

Introduction

Challenges

- Large intra- and inter-species variations
- \succ Lack large-scale annotated data (data scarcity)

Motivation

- [Relation to humans] pretraining and finetuning curves biased towards human-like species such as monkey and produce poor results on less human-like species such as penguin (a)
- [Relation among animals] finetuning certain species leads to performance gains for other species as well (b) -> knowledge sharing among animal species



Contributions

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- Propose Meta-CSKT, the first to leverage bi-directional crossspecies knowledge transfer for data-scarce animal face alignment
- Propose positive example mining method to effectively utilize unlabeled data: **purify** unlabeled data and **augment** labeled data
- Extensive experiments on three datasets demonstrate the superiority of our method for animal face alignment with **a few** labeled images (e.g., 40)

Data-Scarce Animal Face Alignment via Bi-Directional Cross-species Knowledge Transfer Dan Zeng, Shanchuang Hong, Shuiwang Li, Qiaomu Shen, Bo Tang

Project website: https://github.com/danzeng1990/Meta-CSKT.

Method: Meta-CSKT



- a) If $\|H_{flip} Flip(H_{orig})\|^2 > T_{neg}$, the unlabeled data is hard negative **b)** If $\Delta H_{orig} < T_{pos}$, the unlabeled data is positive
- c) Elsewise, the unlabeled data is semi-hard positives



$$B(I_{pos}; \theta_{\mathcal{B}})\|^2$$

> Evaluation on Horse Facial Keypoint dataset WarpingNet Ground Truth

Evaluation on AnimalWeb (with few labeled images)

Models	# Labeled	NME	Models	#Labeled	NME
(Known)	Images		(Unknown)	Images	
HG2	17.96K	5.22	HG2	17.62K	6.14
HG3	17.96K	5.12	HG3	17.62K	5.96
Ours	40	5.61		40	7.44
	80	5.55	Ours	80	7.21

Effect of Meta-CSKT design

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Models	Meta-CSKT loss		loss	Positive Example Mining		NME
	L_{S}	L_u	L_f	Exc. negative	Inc. positive	Known/Unknown
1		×	×	×	×	6.67/10.07
2		\checkmark	×	×	×	6.03/9.03
3	\checkmark	\checkmark	\checkmark	×	×	5.93/8.88
4	\checkmark	\checkmark	\checkmark	✓	×	5.89/8.84
Ours	\checkmark	\checkmark	\checkmark	✓	\checkmark	5.61/7.44

Example Face



Model 1

Model 2



Wechat

Experiments

WarpingNet



Known species settings: comparable; Unknown species settings: acceptable gap (1%)











Ground Truth

Model 3

Model 4

Ours