JNet_588 Report

psf loss 1.0 and ewc 1.0, adjust_luminance = false
pretrained model : JNet_584_pretrain

Model Parameters

|Parameter|Value|Comment| | :--- | :--- | :--- | |hidden_channels_list|[16, 32, 64, 128, 256]|| |attn_list|[False, False, False, False, False]|| |nblocks|2|| |activation|nn.ReLU(inplace=True)|| |dropout|0.5|| |superres|True|| |partial|None|| |reconstruct|False|| |apply_vq|False|| |use_x_quantized|False|| |threshold|0.5|| |use_fftconv|True|| |mu_z|1.2|| |sig_z|0.3|| |blur_mode|gibsonlanni|`gaussian` or `gibsonlanni`| |size_x|51|| |size_y|51|| |size_z|201|| |NA|0.7|| |wavelength|0.9|microns| |M|20|magnification| |ns|1.4|specimen refractive index (RI)| |ng0|1.5|coverslip RI design value| |ng|1.5|coverslip RI experimental value| |ni0|1.33|immersion medium RI design value| |ni|1.33|immersion medium RI experimental value| |ti0|150|microns, working distance (immersion medium thickness) design value| |tg0|170|microns, coverslip thickness design value| |tg|170|microns, coverslip thickness experimental value| |res_lateral|0.05|microns| |res_axial|0.5|microns| |pZ|0|microns, particle distance from coverslip| |bet_z|5.0|| |bet_xy|10.0|| |poisson_weight|0.001|| |sig_eps|0.001|| |background|0.01|| |scale|10|| |mid|40|num of NeurIPSF middle channel| |loss_fn|nn.MSELoss()|loss func for NeurIPSF| |lr|0.01|lr for pre-training NeurIPSF| |num_iter_psf_pretrain|20000|epoch for pre-training of NeurIPSF| |nipsf_loss_target|1e-05|epoch for pre-training of NeurIPSF| |device|cuda||

Datasets and other training details

simulation_data_generation

|Parameter|Value| | :--- | :--- | |dataset_name|_var_num_realisticdata3| |train_num|16| |valid_num|4| |image_size|[1200, 500, 500]| |train_object_num_min|1500| |train_object_num_max|2500| |valid_object_num_min|1500| |valid_object_num_max|2500|

pretrain_dataset

|Parameter|Value| | :--- | :--- | |folderpath|_var_num_realisticdata3| |labelname|_label| |size|[1200, 500, 500]| |cropsize|[240, 112, 112]| |I|200| |low|0| |high|16| |scale|10| |mask|True| |mask_size|[1, 10, 10]| |mask_num|30| |surround|False| |surround_size|[32, 4, 4]|

pretrain_val_dataset

|Parameter|Value| | :--- | :--- | |folderpath|_var_num_realisticdata3| |labelname|_label| |size|[1200, 500, 500]| |cropsize|[240, 112, 112]| |I|20| |low|16| |high|20| |scale|10| |mask|False| |mask_size|[1, 10, 10]| |mask_num|False| |surround|False| |surround_size|[32, 4, 4]| |seed|907|

train_dataset

|Parameter|Value| | :--- | :--- | |folderpath|_20231208_tsuji_beads_stackreged| |size|[310, 512, 512]| |cropsize|[240, 112, 112]| |I|200| |scale|10| |train|True| |mask|True| |mask_size|[1, 10, 10]| |mask_num|10| |surround|False| |surround_size|[32, 4, 4]|

val_dataset

|Parameter|Value| | :--- | :--- | |folderpath|_20231208_tsuji_beads_stackreged| |size|[310, 512, 512]| |cropsize|[240, 112, 112]| |I|20| |scale|10| |train|False| |mask|False| |mask_size|[1, 10, 10]| |mask_num|10| |surround|False| |surround_size|[32, 4, 4]| |seed|723|

pretrain_loop

|Parameter|Value| | :--- | :--- | |batch_size|1| |n_epochs|100| |lr|0.001| |loss_fnx|nn.BCELoss()| |loss_fnz|nn.BCELoss()| |path|model| |savefig_path|train| |partial|params['partial']| |ewc|None| |es_patience|10| |is_vibrate|False| |weight_x|1| |weight_z|1| |without_noise|False|

train_loop

|Parameter|Value| | :--- | :--- | |batch_size|1| |n_epochs|100| |lr|0.001| |loss_fn|nn.MSELoss()| |path|model| |savefig_path|train| |partial|None| |ewc|True| |params|params| |es_patience|10| |reconstruct|True| |is_instantblur|False| |is_vibrate|False| |adjust_luminance|False| |zloss_weight|1| |ewc_weight|1.0| |qloss_weight|1.0| |ploss_weight|1.0| |mrfloss_order|1| |mrfloss_dilation|1| |mrfloss_weights|{'l_00': 0, 'l_01': 0, 'l_10': 0, 'l_11': 0}|

Results

Pretraining

Segmentation: mean MSE: 0.007117437664419413, mean BCE: 0.027199745178222656
Luminance Estimation: mean MSE: 0.981894314289093, mean BCE: inf

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|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |
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JNet

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outputx

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JNet

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labelx

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JNet

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JNet

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MSEx: 0.00663389265537262, BCEx: 0.024624068289995193
MSEz: 0.9796909689903259, BCEz: inf

|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |
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outputx

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JNet

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JNet

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JNet

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MSEx: 0.00663389265537262, BCEx: 0.024624068289995193
MSEz: 0.9796909689903259, BCEz: inf

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|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | |
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JNet

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pretrain

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outputx

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JNet

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584

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pretrain

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labelx

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plane

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JNet

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584

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pretrain

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outputz

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JNet

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584

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pretrain

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labelz

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MSEx: 0.007459986489266157, BCEx: 0.02866789698600769
MSEz: 0.9869283437728882, BCEz: inf

|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |
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JNet

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584

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pretrain

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outputx

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depth

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JNet

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584

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pretrain

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labelx

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depth

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JNet

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584

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pretrain

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outputz

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depth

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JNet

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584

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MSEx: 0.007459986489266157, BCEx: 0.02866789698600769
MSEz: 0.9869283437728882, BCEz: inf

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|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |

JNet

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584

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pretrain

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original

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plane

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JNet

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584

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pretrain

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novibrate

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plane

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JNet

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584

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pretrain

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aligned

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plane

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JNet

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584

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pretrain

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outputx

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plane

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JNet

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584

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pretrain

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labelx

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plane

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JNet

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584

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pretrain

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outputz

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JNet

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MSEx: 0.007038201671093702, BCEx: 0.027654405683279037
MSEz: 0.9864491820335388, BCEz: 8.229743957519531

|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |

JNet

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584

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pretrain

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JNet

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JNet

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pretrain

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outputz

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JNet

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MSEx: 0.007038201671093702, BCEx: 0.027654405683279037
MSEz: 0.9864491820335388, BCEz: 8.229743957519531

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|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |
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JNet

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outputx

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JNet

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584

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pretrain

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labelx

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plane

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JNet

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584

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pretrain

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outputz

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plane

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JNet

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pretrain

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labelz

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MSEx: 0.008302591741085052, BCEx: 0.03168882057070732
MSEz: 0.9688166975975037, BCEz: inf

|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |
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JNet

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outputx

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JNet

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584

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pretrain

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labelx

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depth

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JNet

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584

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pretrain

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outputz

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depth

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JNet

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pretrain

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depth

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MSEx: 0.008302591741085052, BCEx: 0.03168882057070732
MSEz: 0.9688166975975037, BCEz: inf

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|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |
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JNet

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JNet

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pretrain

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labelx

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plane

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JNet

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584

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pretrain

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outputz

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plane

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JNet

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584

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pretrain

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labelz

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plane

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MSEx: 0.0061525143682956696, BCEx: 0.02336353063583374
MSEz: 0.9875862002372742, BCEz: inf

|original|novibrate|aligned|outputx|labelx|outputz|labelz| | :---: | :---: | :---: | :---: | :---: | :---: | :---: | | |

JNet

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584

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pretrain

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original

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JNet

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pretrain

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novibrate

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JNet

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584

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pretrain

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aligned

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depth

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JNet

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584

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pretrain

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outputx

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JNet

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584

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pretrain

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labelx

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JNet
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pretrain
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depth
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JNet
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584
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pretrain
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labelz
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MSEx: 0.0061525143682956696, BCEx: 0.02336353063583374
MSEz: 0.9875862002372742, BCEz: inf

pretrain

volume mean: 3.4894237711588554, volume sd: 0.23449575599800496

beads_roi000_im000.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi000

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im000.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi000

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im000.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi000

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im000.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi000

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im000.

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heatmap

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depth

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volume: 3.2842309570312507, MSE: 0.001101232715882361, quantized loss: 0.00028521419153548777

beads_roi001_im004.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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pretrain

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beads

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roi001

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im004.

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original

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depth

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JNet

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pretrain

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beads

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roi001

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im004.

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JNet

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584

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pretrain

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beads

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roi001

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im004.

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JNet

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584

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pretrain

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beads

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roi001

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im004.

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heatmap

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depth

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volume: 3.8444382324218758, MSE: 0.0011423139367252588, quantized loss: 0.00033242456265725195

beads_roi002_im005.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi002

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im005.

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original

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JNet

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584

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pretrain

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beads

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roi002

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im005.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi002

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im005.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi002

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im005.

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heatmap

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depth

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volume: 3.419813232421876, MSE: 0.0010817451402544975, quantized loss: 0.00030168122611939907

beads_roi003_im006.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi003

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im006.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi003

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im006.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi003

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im006.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi003

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im006.

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heatmap

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depth

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volume: 3.503425048828126, MSE: 0.001097343978472054, quantized loss: 0.00030660154880024493

beads_roi004_im006.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi004

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im006.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi004

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im006.

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output

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depth

JNet

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584

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pretrain

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beads

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roi004

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im006.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi004

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im006.

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heatmap

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depth

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volume: 3.5564414062500007, MSE: 0.0011274017160758376, quantized loss: 0.00031118563492782414

beads_roi005_im007.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi005

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im007.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi005

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im007.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi005

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im007.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi005

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im007.

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heatmap

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depth

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volume: 3.322938720703126, MSE: 0.0010796904098242521, quantized loss: 0.00029913525213487446

beads_roi006_im008.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi006

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im008.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi006

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im008.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi006

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im008.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi006

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im008.

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heatmap

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depth

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volume: 3.613320556640626, MSE: 0.001059770118445158, quantized loss: 0.0003323771816212684

beads_roi007_im009.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi007

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im009.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi007

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im009.

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output

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depth

JNet

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584

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pretrain

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beads

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roi007

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im009.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi007

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im009.

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heatmap

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depth

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volume: 3.435328613281251, MSE: 0.00111062778159976, quantized loss: 0.0003017105918843299

beads_roi008_im010.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi008

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im010.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi008

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im010.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi008

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im010.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi008

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im010.

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heatmap

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depth

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volume: 3.5335095214843757, MSE: 0.0010923290392383933, quantized loss: 0.00030853398493491113

beads_roi009_im011.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |
JNet

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584

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pretrain

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beads

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roi009

–

im011.

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original

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depth
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JNet

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584

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pretrain

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beads

–

roi009

–

im011.

–

output

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depth

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JNet

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584

–

pretrain

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beads

–

roi009

–

im011.

–

reconst

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depth

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JNet

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584

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pretrain

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beads

–

roi009

–

im011.

–

heatmap

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depth

|

volume: 3.334980224609376, MSE: 0.0010555305052548647, quantized loss: 0.0002989350468851626

beads_roi010_im012.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi010

–

im012.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi010

–

im012.

–

output

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depth

JNet

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584

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pretrain

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beads

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roi010

–

im012.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi010

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im012.

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heatmap

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depth

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volume: 3.898695312500001, MSE: 0.001117922249250114, quantized loss: 0.00033721773070283234

beads_roi011_im013.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi011

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im013.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi011

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im013.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi011

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im013.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi011

–

im013.

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heatmap

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depth

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volume: 3.940753173828126, MSE: 0.0011050108587369323, quantized loss: 0.00034512538695707917

beads_roi012_im014.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi012

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im014.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi012

–

im014.

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output

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depth

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JNet

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584

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pretrain

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beads

–

roi012

–

im014.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi012

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im014.

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heatmap

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depth

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volume: 3.4553366699218757, MSE: 0.001213587005622685, quantized loss: 0.0002906744775827974

beads_roi013_im015.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi013

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im015.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi013

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im015.

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output

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depth

JNet

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584

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pretrain

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beads

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roi013

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im015.

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reconst

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depth

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JNet

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584

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pretrain

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beads

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roi013

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im015.

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heatmap

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depth

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volume: 3.208452392578126, MSE: 0.001137966406531632, quantized loss: 0.00028277223464101553

beads_roi014_im016.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi014

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im016.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi014

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im016.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi014

–

im016.

–

reconst

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depth

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JNet

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584

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pretrain

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beads

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roi014

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im016.

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heatmap

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depth

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volume: 3.3563659667968757, MSE: 0.0010714237578213215, quantized loss: 0.00033797870855778456

beads_roi015_im017.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi015

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im017.

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original

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depth

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JNet

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584

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pretrain

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beads

–

roi015

–

im017.

–

output

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depth

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JNet

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584

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pretrain

–

beads

–

roi015

–

im017.

–

reconst

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depth

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JNet

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584

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pretrain

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beads

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roi015

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im017.

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heatmap

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depth

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volume: 3.246431640625001, MSE: 0.0010734890820458531, quantized loss: 0.0002901337284129113

beads_roi016_im018.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi016

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im018.

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original

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depth

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JNet

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584

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pretrain

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beads

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roi016

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im018.

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output

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depth

JNet

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584

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pretrain

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beads

–

roi016

–

im018.

–

reconst

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depth

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JNet

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584

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pretrain

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beads

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roi016

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im018.

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heatmap

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depth

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volume: 3.5162871093750008, MSE: 0.0011937689268961549, quantized loss: 0.00029882637318223715

beads_roi017_im018.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi017

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im018.

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original

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depth

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JNet

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584

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pretrain

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beads

–

roi017

–

im018.

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output

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depth

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JNet

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584

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pretrain

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beads

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roi017

_

im018.

_

reconst

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depth

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JNet

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584

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pretrain

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beads

_

roi017

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im018.

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heatmap

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depth

|

volume: 3.405478515625001, MSE: 0.0012289440492168069, quantized loss: 0.00028909786487929523

beads_roi018_im022.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi018

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im022.

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original

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depth

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JNet

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584

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pretrain

–

beads

–

roi018

–

im022.

–

output

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi018

–

im022.

–

reconst

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi018

–

im022.

–

heatmap

–

depth

|

volume: 3.0705837402343756, MSE: 0.001083890674635768, quantized loss: 0.00027944252360612154

beads_roi019_im023.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi019

–

im023.

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original

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depth

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JNet

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584

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pretrain

–

beads

–

roi019

–

im023.

–

output

–

depth

JNet

–

584

–

pretrain

–

beads

–

roi019

–

im023.

–

reconst

–

depth

|

JNet

–

584

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pretrain

–

beads

–

roi019

–

im023.

–

heatmap

–

depth

|

volume: 3.0369553222656256, MSE: 0.0011049945605918765, quantized loss: 0.0002759440103545785

beads_roi020_im024.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi020

–

im024.

–

original

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depth

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JNet

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584

–

pretrain

–

beads

–

roi020

–

im024.

–

output

–

depth

|

JNet

–

584

–

pretrain

_

beads

_

roi020

_

im024.

_

reconst

_

depth

|

JNet

_

584

_

pretrain

_

beads

_

roi020

_

im024.

_

heatmap

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depth

|

volume: 3.6872309570312507, MSE: 0.0011134262895211577, quantized loss: 0.00030431768391281366

beads_roi021_im026.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi021

–

im026.

–

original

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depth

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JNet

–

584

–

pretrain

–

beads

–

roi021

–

im026.

–

output

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi021

–

im026.

–

reconst

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi021

–

im026.

–

heatmap

–

depth

|

volume: 3.5494353027343757, MSE: 0.0010463210055604577, quantized loss: 0.00030415935907512903

beads_roi022_im027.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi022

–

im027.

–

original

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depth

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JNet

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584

–

pretrain

–

beads

–

roi022

–

im027.

–

output

–

depth

JNet

–

584

–

pretrain

–

beads

–

roi022

–

im027.

–

reconst

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi022

–

im027.

–

heatmap

–

depth

|

volume: 3.379167724609376, MSE: 0.001115325023420155, quantized loss: 0.0002856942592188716

beads_roi023_im028.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

–

roi023

–

im028.

–

original

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depth

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JNet

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584

–

pretrain

–

beads

–

roi023

–

im028.

–

output

–

depth

|

JNet

–

584

–

pretrain

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beads

_

roi023

_

im028.

_

reconst

_

depth

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JNet

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584

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pretrain

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beads

_

roi023

_

im028.

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heatmap

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depth

|

volume: 3.887989746093751, MSE: 0.000940138241276145, quantized loss: 0.00036663454375229776

beads_roi024_im028.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

–

roi024

–

im028.

–

original

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depth

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JNet

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584

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pretrain

–

beads

–

roi024

–

im028.

–

output

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi024

–

im028.

–

reconst

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi024

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im028.

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heatmap

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depth

|

volume: 3.743247314453126, MSE: 0.0010195090435445309, quantized loss: 0.0003285563725512475

beads_roi025_im028.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi025

_

im028.

_

original

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depth

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JNet

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584

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pretrain

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beads

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roi025

–

im028.

–

output

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depth

JNet

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584

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pretrain

–

beads

–

roi025

–

im028.

–

reconst

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depth

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JNet

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584

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pretrain

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beads

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roi025

–

im028.

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heatmap

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depth

|

volume: 3.743247314453126, MSE: 0.0010195090435445309, quantized loss: 0.0003285563725512475

beads_roi026_im029.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi026

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im029.

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original

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depth

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JNet

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584

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pretrain

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beads

–

roi026

–

im029.

–

output

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depth

|

JNet

–

584

–

pretrain

–

beads

–

roi026

–

im029.

–

reconst

–

depth

|

JNet

–

584

–

pretrain

–

beads

–

roi026

–

im029.

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heatmap

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depth

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volume: 3.7226926269531257, MSE: 0.0011379948118701577, quantized loss: 0.00031799066346138716

beads_roi027_im029.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi027

–

im029.

–

original

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depth

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JNet

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584

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pretrain

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beads

–

roi027

–

im029.

–

output

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depth

|

JNet

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584

–

pretrain

–

beads

–

roi027

–

im029.

–

reconst

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depth

|

JNet

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584

–

pretrain

–

beads

–

roi027

–

im029.

–

heatmap

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depth

|

volume: 3.2995615234375006, MSE: 0.0011108177714049816, quantized loss: 0.0002911230840254575

beads_roi028_im030.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

–

roi028

–

im030.

–

original

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depth

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JNet

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584

–

pretrain

–

beads

–

roi028

–

im030.

–

output

–

depth

JNet

–

584

–

pretrain

–

beads

–

roi028

–

im030.

–

reconst

–

depth

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JNet

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584

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pretrain

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beads

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roi028

_

im030.

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heatmap

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depth

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volume: 3.278461914062501, MSE: 0.001091885264031589, quantized loss: 0.00028876453870907426

beads_roi029_im030.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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584

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pretrain

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beads

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roi029

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im030.

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original

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depth

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JNet

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584

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pretrain

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beads

–

roi029

–

im030.

–

output

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depth

|

JNet

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584

–

pretrain

–

beads

–

roi029

–

im030.

–

reconst

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depth

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JNet

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584

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pretrain

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beads

–

roi029

–

im030.

–

heatmap

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depth

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volume: 3.4079123535156257, MSE: 0.0011299886973574758, quantized loss: 0.0002938350953627378

finetuning

volume mean: 4.140385725911459, volume sd: 0.32927357608995167

beads_roi000_im000.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

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depth

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JNet

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588

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beads

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roi000

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im000.

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reconst

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depth

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JNet

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588

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beads

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roi000

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im000.

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heatmap

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depth

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volume: 3.871262451171876, MSE: 0.0008142756414599717, quantized loss: 0.00034754903754219413

beads_roi001_im004.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

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roi001

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im004.

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original

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depth

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JNet

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588

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beads

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roi001

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im004.

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output

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depth

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JNet

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588

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beads

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roi001

–

im004.

–

reconst

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depth

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JNet

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588

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beads

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roi001

–

im004.

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heatmap

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depth

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volume: 4.524293945312501, MSE: 0.0012407031608745456, quantized loss: 0.00041940505616366863

beads_roi002_im005.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

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roi002

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im005.

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original

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depth

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JNet

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588

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beads

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roi002

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im005.

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output

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depth

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JNet

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588

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beads

–

roi002

–

im005.

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reconst

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depth

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JNet

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588

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beads

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roi002

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im005.

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heatmap

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depth

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volume: 3.988917236328126, MSE: 0.0009958130540326238, quantized loss: 0.00036364560946822166

beads_roi003_im006.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

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roi003

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im006.

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original

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depth

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JNet

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588

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beads

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roi003

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im006.

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output

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depth

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JNet

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588

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beads

–

roi003

–

im006.

–

reconst

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depth

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JNet

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588

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beads

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roi003

–

im006.

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heatmap

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depth

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volume: 4.140741699218751, MSE: 0.0009553001145832241, quantized loss: 0.00040723782149143517

beads_roi004_im006.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

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roi004

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im006.

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original

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depth

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JNet

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588

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beads

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roi004

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im006.

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output

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depth

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JNet

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588

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beads

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roi004

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im006.

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reconst

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depth

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JNet

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588

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beads

–

roi004

–

im006.

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heatmap

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depth

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volume: 4.305850585937501, MSE: 0.0010046787792816758, quantized loss: 0.0004103612736798823

beads_roi005_im007.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

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roi005

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im007.

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original

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depth

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JNet

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588

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beads

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roi005

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im007.

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output

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depth

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JNet

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588

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beads

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roi005

–

im007.

–

reconst

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depth

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JNet

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588

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beads

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roi005

–

im007.

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heatmap

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depth

|

volume: 4.128540039062501, MSE: 0.0009457077248953283, quantized loss: 0.0004073472518939525

beads_roi006_im008.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

–

588

–

beads

–

roi006

–

im008.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi006

–

im008.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi006

–

im008.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi006

–

im008.

–

heatmap

–

depth

|

volume: 4.286878417968751, MSE: 0.0010667891474440694, quantized loss: 0.0004549869627226144

beads_roi007_im009.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

–

beads

–

roi007

–

im009.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi007

–

im009.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi007

–

im009.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi007

–

im009.

–

heatmap

–

depth

|

volume: 4.160157226562501, MSE: 0.0009949057130143046, quantized loss: 0.0004021613276563585

beads_roi008_im010.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi008

–

im010.

–

original

–

depth

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JNet

–

588

–

beads

–

roi008

–

im010.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi008

–

im010.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi008

–

im010.

–

heatmap

–

depth

|

volume: 4.338860351562501, MSE: 0.0010538581991568208, quantized loss: 0.0004094493924640119

beads_roi009_im011.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

–

beads

–

roi009

–

im011.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi009

–

im011.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi009

–

im011.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi009

–

im011.

–

heatmap

–

depth

|

volume: 3.988388916015626, MSE: 0.0008648636285215616, quantized loss: 0.00036720995558425784

beads_roi010_im012.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi010

–

im012.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi010

–

im012.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi010

–

im012.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi010

–

im012.

–

heatmap

–

depth

|

volume: 4.773180664062501, MSE: 0.0011614401591941714, quantized loss: 0.00045484394649975

beads_roi011_im013.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

–

beads

–

roi011

–

im013.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi011

–

im013.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi011

–

im013.

–

reconst

–

depth

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JNet

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588

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beads

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roi011

_

im013.

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heatmap

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depth
|

volume: 4.591898437500001, MSE: 0.0011228666407987475, quantized loss: 0.0004261753347236663

beads_roi012_im014.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

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roi012

_

im014.

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original

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depth

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JNet

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588

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beads

–

roi012

–

im014.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi012

–

im014.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi012

–

im014.

–

heatmap

–

depth

|

volume: 4.012067138671876, MSE: 0.0010046296520158648, quantized loss: 0.0003549605899024755

beads_roi013_im015.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi013

–

im015.

–

original

–

depth

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JNet

–

588

–

beads

–

roi013

–

im015.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi013

–

im015.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi013

–

im015.

–

heatmap

–

depth

|

volume: 3.904076660156251, MSE: 0.0008911574259400368, quantized loss: 0.00035656860563904047

beads_roi014_im016.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

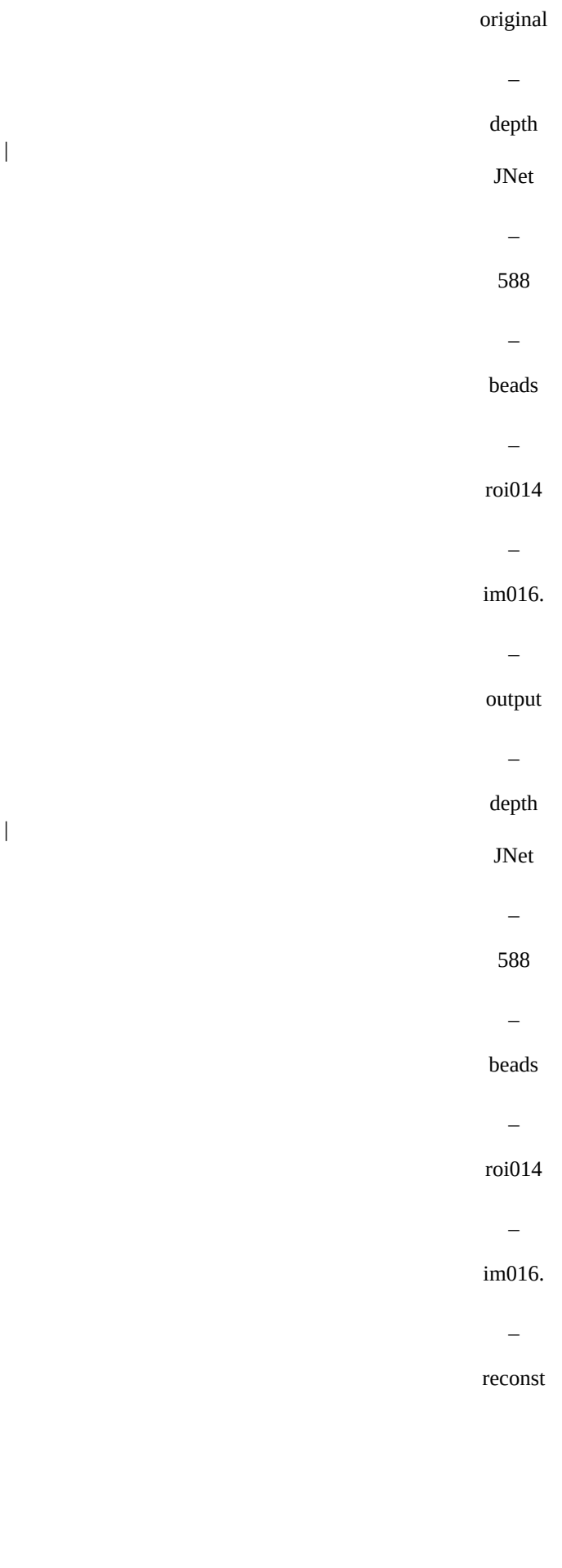
–

roi014

–

im016.

–


original
–
depth
|
JNet
–
588
–
beads
–
roi014
–
im016.
–
output
–
depth
|
JNet
–
588
–
beads
–
roi014
–
im016.
–
reconst

–

depth

|

JNet

–

588

–

beads

–

roi014

–

im016.

–

heatmap

–

depth

|

volume: 3.6679875488281257, MSE: 0.001050428836606443, quantized loss: 0.0003859648131765425

beads_roi015_im017.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi015

–

im017.

–

original

–

depth

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JNet

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588

–

beads

–

roi015

–

im017.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi015

–

im017.

–

reconst

–

depth

|

JNet

–

588

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beads

–

roi015

–

im017.

–

heatmap

–

depth

|

volume: 3.973060791015626, MSE: 0.000845202011987567, quantized loss: 0.0003793463984038681

beads_roi016_im018.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi016

–

im018.

–

original

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depth

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JNet

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588

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beads

–

roi016

–

im018.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi016

–

im018.

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reconst

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depth

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JNet

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588

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beads

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roi016

_

im018.

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heatmap

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depth

|

volume: 4.435893066406251, MSE: 0.0010361452586948872, quantized loss: 0.0004482119402382523

beads_roi017_im018.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

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roi017

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im018.

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original

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depth

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JNet

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588

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beads

–

roi017

–

im018.

–

output

–

depth

|

JNet

–

588

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beads

–

roi017

–

im018.

–

reconst

–

depth

|

JNet

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588

–

beads

–

roi017

–

im018.

–

heatmap

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depth

|

volume: 4.269465820312501, MSE: 0.0010318701388314366, quantized loss: 0.00042875969666056335

beads_roi018_im022.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi018

–

im022.

–

original

–

depth

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JNet

–

588

–

beads

–

roi018

–

im022.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi018

–

im022.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi018

–

im022.

–

heatmap

–

depth

|

volume: 3.384663330078126, MSE: 0.0008023878908716142, quantized loss: 0.0003046446945518255

beads_roi019_im023.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi019

–

im023.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi019

–

im023.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi019

–

im023.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi019

–

im023.

–

heatmap

–

depth

|

volume: 3.410252441406251, MSE: 0.0007496133330278099, quantized loss: 0.00030491879442706704

beads_roi020_im024.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi020

–

im024.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi020

–

im024.

–

output

–

depth

|

JNet

–

588

–

beads

_

roi020

_

im024.

_

reconst

_

depth

|

JNet

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588

_

beads

_

roi020

_

im024.

_

heatmap

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depth

|

volume: 4.4099628906250015, MSE: 0.0010074384044855833, quantized loss: 0.00039389016455970705

beads_roi021_im026.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi021

–

im026.

–

original

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depth

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JNet

–

588

–

beads

–

roi021

–

im026.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi021

–

im026.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi021

–

im026.

–

heatmap

–

depth

|

volume: 4.184763183593751, MSE: 0.0009392094216309488, quantized loss: 0.00037759612314403057

beads_roi022_im027.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

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beads

–

roi022

–

im027.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi022

–

im027.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi022

–

im027.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi022

–

im027.

–

heatmap

–

depth

|

volume: 4.152851562500001, MSE: 0.0008890301105566323, quantized loss: 0.00038875974132679403

beads_roi023_im028.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

–

beads

–

roi023

–

im028.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi023

–

im028.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi023

–

im028.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi023

–

im028.

–

heatmap

–

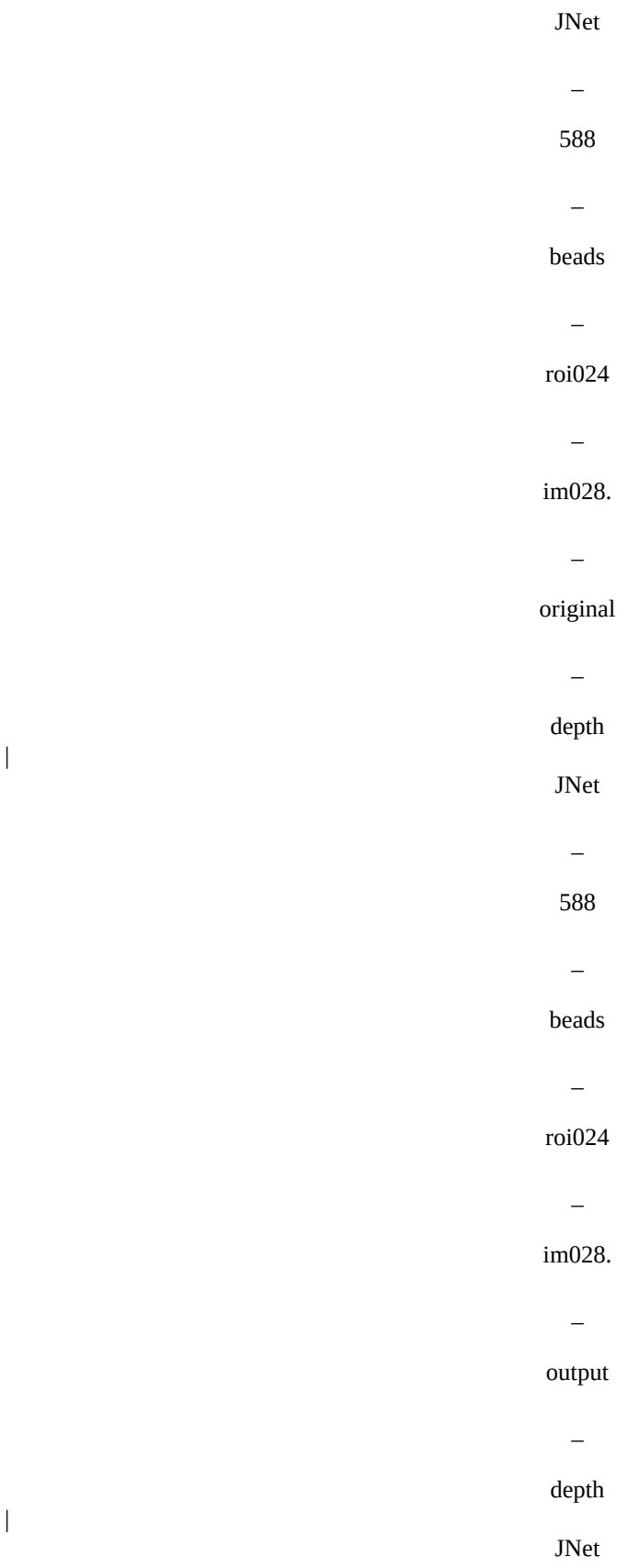
depth

|

volume: 4.610416992187501, MSE: 0.0011237721191719174, quantized loss: 0.00046357244718819857

beads_roi024_im028.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |


JNet
–
588
–
beads
–
roi024
–
im028.
–
original
–
depth
|
JNet
–
588
–
beads
–
roi024
–
im028.
–
output
–
depth
|
JNet

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588

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beads

_

roi024

_

im028.

_

reconst

_

depth

|

JNet

_

588

_

beads

_

roi024

_

im028.

_

heatmap

_

depth

|

volume: 4.314096191406251, MSE: 0.0010833541164174676, quantized loss: 0.0003982804191764444

beads_roi025_im028.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

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JNet

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588

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beads

–

roi025

–

im028.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi025

–

im028.

–

heatmap

–

depth

|

volume: 4.314096191406251, MSE: 0.0010833541164174676, quantized loss: 0.0003982804191764444

beads_roi026_im029.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

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588

–

beads

–

roi026

–

im029.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi026

–

im029.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi026

–

im029.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi026

–

im029.

–

heatmap

–

depth

|

volume: 4.505202636718751, MSE: 0.0010203708661720157, quantized loss: 0.00040366442408412695

beads_roi027_im029.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |
JNet

–

588

–

beads

–

roi027

–

im029.

–

original

–

depth
|
JNet

–

588

–

beads

–

roi027

–

im029.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi027

–

im029.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi027

–

im029.

–

heatmap

–

depth

|

volume: 3.881690185546876, MSE: 0.000979345990344882, quantized loss: 0.00034281547414138913

beads_roi028_im030.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

–

588

–

beads

–

roi028

–

im030.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi028

–

im030.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi028

–

im030.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi028

–

im030.

–

heatmap

–

depth

|

volume: 3.725411621093751, MSE: 0.00087216921383515, quantized loss: 0.0003354476357344538

beads_roi029_im030.

|original|output|reconst|heatmap| | :---: | :---: | :---: | :---: | |

JNet

–

588

–

beads

–

roi029

–

im030.

–

original

–

depth

|

JNet

–

588

–

beads

–

roi029

–

im030.

–

output

–

depth

|

JNet

–

588

–

beads

–

roi029

–

im030.

–

reconst

–

depth

|

JNet

–

588

–

beads

–

roi029

–

im030.

–

heatmap

–

depth

|

volume: 3.956643554687501, MSE: 0.0009406699682585895, quantized loss: 0.00035356965963728726

If the pixels are red, the reconstructed image is brighter than the original. If they are blue, the reconstructed image is darker. |pre|post| | :---: | :---: | |

JNet

–

588

–

psf

–

pre

|

JNet

–

588

–

psf

–

post

|

Architecture

```
JNet(
  (prev0): JNetBlock0(
    (conv): Conv3d(1, 16, kernel_size=(7, 7, 7), stride=(1, 1, 1),
padding=same, padding_mode=replicate)
  )
  (prev): ModuleList(
    (0-1): 2 x JNetBlock(
      (bn1): BatchNorm3d(16, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (relu1): ReLU(inplace=True)
      (conv1): Conv3d(16, 16, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (bn2): BatchNorm3d(16, eps=1e-05, momentum=0.1, affine=True,
```

```
track_running_stats=True)
      (relu2): ReLU(inplace=True)
      (dropout1): Dropout(p=0.5, inplace=False)
      (conv2): Conv3d(16, 16, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
    )
  )
  (mid): JNetLayer(
    (pool): JNetPooling(
      (maxpool): MaxPool3d(kernel_size=2, stride=2, padding=0,
dilation=1, ceil_mode=False)
      (conv): Conv3d(16, 32, kernel_size=(1, 1, 1), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (relu): ReLU(inplace=True)
    )
    (conv): Conv3d(32, 32, kernel_size=(1, 1, 1), stride=(1, 1, 1),
padding=same, padding_mode=replicate)
    (prev): ModuleList(
      (0-1): 2 x JNetBlock(
        (bn1): BatchNorm3d(32, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
        (relu1): ReLU(inplace=True)
        (conv1): Conv3d(32, 32, kernel_size=(3, 3, 3), stride=(1,
1, 1), padding=same, padding_mode=replicate)
        (bn2): BatchNorm3d(32, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
        (relu2): ReLU(inplace=True)
        (dropout1): Dropout(p=0.5, inplace=False)
        (conv2): Conv3d(32, 32, kernel_size=(3, 3, 3), stride=(1,
1, 1), padding=same, padding_mode=replicate)
      )
    )
    (mid): JNetLayer(
      (pool): JNetPooling(
        (maxpool): MaxPool3d(kernel_size=2, stride=2, padding=0,
dilation=1, ceil_mode=False)
        (conv): Conv3d(32, 64, kernel_size=(1, 1, 1), stride=(1, 1,
1), padding=same, padding_mode=replicate)
        (relu): ReLU(inplace=True)
      )
      (conv): Conv3d(64, 64, kernel_size=(1, 1, 1), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (prev): ModuleList(
        (0-1): 2 x JNetBlock(
          (bn1): BatchNorm3d(64, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
          (relu1): ReLU(inplace=True)
          (conv1): Conv3d(64, 64, kernel_size=(3, 3, 3), stride=(1,
1, 1), padding=same, padding_mode=replicate)
          (bn2): BatchNorm3d(64, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
          (relu2): ReLU(inplace=True)
          (dropout1): Dropout(p=0.5, inplace=False)
          (conv2): Conv3d(64, 64, kernel_size=(3, 3, 3), stride=(1,
```

```
1, 1), padding=same, padding_mode=replicate)
        )
      )
      (mid): JNetLayer(
        (pool): JNetPooling(
          (maxpool): MaxPool3d(kernel_size=2, stride=2, padding=0,
dilation=1, ceil_mode=False)
          (conv): Conv3d(64, 128, kernel_size=(1, 1, 1), stride=(1,
1, 1), padding=same, padding_mode=replicate)
          (relu): ReLU(inplace=True)
        )
        (conv): Conv3d(128, 128, kernel_size=(1, 1, 1), stride=(1,
1, 1), padding=same, padding_mode=replicate)
        (prev): ModuleList(
          (0-1): 2 x JNetBlock(
            (bn1): BatchNorm3d(128, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
            (relu1): ReLU(inplace=True)
            (conv1): Conv3d(128, 128, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
            (bn2): BatchNorm3d(128, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
            (relu2): ReLU(inplace=True)
            (dropout1): Dropout(p=0.5, inplace=False)
            (conv2): Conv3d(128, 128, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
          )
        )
        (mid): JNetLayer(
          (pool): JNetPooling(
            (maxpool): MaxPool3d(kernel_size=2, stride=2,
padding=0, dilation=1, ceil_mode=False)
            (conv): Conv3d(128, 256, kernel_size=(1, 1, 1),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
            (relu): ReLU(inplace=True)
          )
          (conv): Conv3d(256, 256, kernel_size=(1, 1, 1),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
          (prev): ModuleList(
            (0-1): 2 x JNetBlock(
              (bn1): BatchNorm3d(256, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
              (relu1): ReLU(inplace=True)
              (conv1): Conv3d(256, 256, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
              (bn2): BatchNorm3d(256, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
              (relu2): ReLU(inplace=True)
              (dropout1): Dropout(p=0.5, inplace=False)
              (conv2): Conv3d(256, 256, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
            )
          )
          (mid): Identity()
```

```
          (attn): Identity()
          (post): ModuleList(
            (0-1): 2 x JNetBlock(
              (bn1): BatchNorm3d(256, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
              (relu1): ReLU(inplace=True)
              (conv1): Conv3d(256, 256, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
              (bn2): BatchNorm3d(256, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
              (relu2): ReLU(inplace=True)
              (dropout1): Dropout(p=0.5, inplace=False)
              (conv2): Conv3d(256, 256, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
            )
          )
          (unpool): JNetUnpooling(
            (upsample): Upsample(scale_factor=2.0,
mode='trilinear')
            (conv): Conv3d(256, 128, kernel_size=(1, 1, 1),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
            (relu): ReLU(inplace=True)
          )
        )
        (attn): Identity()
        (post): ModuleList(
          (0-1): 2 x JNetBlock(
            (bn1): BatchNorm3d(128, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
            (relu1): ReLU(inplace=True)
            (conv1): Conv3d(128, 128, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
            (bn2): BatchNorm3d(128, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
            (relu2): ReLU(inplace=True)
            (dropout1): Dropout(p=0.5, inplace=False)
            (conv2): Conv3d(128, 128, kernel_size=(3, 3, 3),
stride=(1, 1, 1), padding=same, padding_mode=replicate)
          )
        )
        (unpool): JNetUnpooling(
          (upsample): Upsample(scale_factor=2.0, mode='trilinear')

          (conv): Conv3d(128, 64, kernel_size=(1, 1, 1), stride=(1,
1, 1), padding=same, padding_mode=replicate)
          (relu): ReLU(inplace=True)
        )
      )
      (attn): Identity()
      (post): ModuleList(
        (0-1): 2 x JNetBlock(
          (bn1): BatchNorm3d(64, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
          (relu1): ReLU(inplace=True)
```

```
          (conv1): Conv3d(64, 64, kernel_size=(3, 3, 3), stride=(1,
1, 1), padding=same, padding_mode=replicate)
          (bn2): BatchNorm3d(64, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
          (relu2): ReLU(inplace=True)
          (dropout1): Dropout(p=0.5, inplace=False)
          (conv2): Conv3d(64, 64, kernel_size=(3, 3, 3), stride=(1,
1, 1), padding=same, padding_mode=replicate)
        )
      )
      (unpool): JNetUnpooling(
        (upsample): Upsample(scale_factor=2.0, mode='trilinear')
        (conv): Conv3d(64, 32, kernel_size=(1, 1, 1), stride=(1, 1,
1), padding=same, padding_mode=replicate)
        (relu): ReLU(inplace=True)
      )
    )
    (attn): Identity()
    (post): ModuleList(
      (0-1): 2 x JNetBlock(
        (bn1): BatchNorm3d(32, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
        (relu1): ReLU(inplace=True)
        (conv1): Conv3d(32, 32, kernel_size=(3, 3, 3), stride=(1,
1, 1), padding=same, padding_mode=replicate)
        (bn2): BatchNorm3d(32, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
        (relu2): ReLU(inplace=True)
        (dropout1): Dropout(p=0.5, inplace=False)
        (conv2): Conv3d(32, 32, kernel_size=(3, 3, 3), stride=(1,
1, 1), padding=same, padding_mode=replicate)
      )
    )
    (unpool): JNetUnpooling(
      (upsample): Upsample(scale_factor=2.0, mode='trilinear')
      (conv): Conv3d(32, 16, kernel_size=(1, 1, 1), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (relu): ReLU(inplace=True)
    )
  )
  (postx): ModuleList(
    (0-1): 2 x JNetBlock(
      (bn1): BatchNorm3d(16, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (relu1): ReLU(inplace=True)
      (conv1): Conv3d(16, 16, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (bn2): BatchNorm3d(16, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (relu2): ReLU(inplace=True)
      (dropout1): Dropout(p=0.5, inplace=False)
      (conv2): Conv3d(16, 16, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
    )
```

```
    (2): JNetBlockN(
      (conv): Conv3d(16, 1, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (sigm): Sigmoid()
    )
  )
  (postz): ModuleList(
    (0-1): 2 x JNetBlock(
      (bn1): BatchNorm3d(16, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (relu1): ReLU(inplace=True)
      (conv1): Conv3d(16, 16, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (bn2): BatchNorm3d(16, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
      (relu2): ReLU(inplace=True)
      (dropout1): Dropout(p=0.5, inplace=False)
      (conv2): Conv3d(16, 16, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
    )
    (2): JNetBlockN(
      (conv): Conv3d(16, 1, kernel_size=(3, 3, 3), stride=(1, 1,
1), padding=same, padding_mode=replicate)
      (sigm): Sigmoid()
    )
  )
  (image): ImagingProcess(
    (emission): Emission()
    (blur): Blur(
      (neuripsf): NeuralImplicitPSF(
        (layers): Sequential(
          (0): BatchNorm1d(2, eps=1e-05, momentum=0.1, affine=True,
track_running_stats=True)
          (1): Linear(in_features=2, out_features=40, bias=True)
          (2): Sigmoid()
          (3): BatchNorm1d(40, eps=1e-05, momentum=0.1,
affine=True, track_running_stats=True)
          (4): Linear(in_features=40, out_features=1, bias=True)
          (5): Sigmoid()
        )
      )
    )
    (noise): Noise()
    (preprocess): PreProcess()
    (hill): Hill()
  )
  (upsample): JNetUpsample(
    (upsample): Upsample(scale_factor=(10.0, 1.0, 1.0),
mode='trilinear')
  )
  (vq): VectorQuantizer()
)
```