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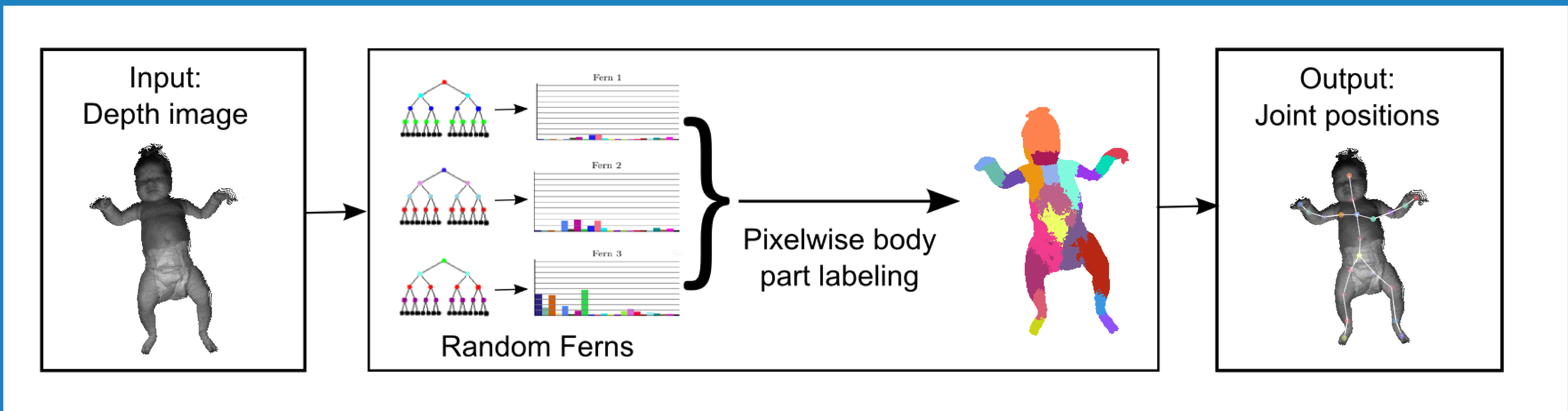

Infant Body Pose Estimation for Motion Analysis

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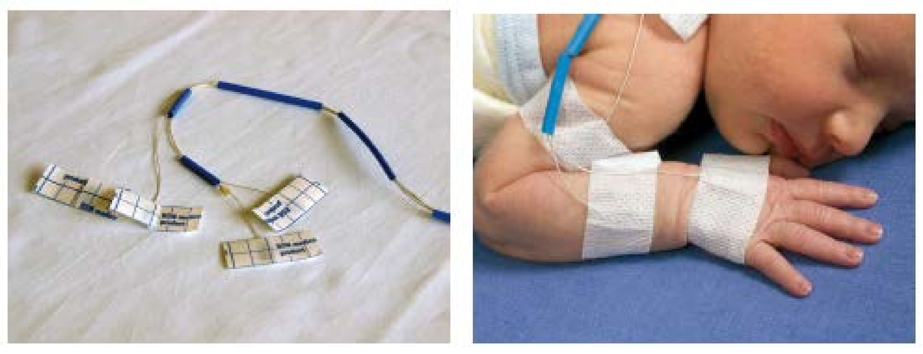
Motivation

- How to capture 3D movements of infants?
  - Kinect SDK? Minimum size: 1 meter!
  - Attach markers / sensors?

Optical markers [Meinecke2006]



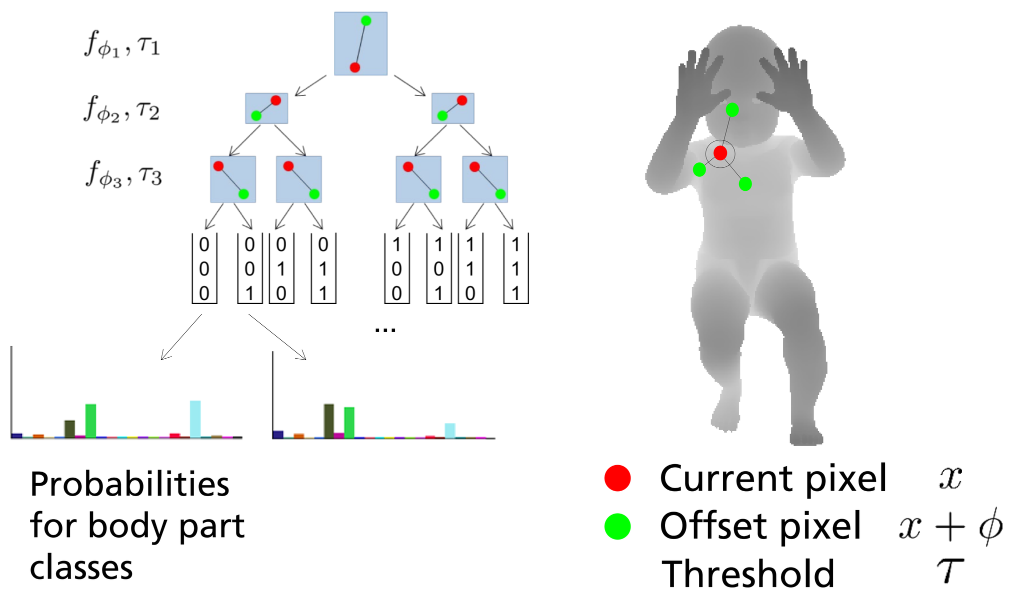
Electromagnetical sensors [Karch2011]

No!

→ Our approach: **Markerless 3D pose estimation using Random Ferns [1]**

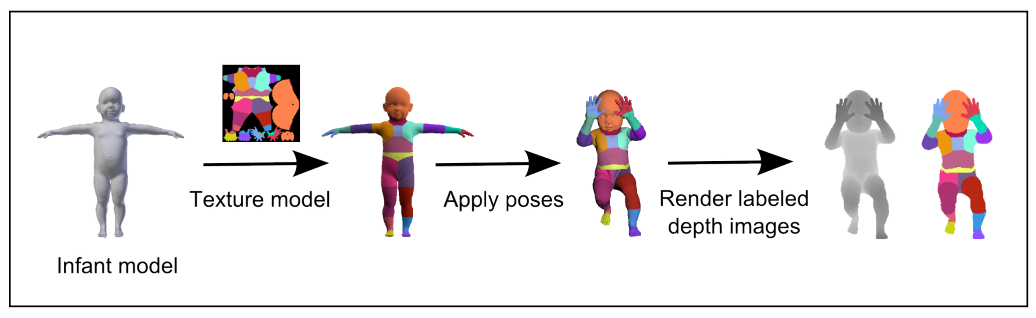
Method: Body pose estimation in depth images using Random Ferns [1]

- Fern: special kind of decision tree
- Input: one pixel of depth image
- Split nodes: binary depth comparison features
- Output: prob. distribution over all body parts
- Highest probability class assigned to pixel
- Joint positions deduced from body part regions



Synthetic training data generation

- Used for generating probability distributions



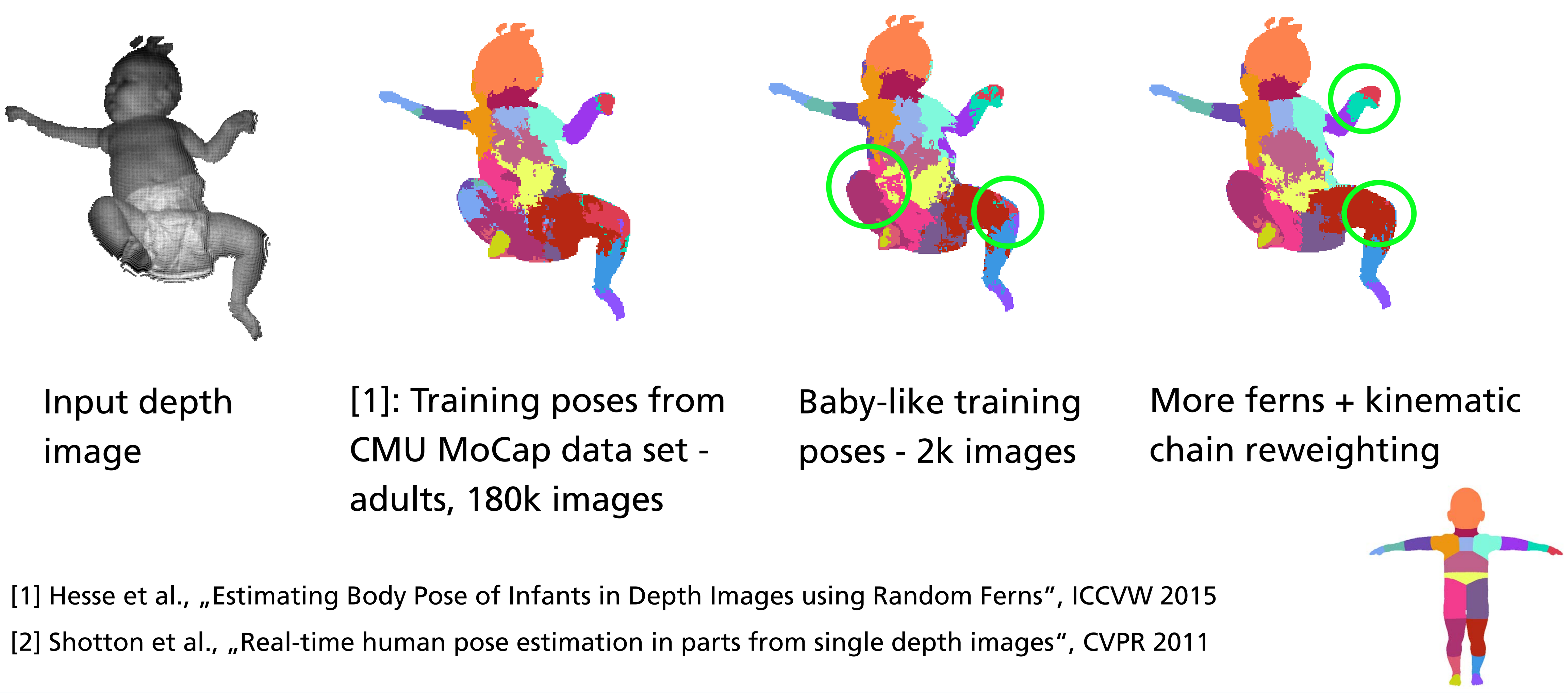
Comparison to Kinect approach [2]

- Training time reduced by 2 orders of magnitude with similar amount of data
- Evaluation: PDT13 data set - avg. joint error
  - Ours: 130 mm
  - Kinect SDK: 96 mm

Evaluation: infant sequence – average joint error in mm

Joint / body part	Head	Neck	ShoulderR	ShoulderL	ElbowR	ElbowL	HandR	HandL
Avg. error	37	20	27	73	24	20	44	149
Joint / body part	**Body center**	**HipR**	**HipL**	**KneeR**	**KneeL**	**FootR**	**FootL**	**Mean**
Avg. error	30	33	12	45	49	28	30	**41**

Improving body part labeling



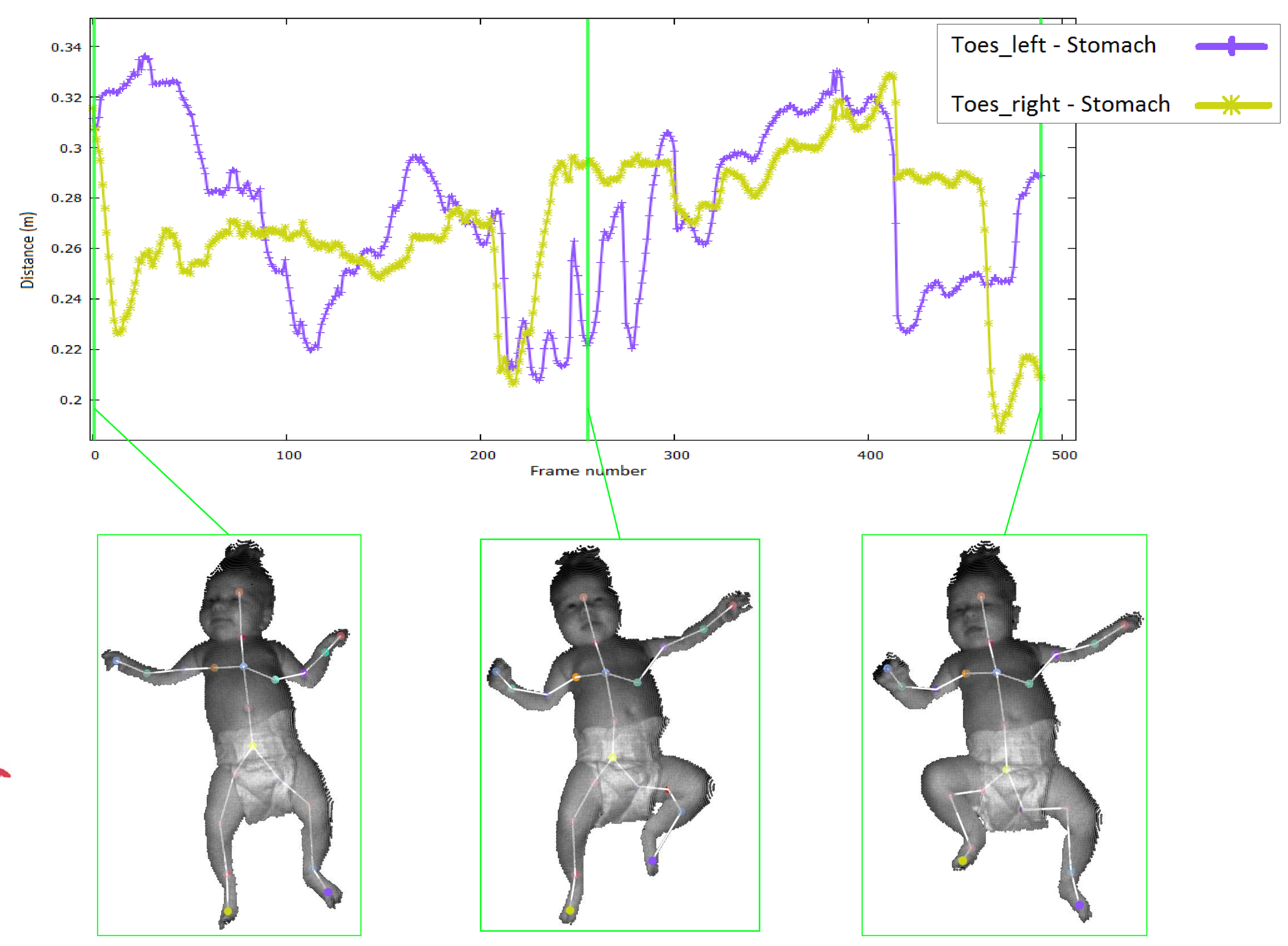
Input depth image

[1]: Training poses from CMU MoCap data set - adults, 180k images

Baby-like training poses - 2k images

More ferns + kinematic chain reweighting

Motion analysis: distance toes – stomach



[1] Hesse et al., „Estimating Body Pose of Infants in Depth Images using Random Ferns“, ICCVW 2015

[2] Shotton et al., „Real-time human pose estimation in parts from single depth images“, CVPR 2011

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