled Real Images

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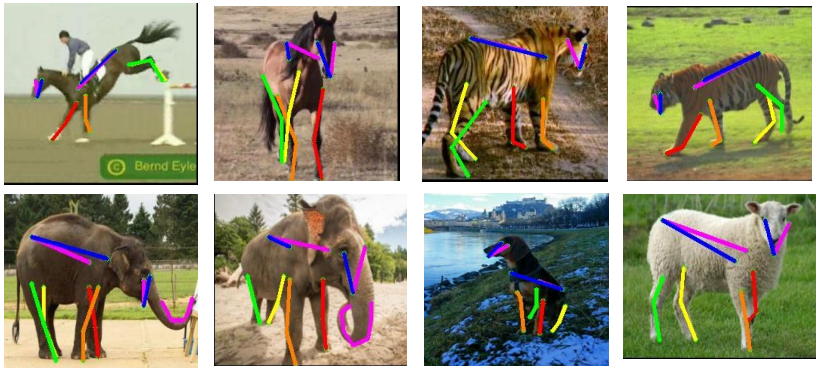
2D Pose



Motivation

Human 2D Pose Estimation

Newell et al., 2016

He et al., 2017

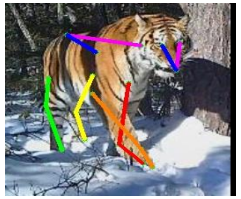
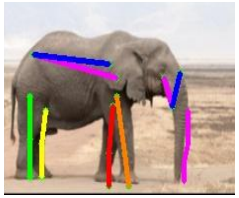
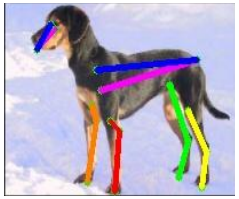
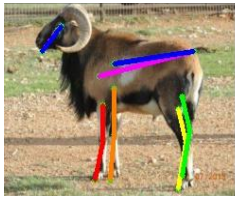
Animal 2D Pose Estimation

? ?

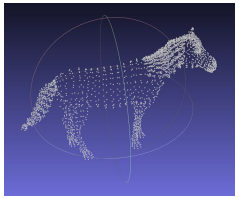
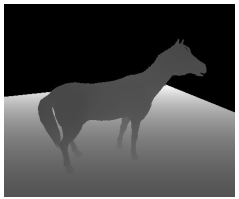
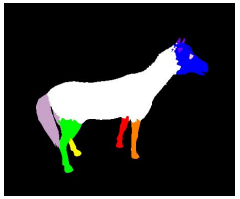
Motivation

Why not annotate large scale animal datasets?

1. Impractical to annotate all animal species

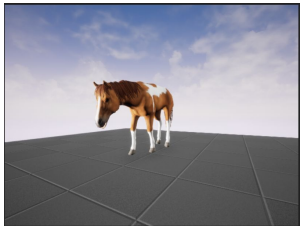
2. Hard to annotate various ground truth

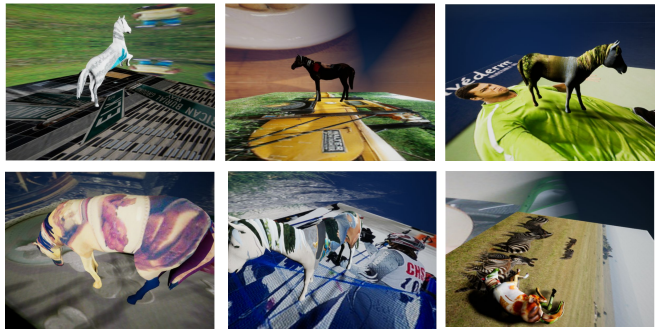
Our Vision: Using **CAD models** to address the problem

Our solution

Source Domain



Synthetic Animal Dataset

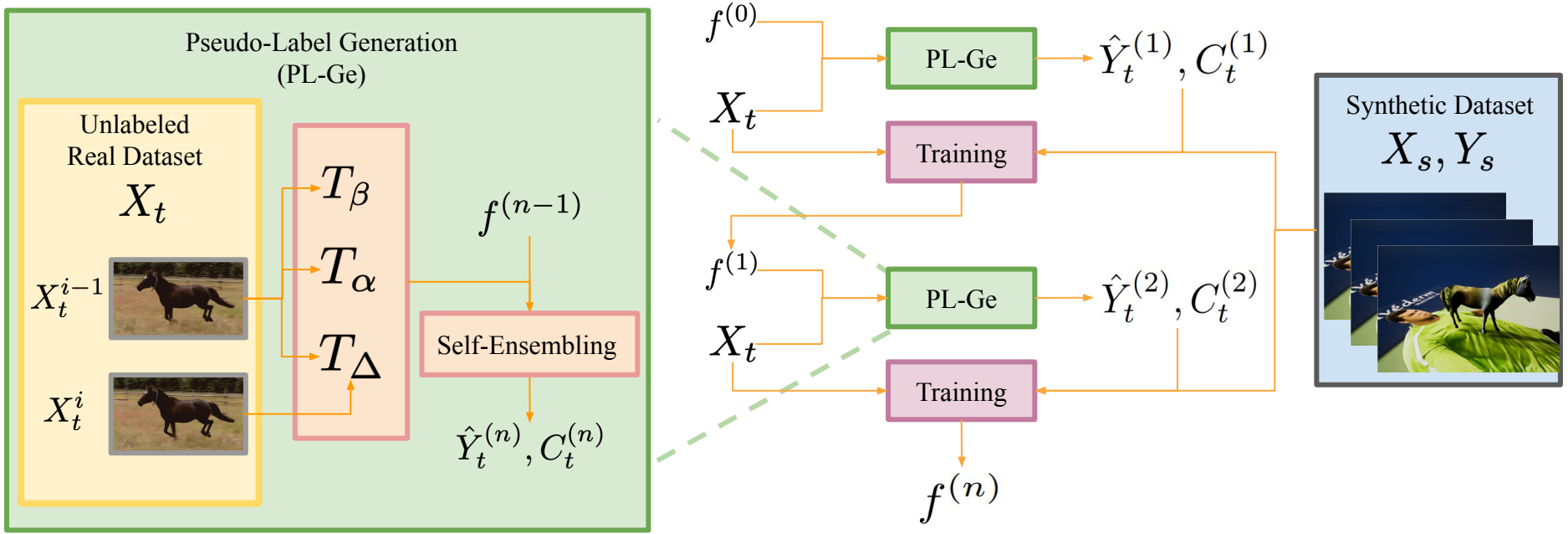


Target Domain

Domain Randomization

Semi-Supervised Learning

Consistency-Constrained Semi-Supervised Learning



Consistency check

Invariance consistency T_β Equivariance consistency T_α Temporal consistency T_Δ

Results

Experiments 1 --- 2D Pose Estimation

Neural Network

- Stacked Hourglass [Newell et al., 2016]

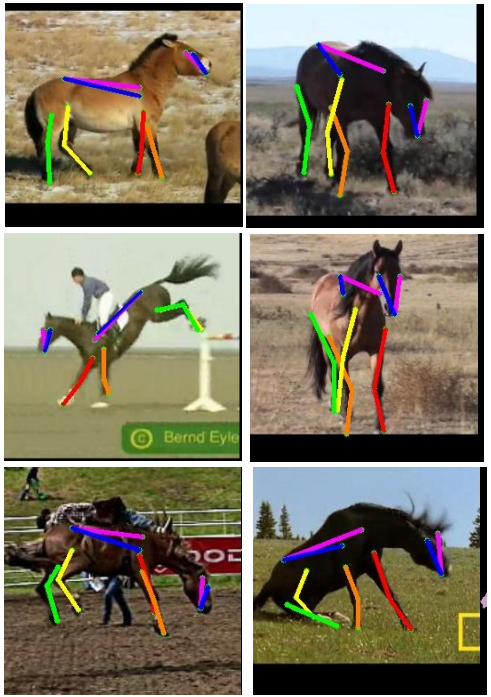
Synthetic Animal Dataset

- Horses and tigers
- 8,000/2,000 training/validation

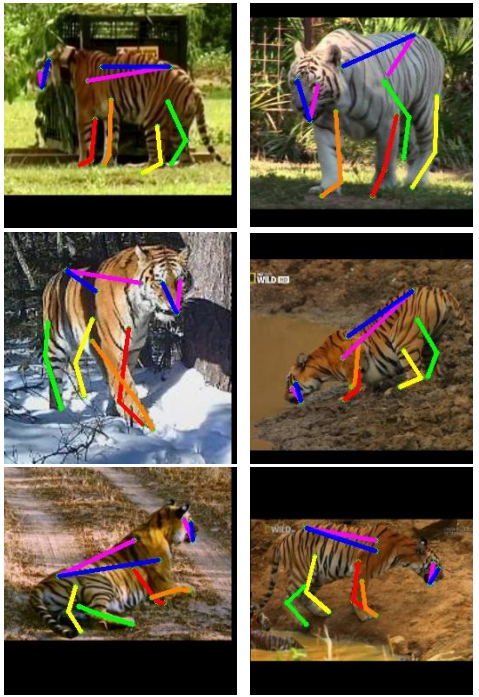
TigDog Dataset

- Horses: 8,380/1,772 train/test
- Tigers: 6,523/1,765 train/test

Horses

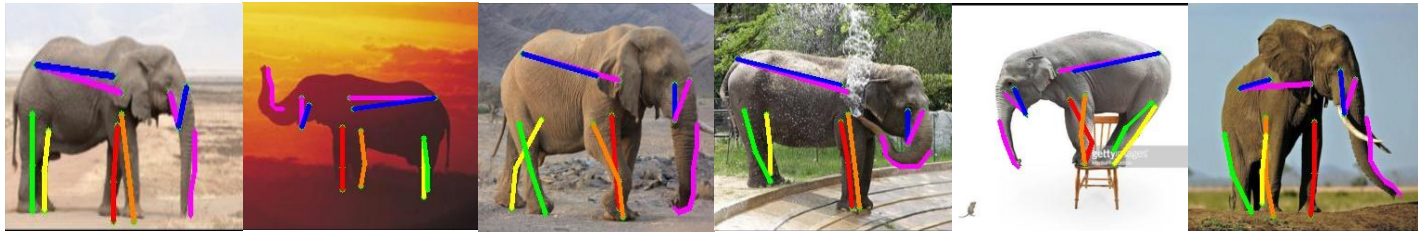


Tigers

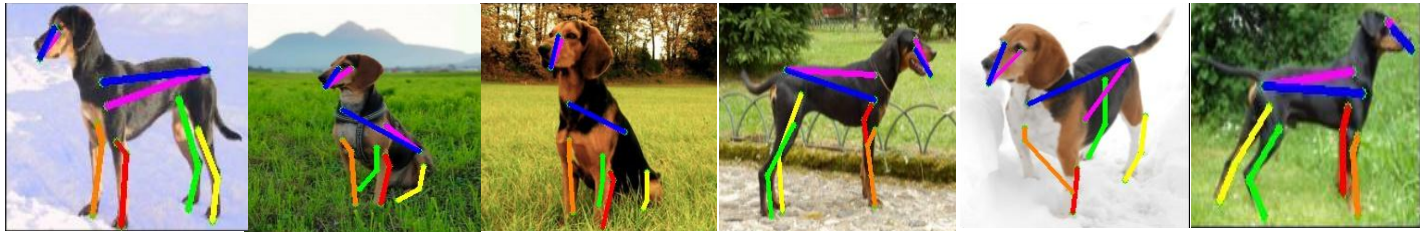


Experiments 1 --- Easy to extend to other categories

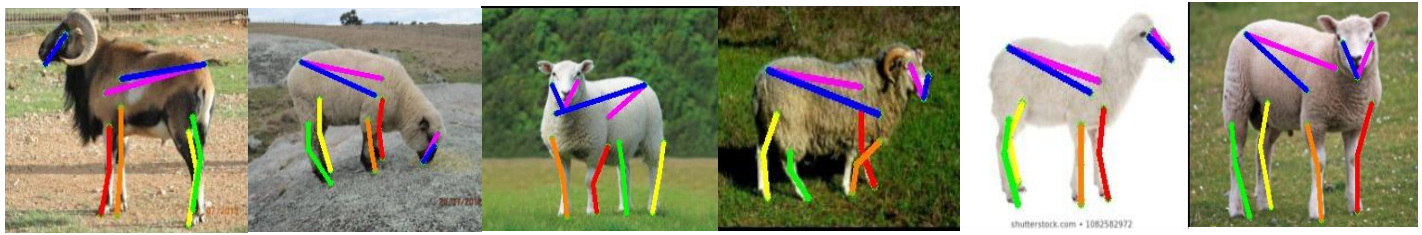
Elephants



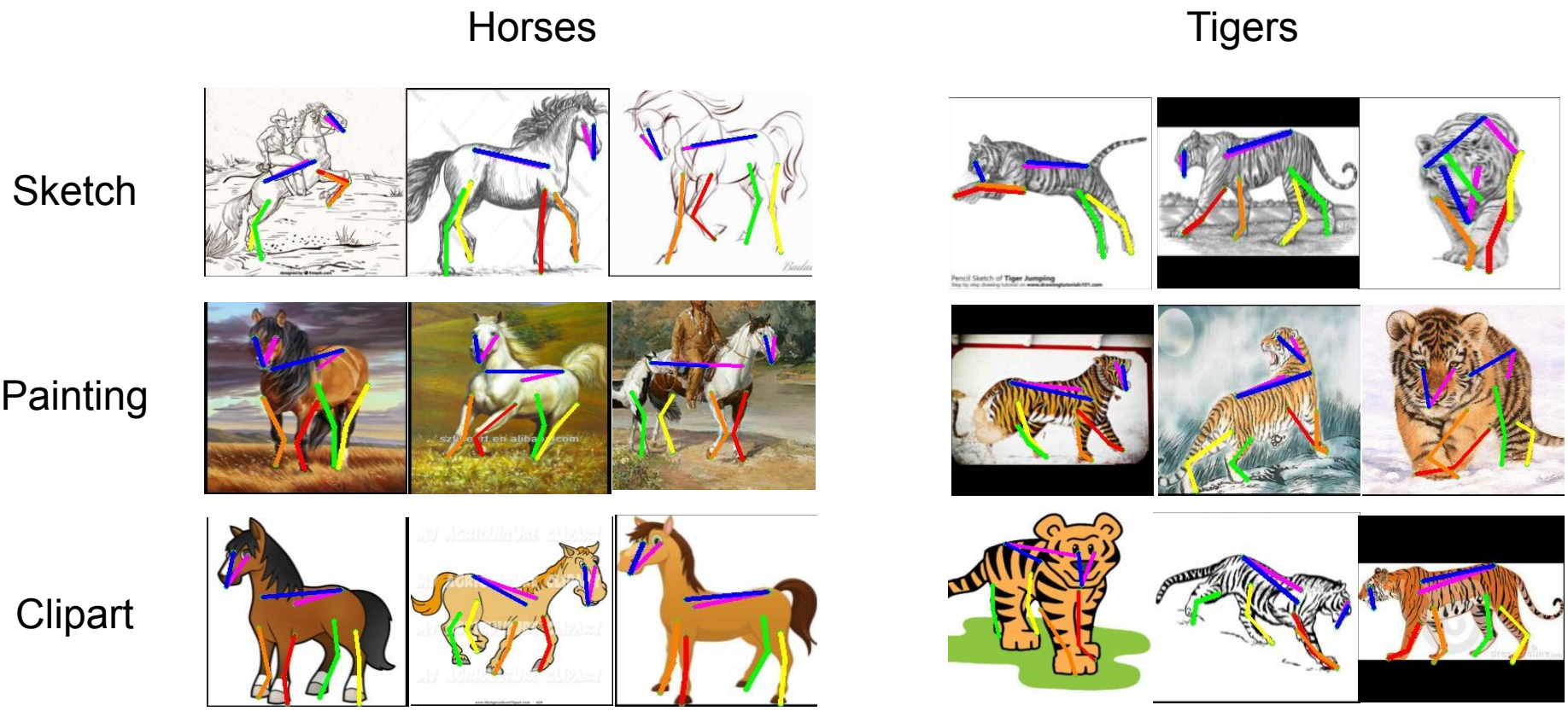
Dogs



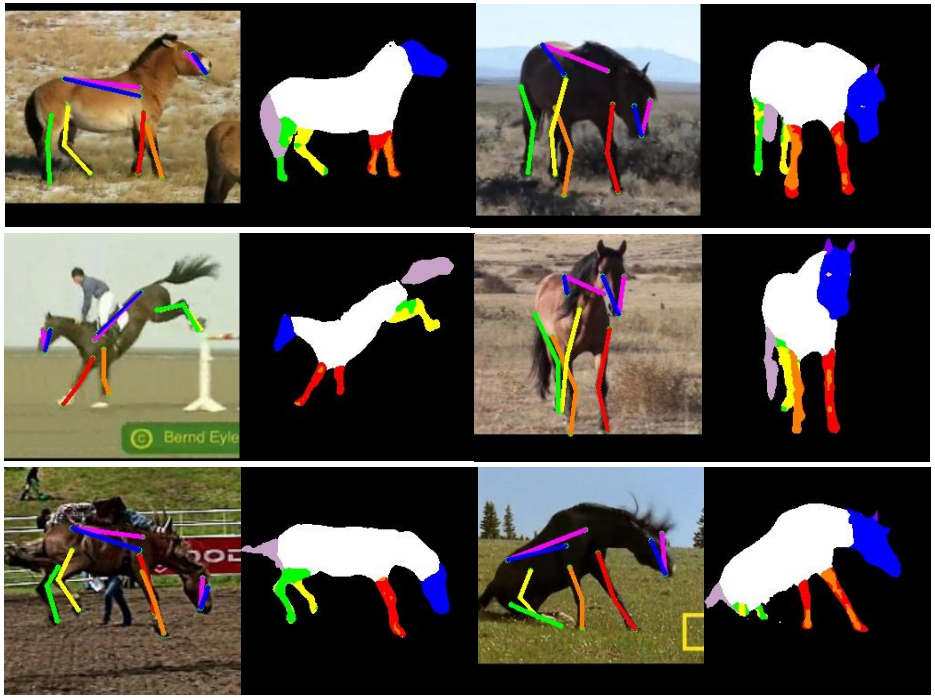
Sheep



Experiments 2 --- Generalization on VisDA-2019 dataset



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