Shape Prior Generation using GAN for 3D-US Kidney Segmentation

Auteurs

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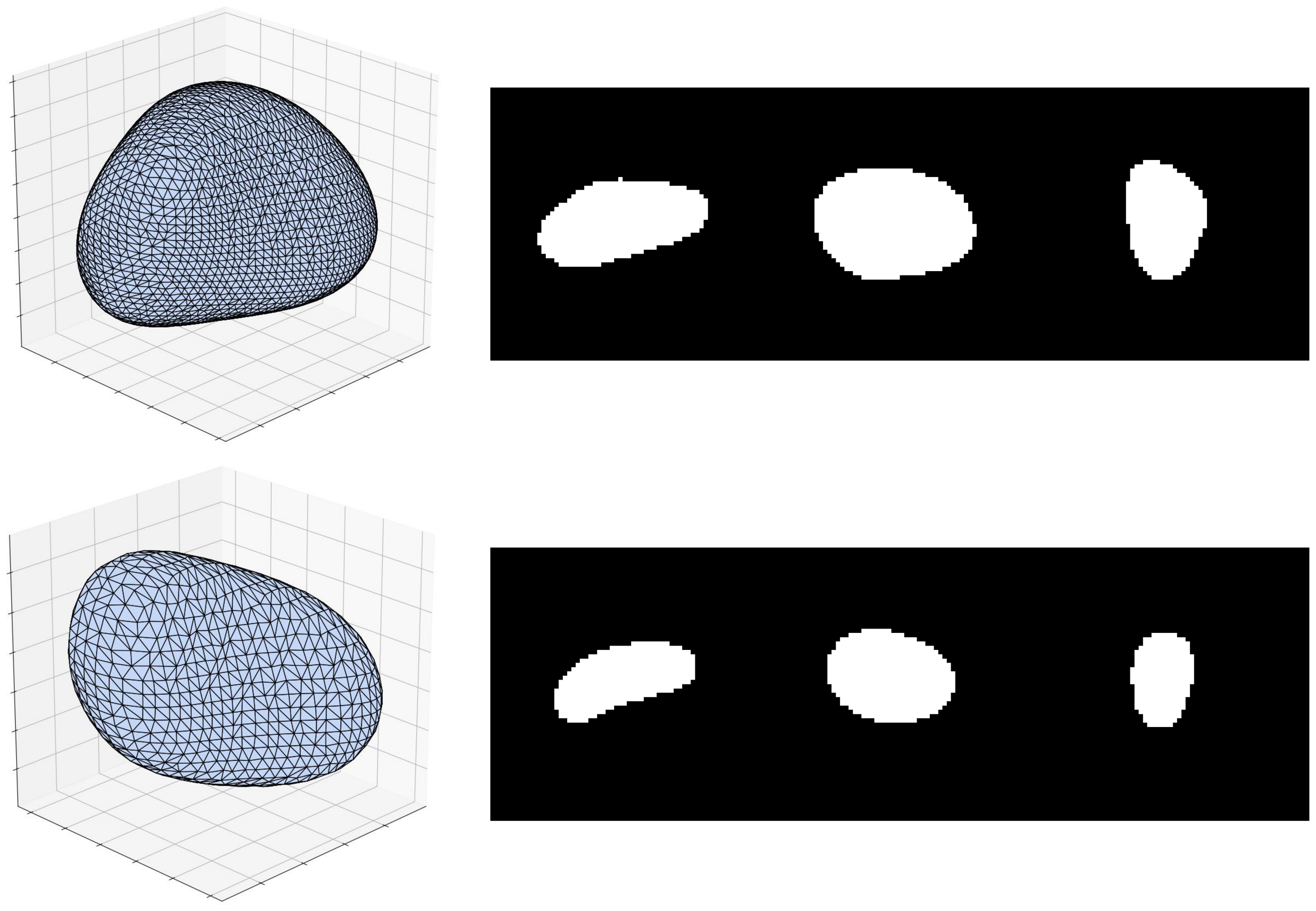
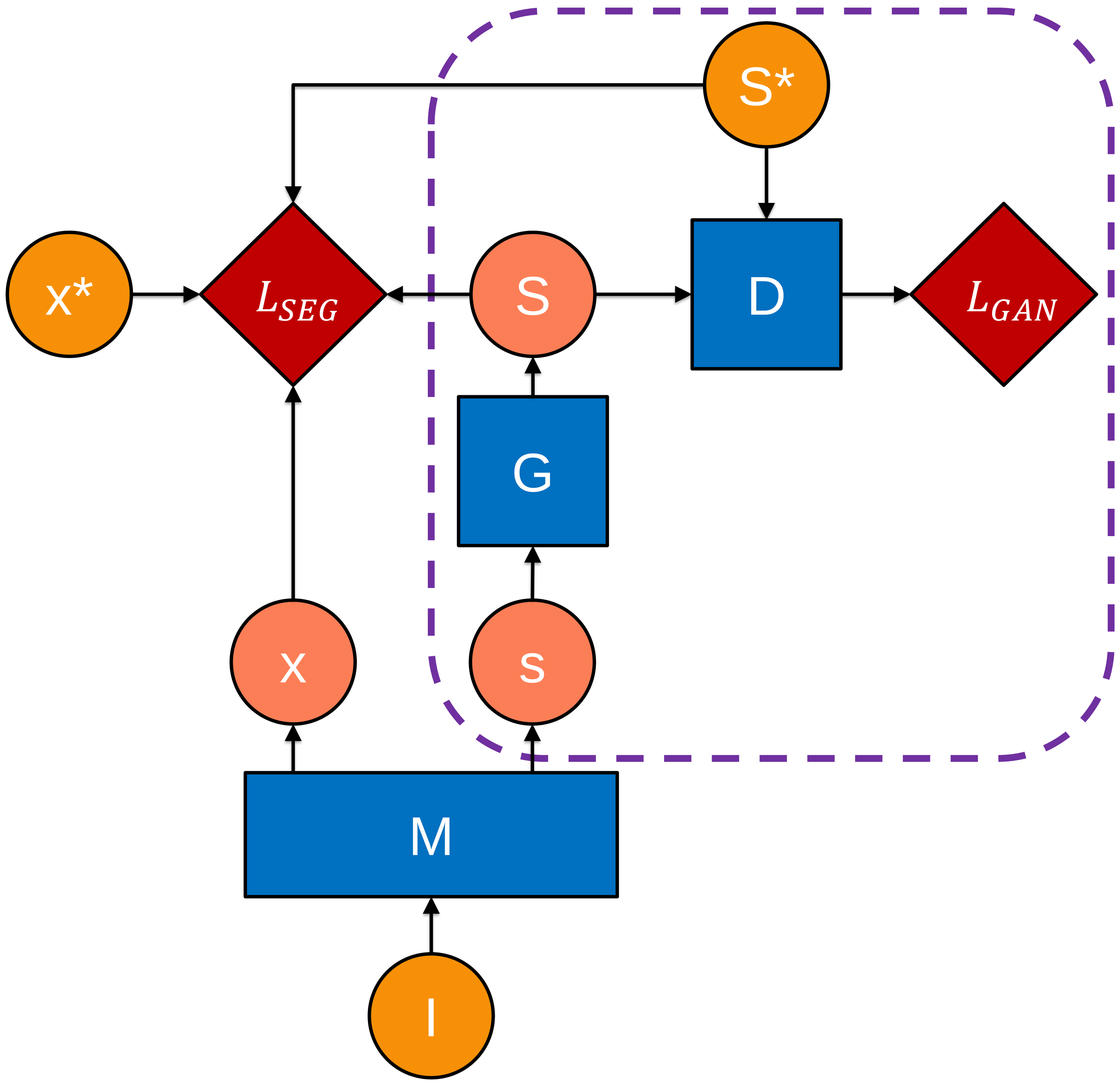
THE PROBLEM OF KIDNEY SEGMENTATION

- 3D ultrasound images require expertise to be interpreted. Automatic organ segmentation is therefore valuable.
- A shape prior is a constraint added to the segmenter on what shape can the target object take. It helps the segmenter to give better results.
- We have a dataset of 1020 3D-US images and their corresponding kidney segmentation.



USING A GAN AS A SHAPE PRIOR



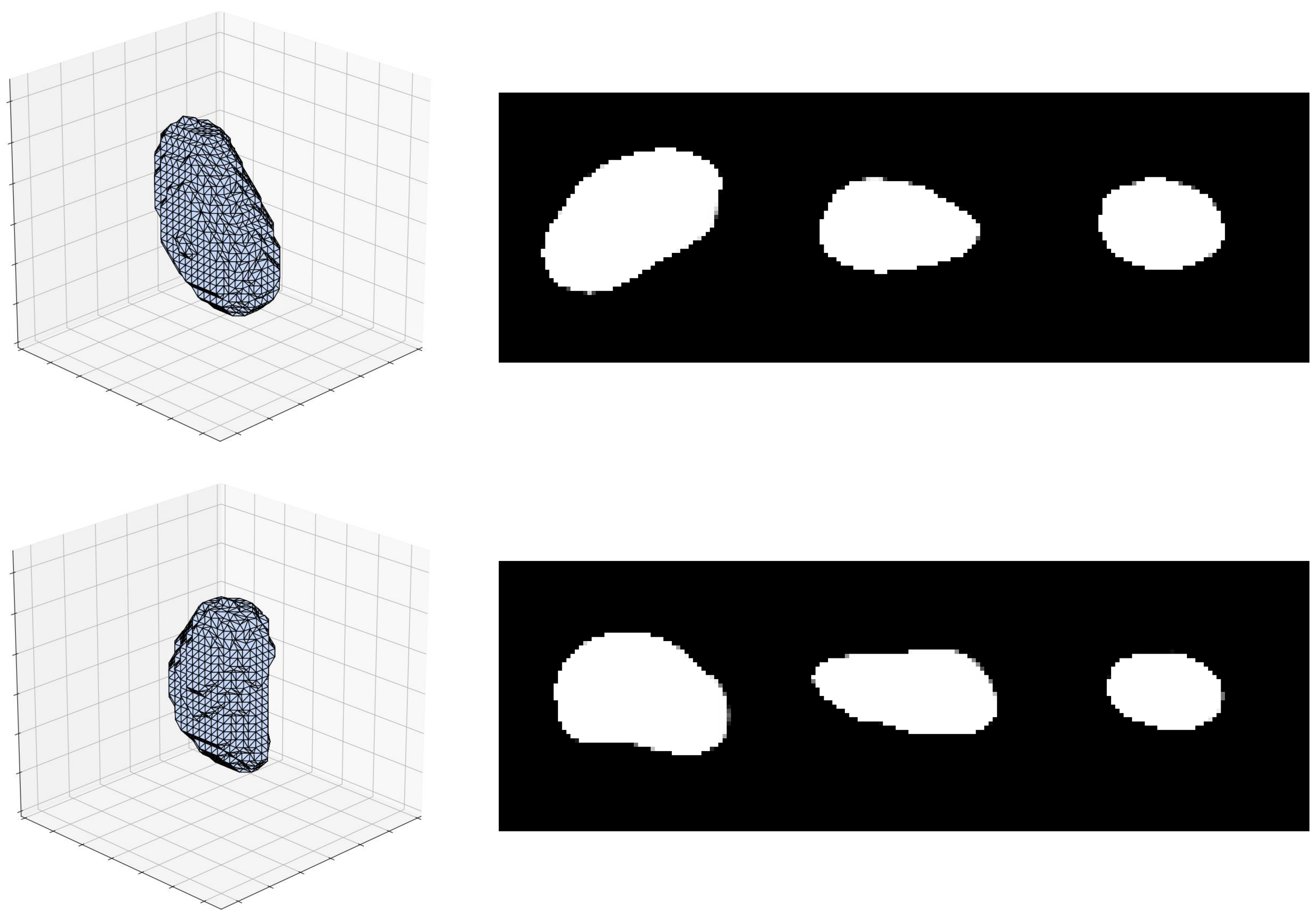
- We are using a Wasserstein GAN with Gradient Penalty (WGAN-GP). [1] [2]
- The training is done in two steps: first the generator using the GAN loss, then the segmenter M using the segmentation loss.
- The segmenter must transform the image in the appropriate input for the generator as well as predict the position of the center of the kidney in the image coordinate space.

$$L_D = E\left[D\left(G(s)\right)\right] - E\left[D(S^*)\right] + \lambda E\left[\left(\|\nabla_{\hat{x}} D(\hat{x})\| - 1\right)^2\right]$$

$$L_G = -E\left[D\left(G(s)\right)\right]$$

$$L_{SEG} = DICE(S + x; S^* + x^*)$$

PRELIMINARY RESULTS



REFERENCES

[1] Arjovsky *et al.* (2017) – Wasserstein GAN
[2] Gulrajani *et al.* (2017) – Improved Training of Wasserstein GANs
[3] Ronneberger *et al.* (2015) – U-Net: Convolutional Networks for Biomedical Image Segmentation
[4] Kamnitsas *et al.* (2016) – Unsupervised Domain Adaptation in Brain Lesion Segmentation with Adversarial Networks

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