Entropy Guided Unsupervised Domain Adaptation for Cross-Center Hip Cartilage Segmentation from MRI

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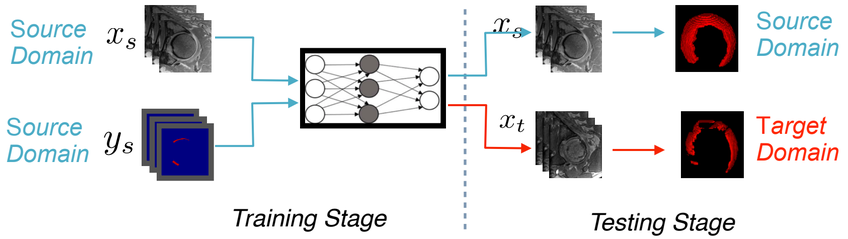
INTRODUCTION & AIM

Hip cartilage damage is a major predictor of the clinical out- come of surgical correction for femoro-acetabular impingement (FAI) and hip dysplasia. Automatic segmentation for hip cartilage is an essential prior step in assessing cartilage damage status.

Deep Convolutional Neural Networks have shown great success in various automated medical image segmentations, but testing on domain-shifted datasets (e.g. images obtained from different centers) can lead to severe performance losses. Our aim it to train a network which can realise cross-center hip MRI cartilage segmentation, without the need for additional time-consuming annotations on the target domain.



METHOD & DATASET

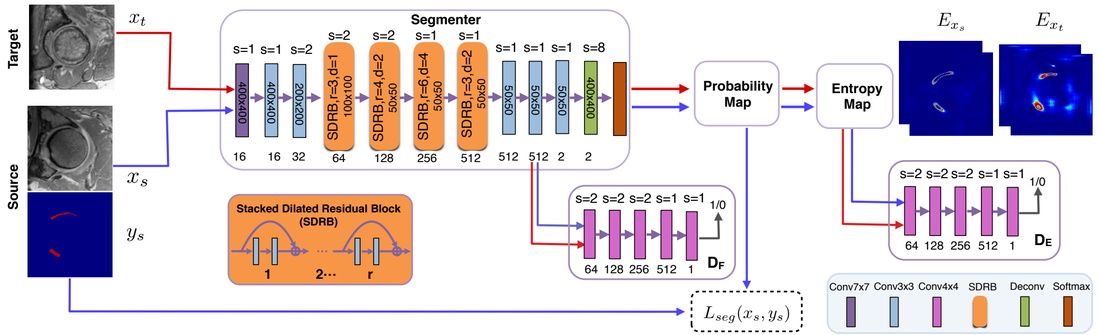


Figure 1. Method overview: red arrows and blue arrows represent the target and source domain, respectively. The segmenter is trained with supervised loss on the source domain, and unsupervised adversarial loss between domains by two discriminators, i.e. the feature map discriminator and the entropy map discriminator.

Dataset & Preprocessing

- The source dataset contains 25 hip MR images from University Hospital of Berne (20 for training and 5 for validation).
- The target dataset contains 21 hip MR images from the Boston Children's Hospital of Harvard Medical School (14 cases for training and 7 cases for testing).
- All MR images were resampled to $0.25*0.25*1mm^3$.

EXPERIMENTS & RESULTS

Table 1. Quantitative comparative results with other state-of-the-art methods for the task of cross-center hip cartilage segmentation.

Methods	Adaptation	DOC (%)	HD (mm)	ASD (mm)
No Adaptation	Train on Source Data Only	46.46	51.10	3.15
CycleGAN (Zhu et al.)	Image Appearance Translation	8.86	64.67	9.48
MCD (Saito et al.)	Max Classifier Discrepancy	59.74	32.43	2.10
ADDA (Tzeng et al.)	Feature Alignment	67.25	24.48	1.23
Ours	Feature Alignment + Entropy Alignment	**72.82**	**14.98**	**0.43**
Target Model	Train on Target Data Directly	81.30	10.48	0.37

Figure 2. Qualitative comparison of segmentation by different methods.