PARE: Part Attention Regressor for 3D Human Body Estimation

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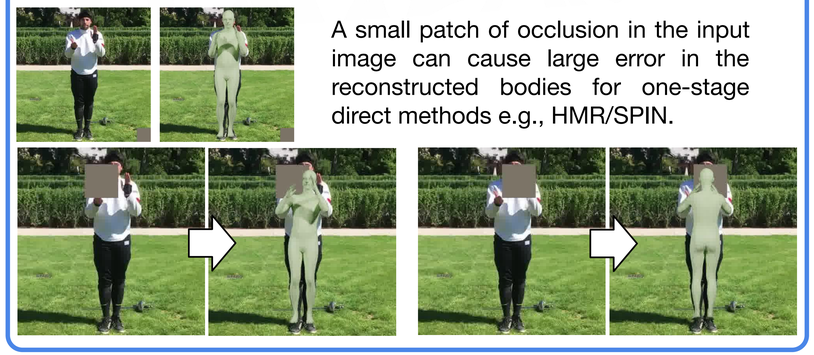
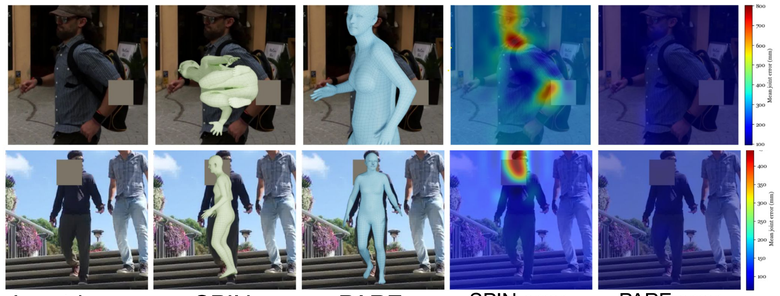
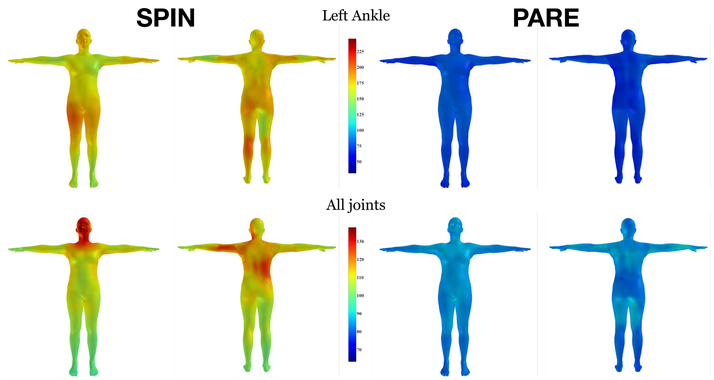
Motivation



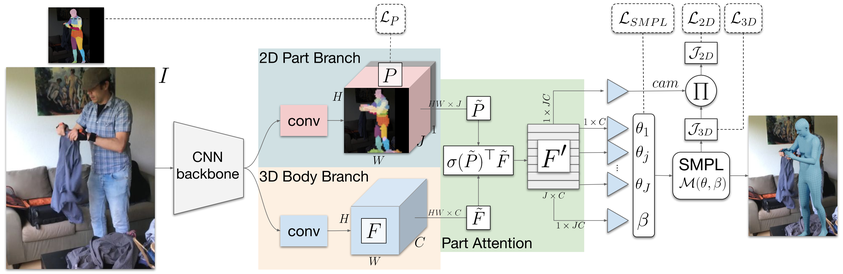
A small patch of occlusion in the input image can cause large error in the reconstructed bodies for one-stage direct methods e.g., HMR/SPIN.

Occlusion Sensitivity Analysis





Part Attention Architecture

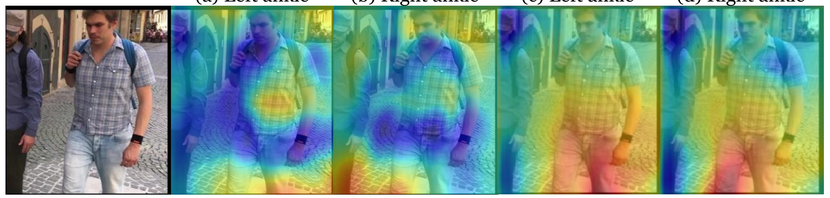


$$\mathcal{L} = \lambda_{3D}\mathcal{L}_{3D} + \lambda_{2D}\mathcal{L}_{2D} + \lambda_{SMPL}\mathcal{L}_{SMPL} + \lambda_P\mathcal{L}_P \qquad \mathcal{L}_P = \frac{1}{HW}\sum_{h,w}\text{CrossEntropy}\left(\sigma(P_{h,w}), \hat{P}_{h,w}\right)$$

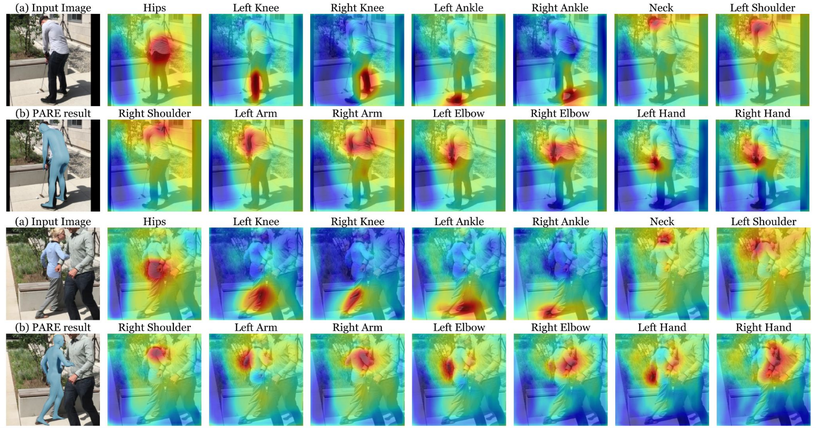
Supervised → Unsupervised Part Attention

$\lambda_P = 1$ *Training step 125K* (a) Left ankle (b) Right ankle

$\lambda_P = 0$ *Training step 200K* (c) Left ankle (d) Right ankle



Attention Maps



Results

Ablation study

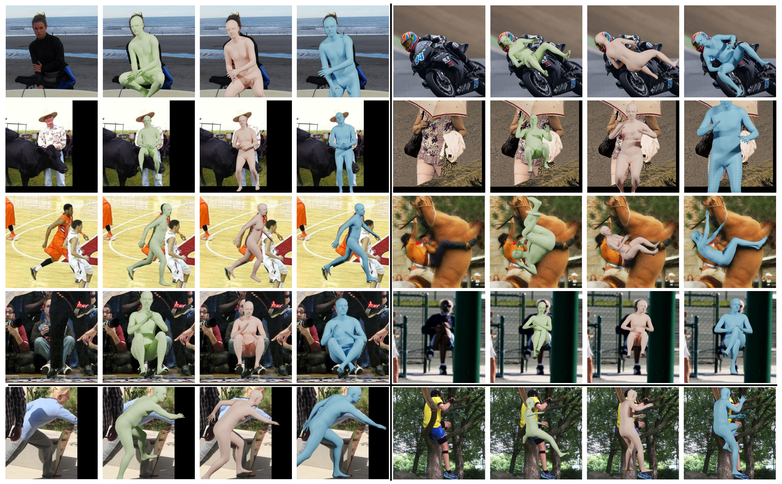
Supervised→unsupervised part attention training (e) works better than other sampling and supervision schemes.

Method		3DPW MPJPE ↓	3DPW PA-MPJPE ↓	3DPW-OCC MPJPE ↓	3DPW-OCC PA-MPJPE ↓
NBF [38]		100.4	63.2	103.5	70.4
HMR-EFT		99.0	59.9	97.9	64.7
P Supervision	*F* Sampling				
(a) Joints	Pooling	95.2	58.9	95.4	63.1
(b) Joints	Attention	95.3	58.8	98.9	63.9
(c) Unsup	Attention	94.8	57.9	95.9	62.7
(d) Parts	Attention	94.5	57.3	94.7	**61.2**
(e) Parts/Unsup	Attention	**93.4**	**57.1**	**93.9**	61.6
(f) Parts	Pooling	97.9	59.1	99.8	64.8

SOTA performance

Quantitative & qualitative evaluation confirms the benefits of PARE over other single stage methods.

	Method	3DPW MPJPE ↓	3DPW PA-MPJPE ↓	3DPW PVE ↓
single stage	HMR [24]	130.0	76.7	
	CMR [30]	-	70.2	-
	SPIN [29]	96.9	59.2	135.1
	HMR-EFT [23]	-	54.2	-
	PARE (R50)	82.9	52.3	99.7
	PARE (HRNet-W32)	82.0	50.9	97.9
	PARE (HRNet-W32) w. 3DPW	**74.5**	**46.5**	**88.6**



Resources

Project Page

pare.is.tue.mpg.de

ArXiv: https://arxiv.org/abs/2104.08527 **Project page:** pare.is.tue.mpg.de