

MSKdeX: Musculoskeletal (MSK) decomposition from an X-ray image for fine-grained estimation of lean muscle mass and muscle volume

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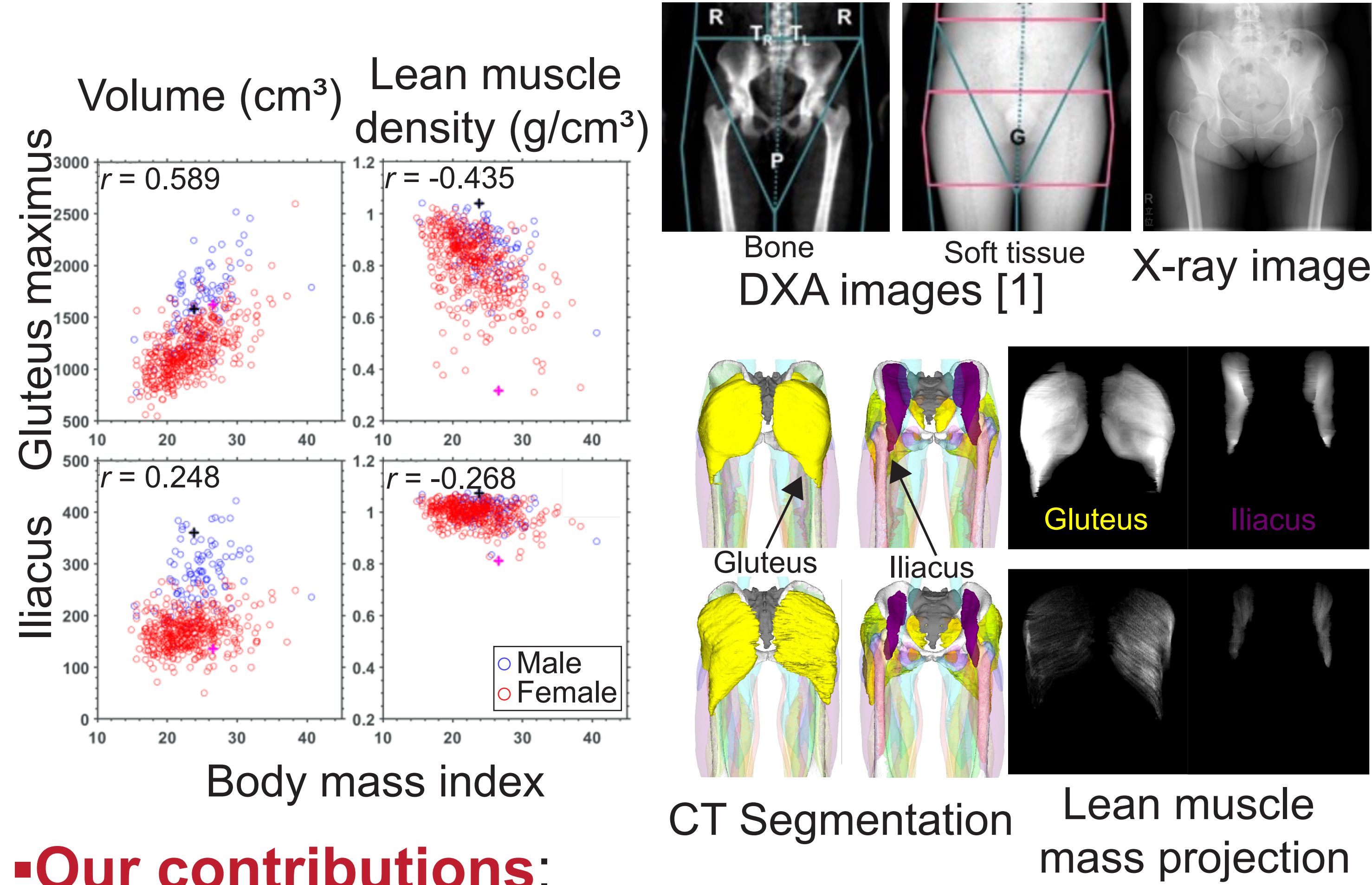
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Introduction

Dual-energy X-ray absorptiometry (DXA) [1] is considered gold standard for **muscle properties estimation** such as lean mass.

Accessing muscle properties from plain **X-ray images** is **difficult** due to **tissues entanglement** while being highly anticipated.

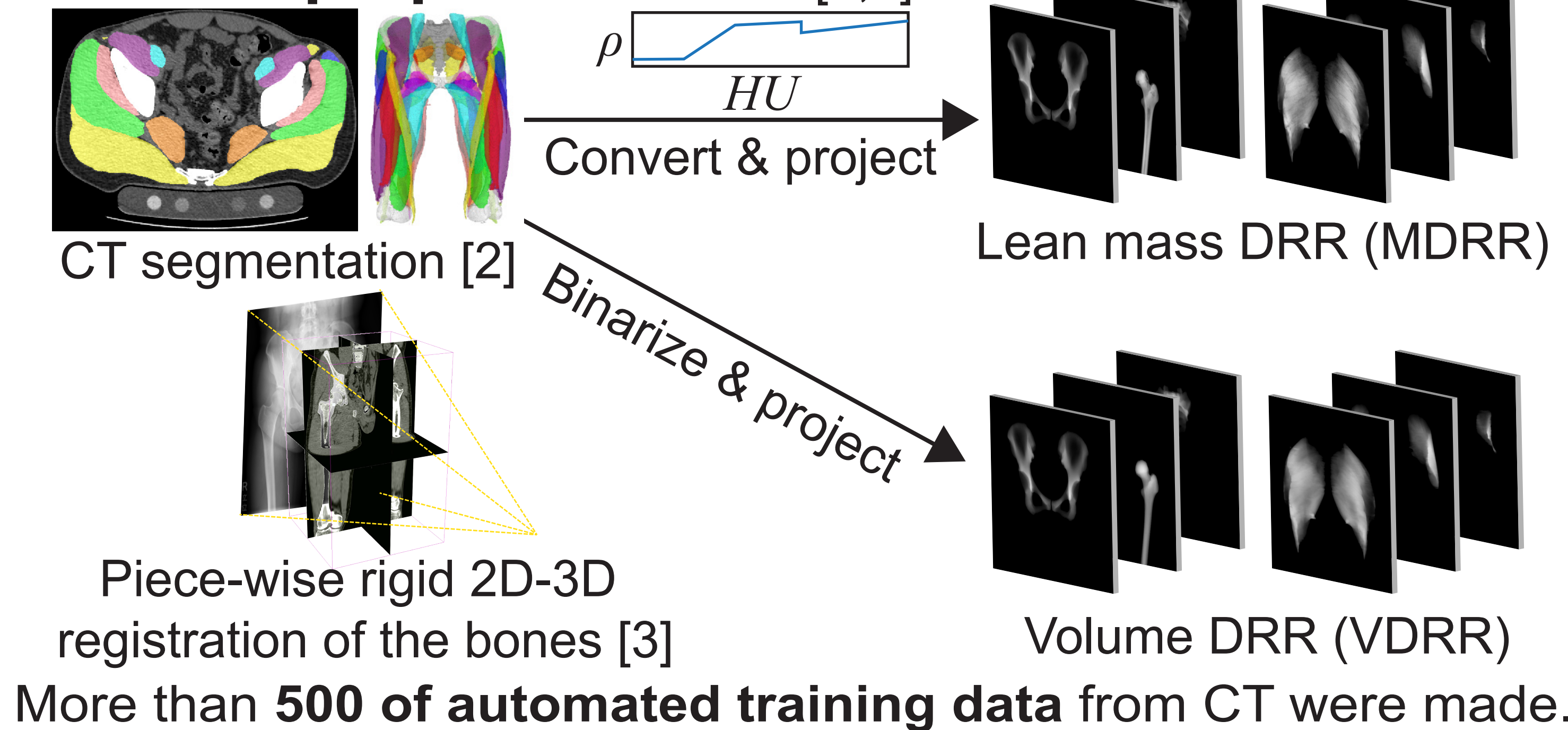


Our contributions:

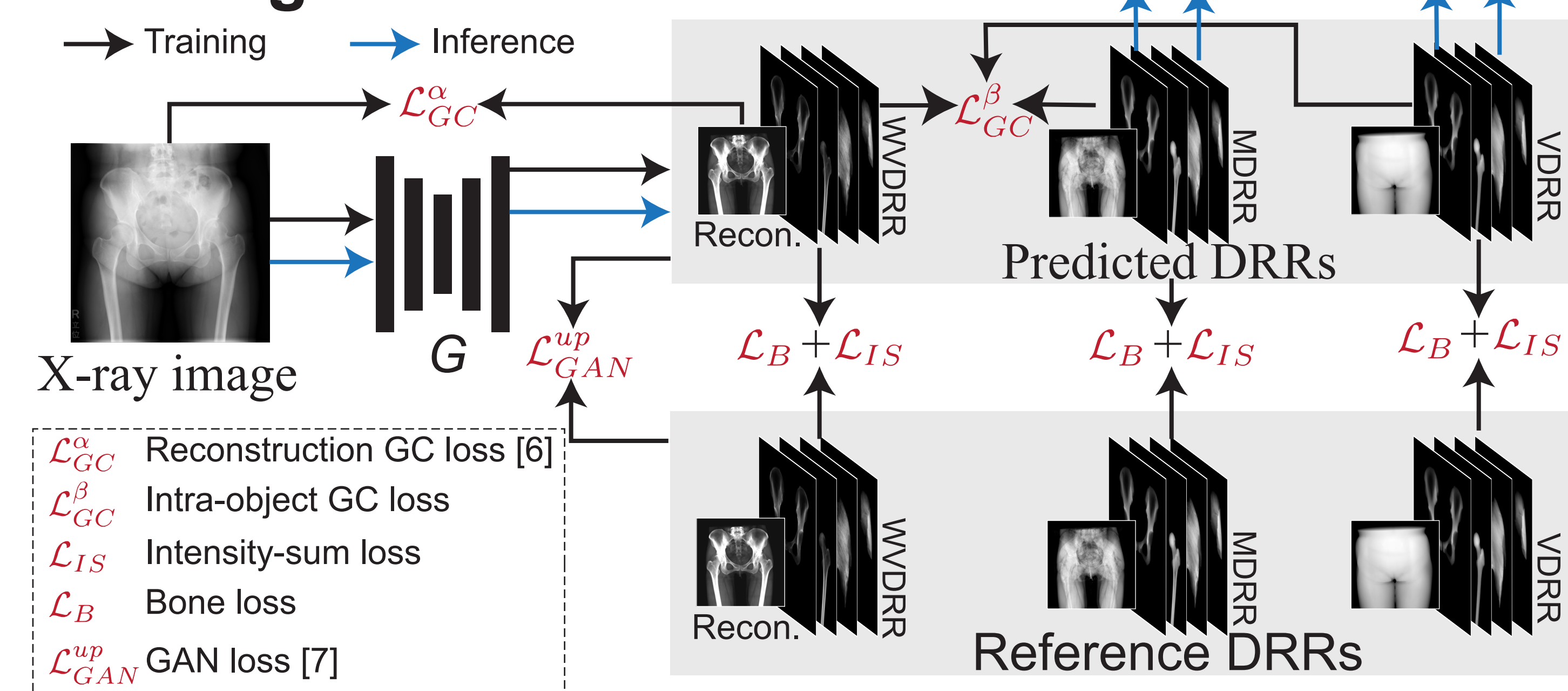
1. The first to estimate **fine-grained** muscle properties (i.e. properties of individual muscles) from a plain X-ray image.
2. **Accurate** estimation of lean muscle mass and muscle volume using **computed tomography (CT)** prior.

Proposed method

Dataset preparation



Training and Inference



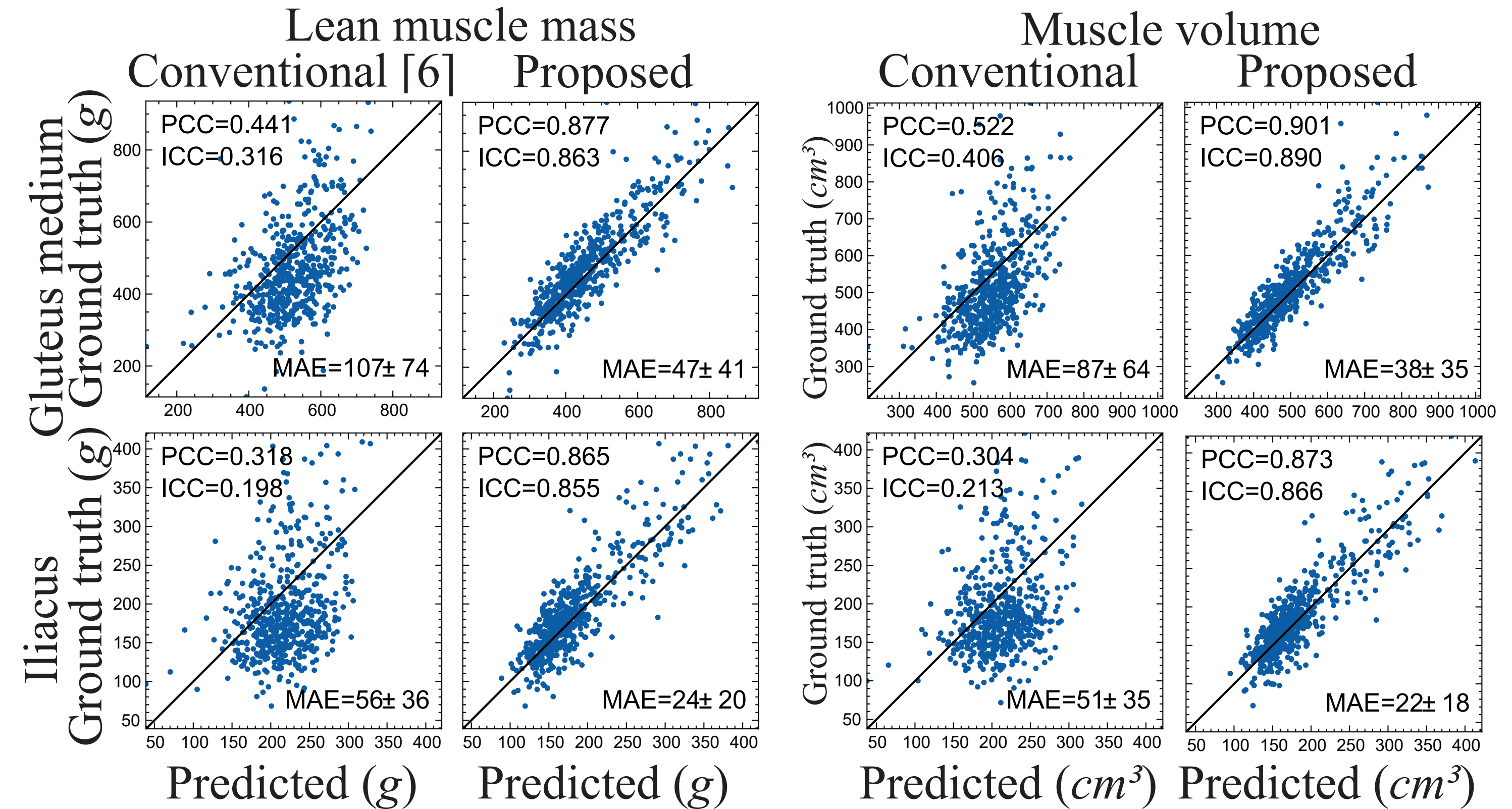
References

- [1] A. Bazzocchi et al.: DXA: Technical aspects and application. Eur. J. Radiol., 2016.
- [2] Y. Hiasa et al.: Automated muscle segmentation from clinical CT using Bayesian U-Net for personalized musculoskeletal modelling. IEEE Trans. Med. Imaging, 2019.
- [3] Y. Otake et al.: Intraoperative image-based multiview 2D/3D registration for image-guided orthopaedic surgery: incorporation of fiducial-based C-arm tracking and GPU-acceleration. IEEE Trans. Med. Imaging, 2012.
- [4] J. Aubrey et al.: Measurement of skeletal muscle radiation attenuation and basis of its biological variation.

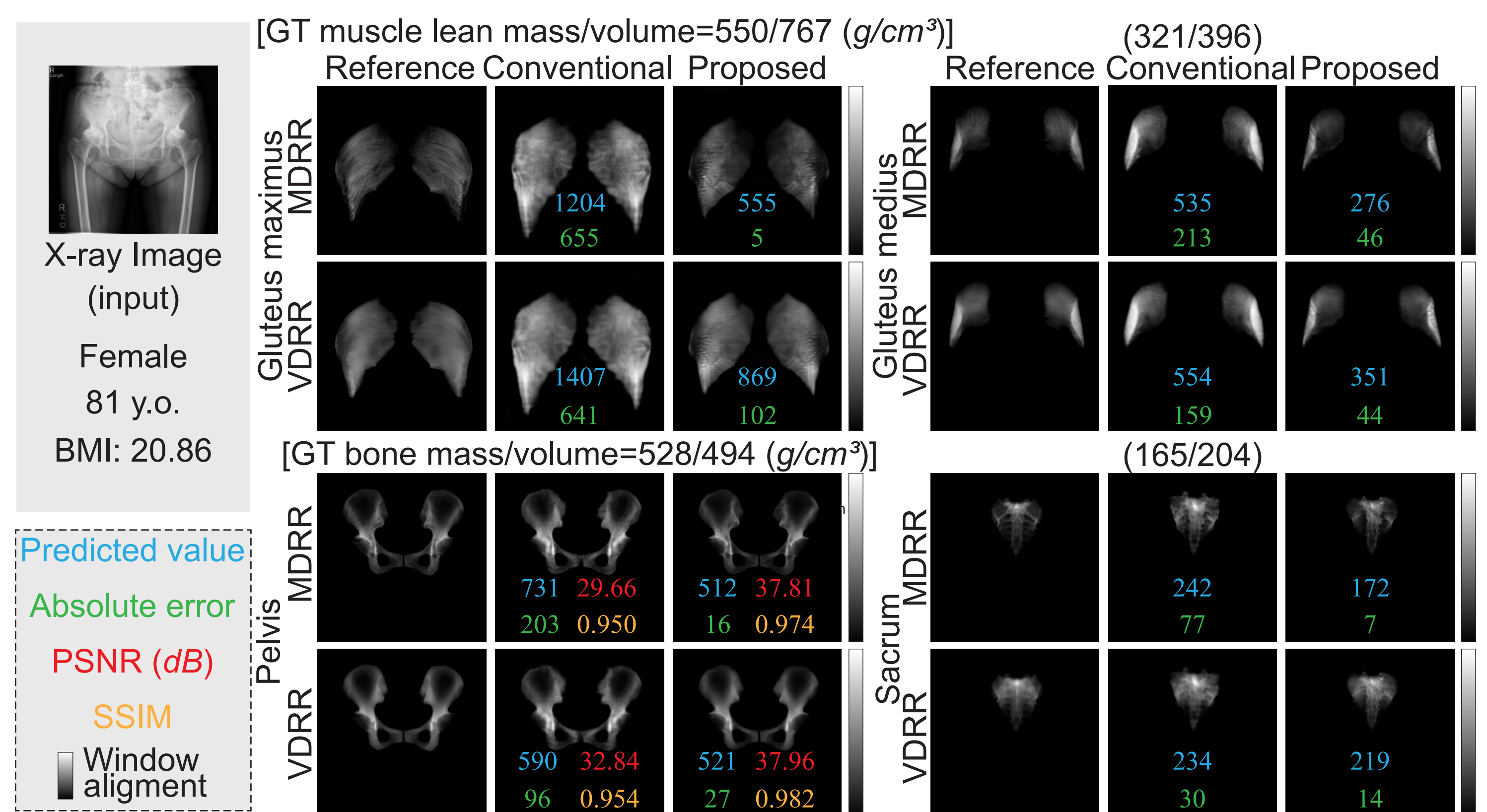
Result

Four-fold cross validation with 539 CT and X-ray image pairs.

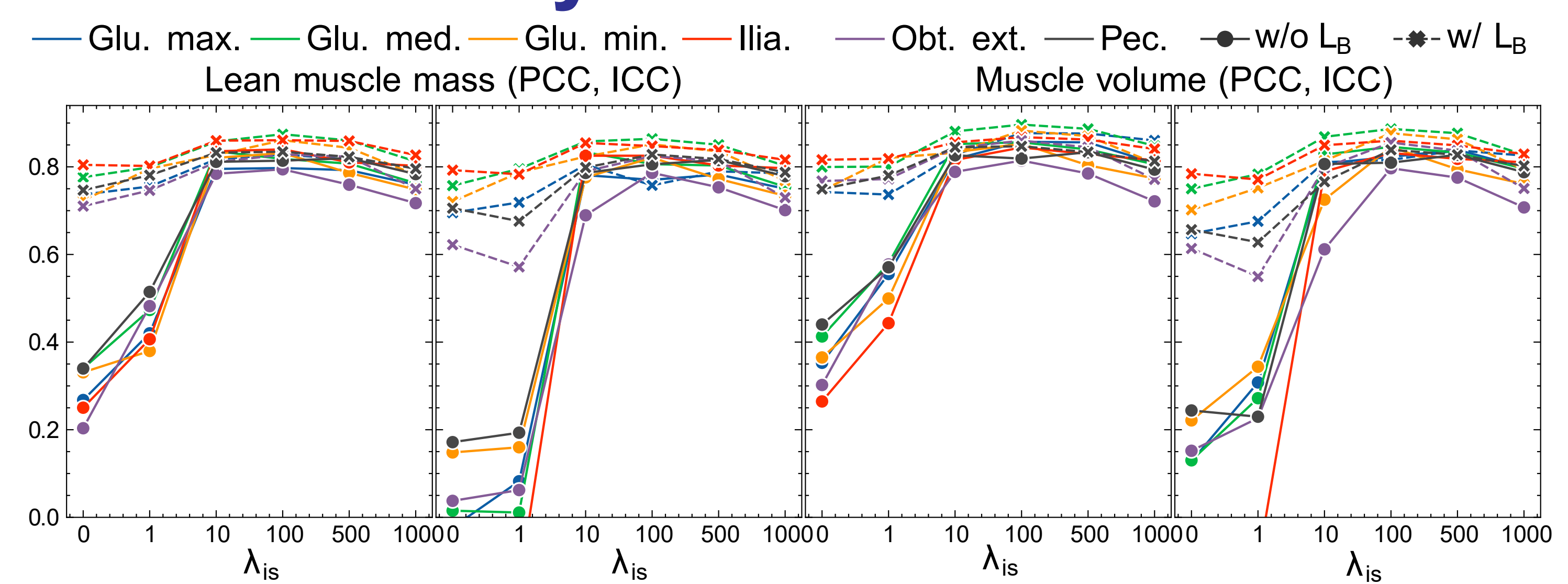
Quantitative result



Qualitative result



Ablation study



Conclusion

- Proposing a method, MSKdeX, for **fine-grained muscle properties estimation** from an X-ray image.
- Proposing effective losses, intensity-summation loss and registered bone loss for **significant improvement** of muscle properties estimation
- Future works include validations with **large-scale dataset** and extension to **large amount number of object**.