SHIFT: Exploiting Synthetic Adult Datasets for Infant Pose Estimation

CVPR-8th ABAW Workshop

UCR Vision and Learning Group
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Autonomous Robots and Control Systems Lab

Introduction/Motivation

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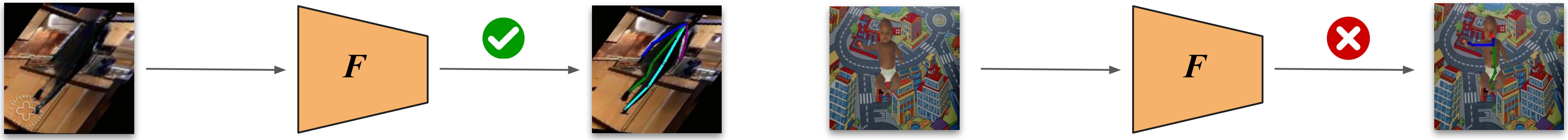
Existing Adult Pose Estimation Models don’t work well on Infant data



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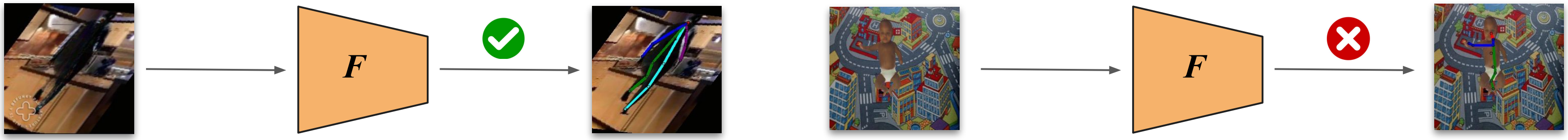
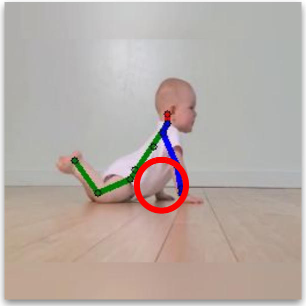


Can we adapt an existing Adult Pose Estimation model to perform well on Infant Data without using Infant Pose Annotations?

Is UDA enough for adapting to Infant Data?

- FiDIP* (SOTA Algorithm for Infant Pose Estimation) does not account for either the anatomy of infants nor the high self-occlusion present in such datasets.

- The pose prior generates *plausible infant poses* but still struggles under self-occlusions.



SOTA*

**Huang et. al, "Invariant Representation Learning for Infant Pose Estimation using Small Data" (FiDIP), IEEE FG, 2021*

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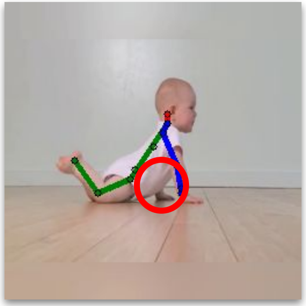
- We address this issue by using a **pose-image consistency module** which leverages *spatial context* to provide additional guidance.



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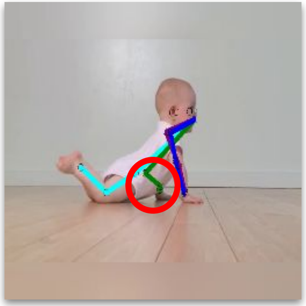

OURS

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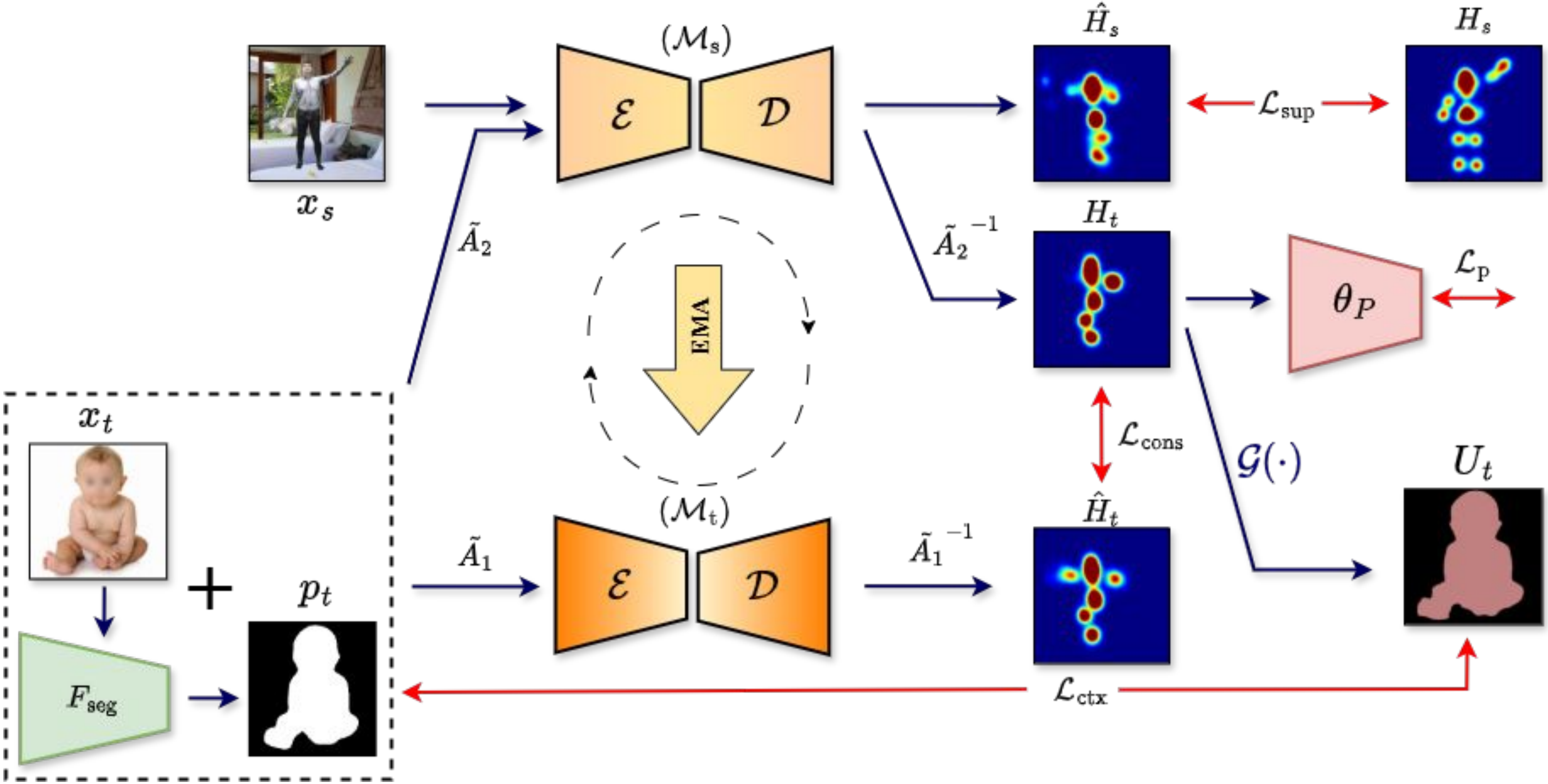
SHIFT: Pipeline Overview



Quantitative Comparisons

Adult to Infant Data Adaptation

Algorithm	SURREAL → MINI-RGBD							
	Head	Sld.	Elb.	Wrist	Hip	Knee	Ankle	Avg.
Source only	99.50	04.10	06.10	11.50	69.60	11.50	75.20	47.40
Oracle	100.00	99.70	97.40	75.00	92.60	86.10	84.30	89.20
RegDA [18]	39.30	04.10	39.70	06.00	74.10	00.60	02.70	20.30
UDAPE [20]	100.00	05.00	54.30	42.70	96.50	32.20	75.40	51.50
SHIFT	100.00	14.90	68.80	45.20	96.50	40.60	72.70	56.40

UDA for ***Surreal*** to ***MINI-RGBD***

Algorithm	SURREAL → SyRIP							
	Head	Sld.	Elb.	Wrist	Hip	Knee	Ankle	Avg.
Source only	52.40	35.60	23.50	27.10	32.90	14.20	24.70	26.30
Oracle	89.40	82.10	65.70	66.10	64.10	50.70	54.50	63.80
RegDA [18]	17.00	28.30	13.40	06.00	02.00	01.00	01.20	08.70
UDAPE [20]	54.40	47.50	13.50	31.10	50.60	26.00	36.50	34.20
SHIFT	53.40	46.10	34.20	38.70	51.10	31.20	37.60	39.80

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UDA for ***Surreal to SyRIP***

Inter Infant Data Adaptation

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SHIFT	✓	32.80	99.00	98.90	70.20	60.70	87.70	87.10	84.10

UDA for ***SyRIP to MINI-RGBD***

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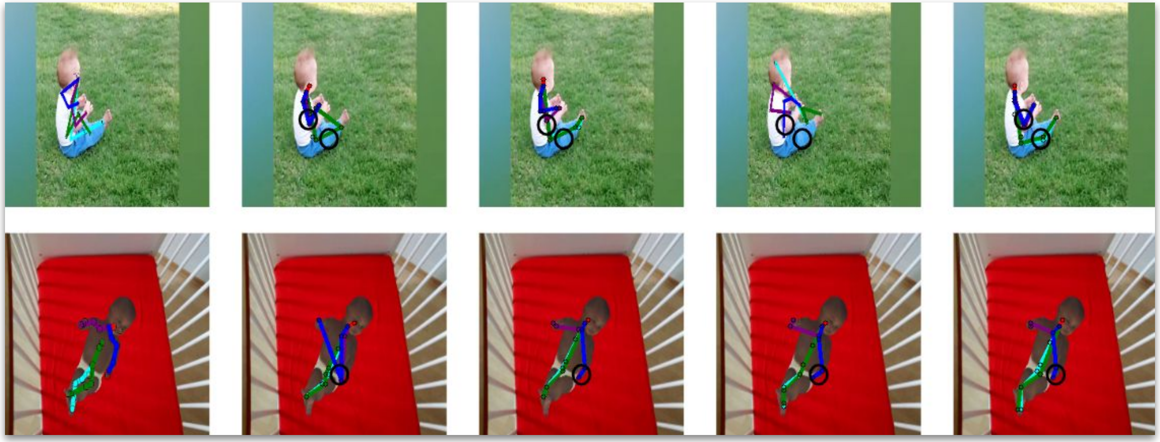
UDA for ***SyRIP to MINI-RGBD***

We beat FiDIP even though they use labeled data for fine-tuning

Qualitative Results

SURREAL → ***SyRIP***

SURREAL → ***MINI-RGBD***



Ground Truth *Source Only* **UDAPE** **FiDIP** **<u>SHIFT</u>** ***<u>(ours)</u>***

Source (Adult) Dataset → *Target (Infant) Dataset*

Qualitative Results

SURREAL → ***SyRIP***

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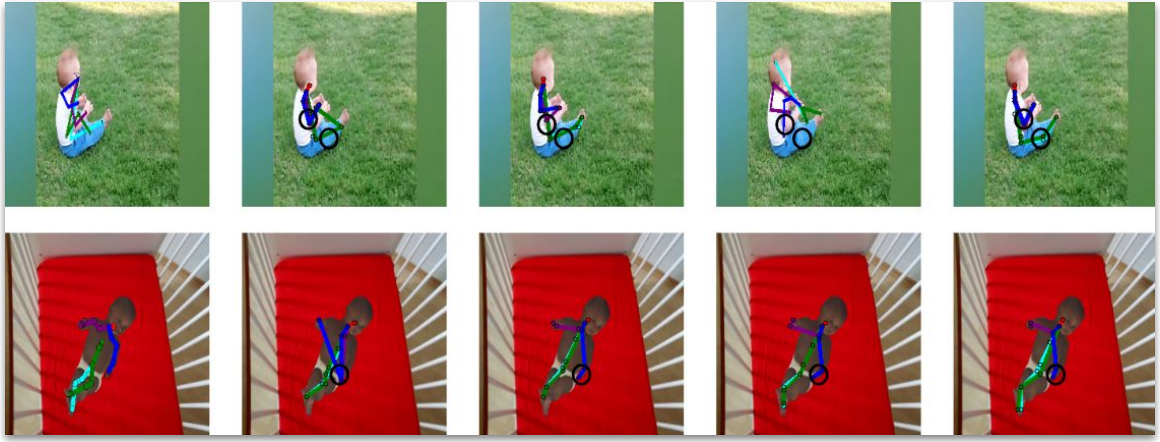


Ground Truth | *Source Only* | **UDAPE** | **FiDIP** | **SHIFT *(ours)***

SURREAL → ***SyRIP***

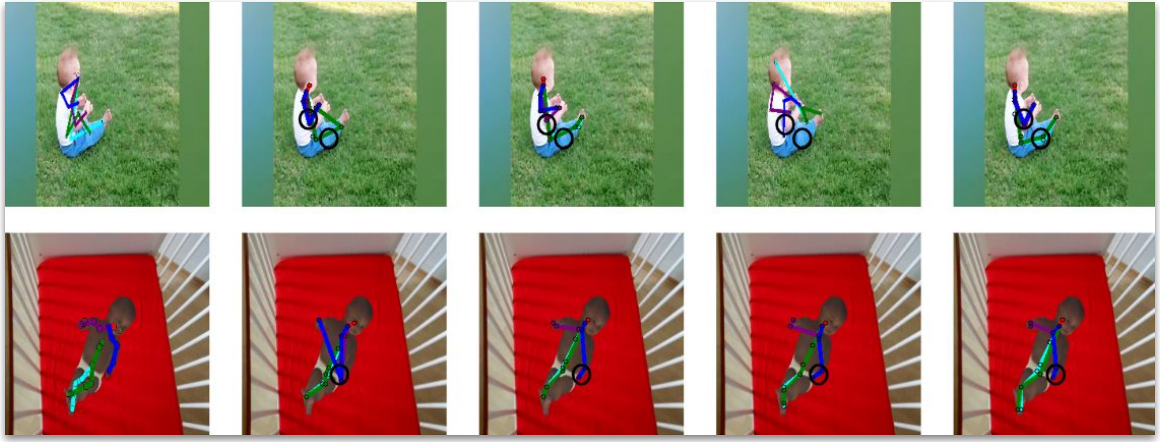
Ground Truth | **UDAPE** | *Seg. Mask* | **SHIFT *(ours)***

Source (Adult) Dataset → *Target (Infant) Dataset*

Qualitative Results

SURREAL → ***SyRIP***

SURREAL → ***MINI-RGBD***



Ground Truth | *Source Only* | **UDAPE** | **FiDIP** | **SHIFT *(ours)***

SHIFT can tackle High Self-Occlusions!

SURREAL → ***SyRIP***

Ground Truth | **UDAPE** | *Seg. Mask* | **SHIFT *(ours)***

Source (Adult) Dataset → *Target (Infant) Dataset*

Thank You!