Unsupervised segmentation

Code
https://github.com/voxelmorph/voxelmorph/blob/dev/scripts/

Dataset https://github.com/voxelmorph/voxelmorph/tree/dev/data
(npz files)

Architecture:
(implemented using tensorflow as well as pytorch backend)
Defined a new architecture called Voxelmorph model,VxmDense [general
purpose library for learning-based tools for alignment/registration]
['https://github.com/voxelmorph/voxelmorph/blob/dev/voxelmorph/tf/netw
orks.py']

Parameters:
inshape: Input shape. e.g. (192, 192, 192)
nb_unet_features: Unet convolutional features. Can be specified via a
list of lists with the form [[encoder feats], [decoder feats]], or as
a single integer.
If None (default), the unet features are defined by the default config
described in the unet class documentation.
nb_unet_levels: Number of levels in unet. Only used when
nb_unet_features is an integer. Default is None.
unet_feat_mult: Per-level feature multiplier. Only used when
nb_unet_features is an integer. Default is 1.
nb_unet_conv_per_level: Number of convolutions per unet level. Default
is 1.
int_steps: Number of flow integration steps. The warp is
non-diffeomorphic when this
                value is 0.
svf_resolution: Resolution (relative voxel size) of the predicted SVF.
                Default is 1.
int_resolution: Resolution (relative voxel size) of the flow field
during vector integration. Default is 2.
int_downsize: Deprecated - use int_resolution instead.
bidir: Enable bidirectional cost function. Default is False.
use_probs: Use probabilities in flow field. Default is False.

src_feats: Number of source image features. Default is 1.
trg_feats: Number of target image features. Default is 1.
unet_half_res: Deprecated - use svf_resolution instead.
input_model: Model to replace default input layer before concatenation. Default is None.
hyp_model: HyperMorph hypernetwork model. Default is None.
reg_field: Field to regularize in the loss. Options are 'svf' to return the
SVF predicted by the Unet, 'preintegrated' to return the SVF that's been rescaled for vector-integration (default), 'postintegrated' to return the rescaled vector-integrated field, and 'warp' to return the final, full-res warp.
name: Model name - also used as layer name prefix. Default is 'vxm_dense'.

Optimizer:
Adam, learning rate can be defined in the command line

Metric: Dice Score

Results of experimentation:

Largely reduces the number of outliers with very poor segmentation (e.g., there are over 100 cases with Unsupervised Deep Learning for Bayesian Brain MRI Segmentation Dice lower than 50% in the caudate(part of the brain) for the baseline approach, and none for this method).

In the T1 dataset, the test intensity distribution is slightly different that of the training dataset. However, this approach successfully generalizes and outperforms the baseline (average 81.9% vs. 79.4%, hippocampi(part of the brain) 79.9% vs. 73.5%).

The results of the experiment with lesser data illustrates the ability of this method to adapt to contrasts other than T1, even when the data is limited, it outperforms the baseline (average 80.5% vs. 78.3%, hippocampi 76.6% vs. 69.8%).