ARUNet-3D-PR-VFold-Test

November 25, 2021

[1]:

```python
from monai.utils import first, set_determinism
from monai.transforms import (
    AddChanneld,
    AsChannelFirstd,
    AsDiscrete,
    AsDiscreted,
    Compose,
    EnsureChannelFirstd,
    EnsureTyped,
    EnsureType,
    Invertd,
    Lambdad,
    LoadImaged,
    RandFlipd,
    RandSpatialCropd,
    RandZoomd,
    Resized,
    ScaleIntensityRanged,
    SpatialCrop,
    SpatialCropd,
    ToTensord,
)
from monai.handlers.utils import from_engine
from monai.networks.nets import UNet
from monai.networks.layers import Norm
from monai.metrics import DiceMetric
from monai.losses import DiceLoss
from monai.inferers import sliding_window_inference
from monai.data import CacheDataset, DataLoader, Dataset, decollate_batch
from monai.config import print_config
from monai.apps import download_and_extract
import monai.utils as utils

import torch
import matplotlib.pyplot as plt
import tempfile
import shutil
import os
from glob import glob

import itk
from itk import TubeTK as ttk

import numpy as np

import site
site.addsitedir('../../ARGUS')
from ARGUSUtils_Transforms import *
```

[19]:

```
img1_dir = "../../Data/VFoldData/BAMC-PTX*Sliding-Annotations-Linear/"

all_images = sorted(glob(os.path.join(img1_dir, '*_?????.nii.gz')))
all_labels = sorted(glob(os.path.join(img1_dir, '*.interpolated-overlay.nii.
 ↪gz')))

gpu_device = 0

num_classes = 3
class_sliding = 1
class_not_sliding = 2

net_in_dims = 3
net_in_channels = 1
net_channels=(16, 32, 64, 128, 32)
net_strides=(2, 2, 2, 2)

num_folds = 15

num_slices = 48
size_x = 320
size_y = 320
roi_size = (size_x,size_y,num_slices)

num_workers_te = 0
batch_size_te = 4

model_filename_base = "./results/BAMC_PTX_ARUNet-3D-PR"

model_type = "last"  #"best" or "last"
```

[20]:

```
num_images = len(all_images)
print(num_images, len(all_labels))

ns_prefix = ['025ns','026ns','027ns','035ns','048ns','055ns','117ns',
             '135ns','193ns','210ns','215ns','218ns','219ns','221ns','247ns']
s_prefix = ['004s','019s','030s','034s','037s','043s','065s','081s',
            '206s','208s','211s','212s','224s','228s','236s','237s']

fold_prefix_list = []
ns_count = 0
s_count = 0
for i in range(num_folds):
    if i%2 == 0:
        num_ns = 1
        num_s = 1
        if i > num_folds-3:
            num_s = 2
    else:
        num_ns = 1
        num_s = 1
    f = []
    for ns in range(num_ns):
        f.append([ns_prefix[ns_count+ns]])
    ns_count += num_ns
    for s in range(num_s):
        f.append([s_prefix[s_count+s]])
    s_count += num_s
    fold_prefix_list.append(f)

train_files = []
val_files = []
test_files = []
for i in range(num_folds):
    tr_folds = []
    for f in range(i,i+num_folds-2):
        tr_folds.append(fold_prefix_list[f%num_folds])
    tr_folds = list(np.concatenate(tr_folds).flat)
    va_folds = list(np.concatenate(fold_prefix_list[(i+num_folds-2) %␣
 ↪num_folds]).flat)
    te_folds = list(np.concatenate(fold_prefix_list[(i+num_folds-1) %␣
 ↪num_folds]).flat)
    train_files.append(
            [
                {"image": img, "label": seg}
                for img, seg in zip(
                    [im for im in all_images if any(pref in im for pref in␣
 ↪tr_folds)],
                    [se for se in all_labels if any(pref in se for pref in␣
 ↪tr_folds)])
            ]
        )
    val_files.append(
            [
                {"image": img, "label": seg}
                for img, seg in zip(
                    [im for im in all_images if any(pref in im for pref in␣
↪va_folds)],
                    [se for se in all_labels if any(pref in se for pref in␣
↪va_folds)])
            ]
        )
    test_files.append(
            [
                {"image": img, "label": seg}
                for img, seg in zip(
                    [im for im in all_images if any(pref in im for pref in␣
↪te_folds)],
                    [se for se in all_labels if any(pref in se for pref in␣
↪te_folds)])
            ]
        )
    print(len(train_files[i]),len(val_files[i]),len(test_files[i]))
```

```
62 62
53 4 5
53 5 4
54 4 4
54 4 4
54 4 4
55 4 3
55 3 4
54 4 4
54 4 4
54 4 4
53 4 5
53 5 4
53 4 5
53 5 4
54 4 4
```

[21]:

```
train_shape = itk.GetArrayFromImage(itk.imread(train_files[0][0]["image"])).
↪shape

test_transforms = Compose(
    [
        LoadImaged(keys=["image", "label"]),
        AddChanneld(keys=['image','label']),
        ScaleIntensityRanged(
            a_min=0, a_max=255,
            b_min=0.0, b_max=1.0,
            keys=["image"]),
        Lambdad(
            func=lambda x: np.where(x==3,1,x),
            keys=['label']),
        ARGUS_RandSpatialCropSlicesd(
            num_slices=num_slices,
            axis=3,
            keys=['image', 'label']),
        ToTensord(keys=["image", "label"]),
    ]
)
```

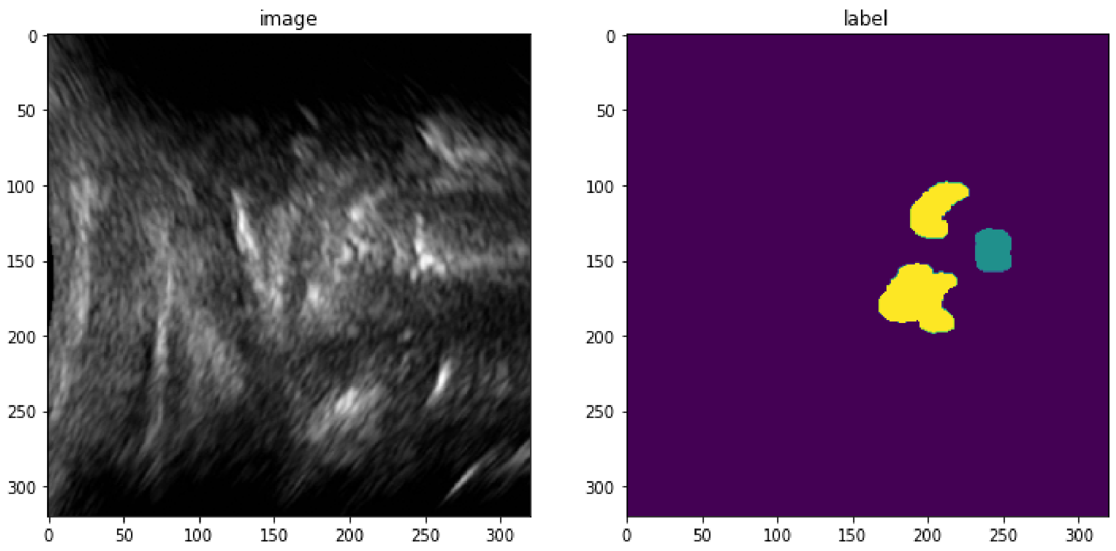
[22]:

```
test_ds = [Dataset(data=test_files[i], transform=test_transforms)
          for i in range(num_folds)]
test_loader = [DataLoader(test_ds[i], batch_size=batch_size_te,␣
 ↪num_workers=num_workers_te)
              for i in range(num_folds)]
```

[23]:

```
imgnum = 0
batchnum = 0
channelnum = 0
slicenum = 24

img = utils.first(test_loader[batchnum])["image"]
print("Image shape =", img.shape)
print("Image range =", img[imgnum,channelnum,:,:,slicenum].min(),␣
 ↪img[imgnum,channelnum,:,:,slicenum].max())
lbl = utils.first(test_loader[batchnum])["label"]
print("Label shape =", lbl.shape)
print("Label range =", lbl[imgnum,channelnum,:,:,slicenum].min(), lbl[imgnum,0,:
 ↪,:,slicenum].max())

plt.figure("Testing", (12, 6))
plt.subplot(1, 2, 1)
plt.title("image")
plt.imshow(img[imgnum, channelnum, :, :, slicenum], cmap="gray")
plt.subplot(1, 2, 2)
plt.title("label")
plt.imshow(lbl[imgnum, channelnum, :, :, slicenum])
plt.show()
```

```
Image shape = torch.Size([4, 1, 320, 320, 48])
Image range = tensor(0.) tensor(0.7490)
Label shape = torch.Size([4, 1, 320, 320, 48])
Label range = tensor(0.) tensor(2.)
```



[24]:

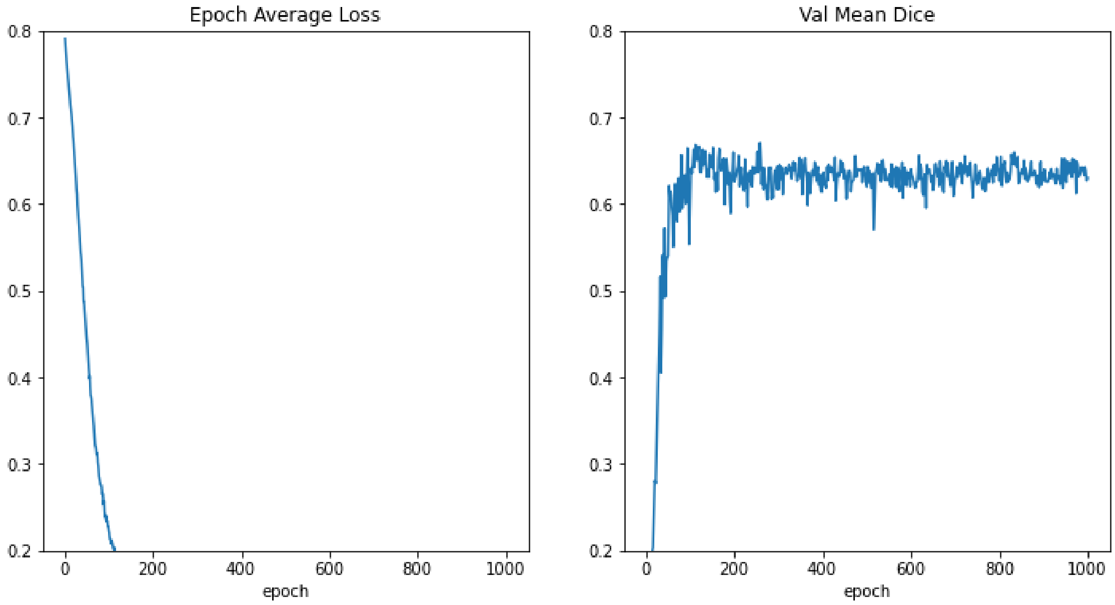
```
device = torch.device("cuda:"+str(gpu_device))
```

[56]:

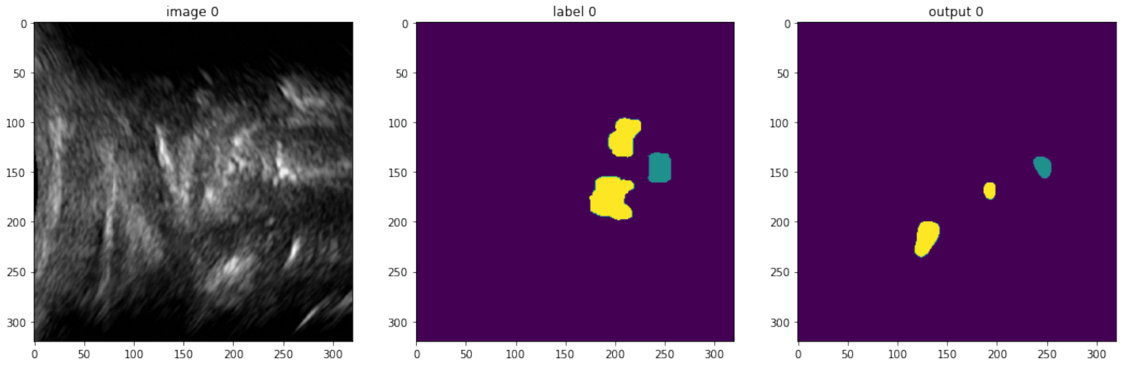
```
def plot_vfold_training_curves(vfold_num, test_loader, min_size_comp,␣
↪max_size_comp, sliding_prior, graph):
    if graph:
        print("    VFOLD =", vfold_num, "of", num_folds)

    patient_correct = 0
    patient_incorrect = 0
    patient_false_negatives = 0

    frame_correct = 0
    frame_incorrect = 0
    frame_false_negatives = 0

    roi_correct = 0
    roi_incorrect = 0
    roi_false_negatives = 0

    loss_file = model_filename_base+"_loss_"+str(vfold_num)+".npy"
    if os.path.exists(loss_file):
        epoch_loss_values = np.load(loss_file)

        metric_file = model_filename_base+"_val_dice_"+str(vfold_num)+".npy"
        metric_values = np.load(metric_file)

        if graph:
            plt.figure("train", (12, 6))
            plt.subplot(1, 2, 1)
            plt.title("Epoch Average Loss")
            x = [i + 1 for i in range(len(epoch_loss_values))]
            y = epoch_loss_values
            plt.xlabel("epoch")
            plt.plot(x, y)
            plt.ylim([0.2,0.8])
            plt.subplot(1, 2, 2)
            plt.title("Val Mean Dice")
            x = [2 * (i + 1) for i in range(len(metric_values))]
            y = metric_values
            plt.xlabel("epoch")
            plt.plot(x, y)
            plt.ylim([0.2,0.8])
            plt.show()

    model_file = model_filename_base+'.'+model_type+'_model.
↪vfold_'+str(vfold_num)+'.pth'
    if os.path.exists(model_file):
        model = UNet(
            dimensions=net_in_dims,
            in_channels=net_in_channels,
            out_channels=num_classes,
            channels=net_channels,
            strides=net_strides,
            num_res_units=2,
            norm=Norm.BATCH,
        ).to(device)
        model.load_state_dict(torch.load(model_file))
        model.eval()
        with torch.no_grad():
            fold_imgnum = 0
            fname = os.path.
↪basename(test_files[vfold_num][fold_imgnum]["image"])
            prevfname = fname
            frame_roi_count = 0
            frame_roi_count_not_sliding = 0
            patient_frame_count = 0
            patient_frame_count_not_sliding = 0
            for batchnum,test_data in enumerate(test_loader):
                test_outputs = sliding_window_inference(
                    test_data["image"].to(device), roi_size, batch_size_te,␣
↪model
                )
                for batch_imgnum in range(test_outputs.shape[0]):
                    prevfname = fname
                    fname = os.path.
↪basename(test_files[vfold_num][fold_imgnum]["image"])

                    if fname[:22]!=prevfname[:22]:
                        patient_frame_count += 1
                        if frame_roi_count_not_sliding == 0: # frame_roi_count
                            if graph:
                                print(" ** Frame Winner = Sliding ( NS␣
↪=",frame_roi_count_not_sliding,"of",frame_roi_count,")")
                            if prevfname[3] == 's':
                                frame_correct += 1
                                if graph:
                                    print("    Correct")
                            else:
                                frame_incorrect += 1
                                frame_false_negatives += 1
                                print("    Frame False Negative =", prevfname)
                        else:
                            patient_frame_count_not_sliding += 1
                            if graph:
                                print(" ** Frame Winner = Not Sliding ( NS␣
↪=",frame_roi_count_not_sliding,"of",frame_roi_count,")")
                            if prevfname[3] == 'n':
                                frame_correct += 1
                                if graph:
                                    print("    Correct")
                            else:
                                frame_incorrect += 1
                                print("    Frame False Positive =", prevfname)
                        if graph:
                            print()
                            print()
                        frame_roi_count = 0
                        frame_roi_count_not_sliding = 0
                    if fname[:4]!=prevfname[:4]:
                        if patient_frame_count_not_sliding == 0:
                            if graph:
                                print("*** Patient Winner = Sliding ( NS␣
↪=",patient_frame_count_not_sliding,"of",patient_frame_count,")")
                            if prevfname[3] == 's':
                                patient_correct += 1
                                if graph:
                                    print("    Correct")
                            else:
                                patient_incorrect += 1
                                patient_false_negatives += 1
                                print("    Patient False Negative =", prevfname)
                        else:
                            if graph:
                                print("*** Patient Winner = Not Sliding ( NS␣
↪=",patient_frame_count_not_sliding,"of",patient_frame_count,")")
                            if prevfname[3] == 'n':
                                patient_correct += 1
                                if graph:
                                    print("    Correct")
                            else:
                                patient_incorrect += 1
                                print("    Patient False Positive =", prevfname)
                        if graph:
                            print()
                            print()

                    prob_shape = test_outputs[batch_imgnum,:,:,:,:].shape
                    prob = np.empty(prob_shape)
                    for c in range(num_classes):
                        itkProb = itk.
↪GetImageFromArray(test_outputs[batch_imgnum,c,:,:,:].cpu())
                        imMathProb = ttk.ImageMath.New(itkProb)
                        imMathProb.Blur(5)
                        itkProb = imMathProb.GetOutput()
                        prob[c] = itk.GetArrayFromImage(itkProb)
                    arrc1 = np.zeros(prob[0].shape)
                    if False:
                        pmin = prob[0].min()
                        pmax = prob[0].max()
                        for c in range(1,num_classes):
                            pmin = min(pmin, prob[c].min())
                            pmax = max(pmax, prob[c].max())
                        prange = pmax - pmin
                        prob = (prob - pmin) / prange
                        prob[class_sliding] = prob[class_sliding] *␣
↪sliding_prior
                        arrc1 = np.argmax(prob,axis=0)
                    else:
                        pmin = prob[0].min()
                        pmax = prob[0].max()
                        for c in range(1,num_classes):
                            pmin = min(pmin, prob[c].min())
                            pmax = max(pmax, prob[c].max())
                        prange = pmax - pmin
                        prob = (prob - pmin) / prange
                        prob[class_sliding] = prob[class_sliding] *␣
↪sliding_prior
                        done = False
                        while not done:
                            done = True
                            count = max(np.count_nonzero(arrc1==class_sliding),␣
↪np.count_nonzero(arrc1==class_not_sliding))
                            prior_factor = 1
                            while count<min_size_comp:
                                prior_factor *= 1.05
                                prob[class_sliding] = prob[class_sliding] * 1.05
                                prob[class_not_sliding] =␣
↪prob[class_not_sliding] * 1.05
                                arrc1 = np.argmax(prob,axis=0)
                                count = max(np.
↪count_nonzero(arrc1==class_sliding), np.
↪count_nonzero(arrc1==class_not_sliding))
                                done = False
                            while count>max_size_comp:
                                prior_factor *= 0.95
                                prob[class_sliding] = prob[class_sliding] * 0.95
                                prob[class_not_sliding] =␣
↪prob[class_not_sliding] * 0.95
                                arrc1 = np.argmax(prob,axis=0)
                                count = max(np.
↪count_nonzero(arrc1==class_sliding), np.
↪count_nonzero(arrc1==class_not_sliding))
                                done = False

                    itkc1 = itk.GetImageFromArray(arrc1.astype(np.float32))
                    imMathC1 = ttk.ImageMath.New(itkc1)
                    for c in range(num_classes):
                        imMathC1.Erode(5,c,0)
                        imMathC1.Dilate(5,c,0)
                    itkc1 = imMathC1.GetOutputUChar()
                    arrc1 = itk.GetArrayFromImage(itkc1)
                    roi_count_sliding = np.count_nonzero(arrc1==class_sliding)
                    roi_count_not_sliding = np.
↪count_nonzero(arrc1==class_not_sliding)
                    roi_decision = "Unknown"
                    roi_message = "Correct"
                    frame_roi_count += 1
                    if roi_count_sliding>roi_count_not_sliding: # and␣
↪roi_count_not_sliding>roi_sliding_min_thresh:
                        roi_decision = "Sliding"
                        if fname[3] == 's':
                            roi_correct += 1
                        else:
                            roi_incorrect += 1
                            roi_false_negatives += 1
                            roi_message = "False Negative"
                    else:
                        frame_roi_count_not_sliding += 1
                        roi_decision = "Not Sliding"
                        if fname[3] == 'n':
                            roi_correct += 1
                        else:
                            roi_incorrect += 1
                            roi_message = "Fales Positive"


                    if graph:
                        print(fname)

                        plt.figure("check", (18, 6))
                        plt.subplot(1, 3, 1)
                        plt.title(f"image {fold_imgnum}")
                        tmpV = test_data["image"][batch_imgnum, 0, :, :
↪,num_slices//2]
                        plt.imshow(tmpV, cmap="gray")
                        plt.subplot(1, 3, 2)
                        plt.title(f"label {fold_imgnum}")
                        tmpV = test_data["label"][batch_imgnum, 0, :, :
↪,num_slices//2]
                        for c in range(num_classes):
                            tmpV[0,c]=c
                        plt.imshow(tmpV)
                        plt.subplot(1, 3, 3)
                        plt.title(f"output {fold_imgnum}")
                        for c in range(num_classes):
                            arrc1[0,c]=c
                        plt.imshow(arrc1[:,:,num_slices//2])
                        plt.show()

                        print("  * ROI Number of not-sliding / sliding pixel␣
↪=", roi_count_not_sliding, roi_count_sliding)
                        print("    ROI =", roi_decision)
                        print("   ", roi_message)
                        print()
                        print()

                        for c in range(num_classes):
                            arrimg = test_outputs.detach().
↪cpu()[batch_imgnum,c,:,:,:]
                            itkimg = itk.GetImageFromArray(arrimg)
                            filename =␣
↪model_filename_base+"_f"+str(vfold_num)+"_i"+str(i)+"_c"+str(c)+".nii.gz"
                            itk.imwrite(itkimg, filename)

                    fold_imgnum += 1

            prevfname = fname
            patient_frame_count += 1
            if frame_roi_count_not_sliding == 0: # frame_roi_count
                if graph:
                    print(" ** Frame Winner = Sliding ( NS␣
↪=",frame_roi_count_not_sliding,"of",frame_roi_count,")")
                if prevfname[3] == 's':
                    frame_correct += 1
                    if graph:
                        print("    Correct")
                else:
                    frame_incorrect += 1
                    frame_false_negatives += 1
                    print("    Frame False Negative =", prevfname)
            else:
                patient_frame_count_not_sliding += 1
                if graph:
                    print(" ** Frame Winner = Not Sliding ( NS␣
↪=",frame_roi_count_not_sliding,"of",frame_roi_count,")")
                if prevfname[3] == 'n':
                    frame_correct += 1
                    if graph:
                        print("    Correct")
                else:
                    frame_incorrect += 1
                    print("    Frame False Positive =", prevfname)
            if graph:
                print()
                print()
            frame_roi_count = 0
            frame_roi_count_not_sliding = 0
            if patient_frame_count_not_sliding == 0:
                if graph:
                    print("*** Patient Winner = Sliding ( NS␣
↪=",patient_frame_count_not_sliding,"of",patient_frame_count,")")
                if prevfname[3] == 's':
                    patient_correct += 1
                    if graph:
                        print("    Correct")
                else:
                    patient_incorrect += 1
                    patient_false_negatives += 1
                    print("    Patient False Negative =", prevfname)
            else:
                if graph:
                    print("*** Patient Winner = Not Sliding ( NS␣
 ↪=",patient_frame_count_not_sliding,"of",patient_frame_count,")")
                if prevfname[3] == 'n':
                    patient_correct += 1
                    if graph:
                        print("    Correct")
                else:
                    patient_incorrect += 1
                    print("    Patient False Positive =", prevfname)
            if graph:
                print()
                print()

    return patient_correct, patient_incorrect, patient_false_negatives,␣
 ↪frame_correct, frame_incorrect, frame_false_negatives, roi_correct,␣
 ↪roi_incorrect, roi_false_negatives
```

```
[ ]: min_size_comp = 110000
max_size_comp = 160000

for sliding_prior in [1]:
    print('*************')
    print("Prior =", sliding_prior)
    t_p_correct = 0
    t_p_incorrect = 0
    t_p_false_negatives = 0
    t_f_correct = 0
    t_f_incorrect = 0
    t_f_false_negatives = 0
    t_r_correct = 0
    t_r_incorrect = 0
    t_r_false_negatives = 0
    for i in range(num_folds):
        (p_correct, p_incorrect, p_false_negatives, f_correct, f_incorrect,␣
 ↪f_false_negatives, r_correct, r_incorrect, r_false_negatives) =␣
 ↪plot_vfold_training_curves(
            i, test_loader[i], min_size_comp, max_size_comp, sliding_prior,␣
 ↪True)
        t_p_correct += p_correct
        t_p_incorrect += p_incorrect
        t_p_false_negatives += p_false_negatives
        t_f_correct += f_correct
        t_f_incorrect += f_incorrect
        t_f_false_negatives += f_false_negatives
        t_r_correct += r_correct
        t_r_incorrect += r_incorrect
        t_r_false_negatives += r_false_negatives
    print()
    print()
    print("Patients: Correct =", t_p_correct, "Incorrect =", t_p_incorrect,␣
↪"Not Sliding as Sliding =", t_p_false_negatives)
    print("Frame: Correct =", t_f_correct, "Incorrect =", t_f_incorrect, "Not␣
↪Sliding as Sliding =", t_f_false_negatives)
    print("ROIs: Correct =", t_r_correct, "Incorrect =", t_r_incorrect, "Not␣
↪Sliding as Sliding =", t_r_false_negatives)
    print('*************')
```

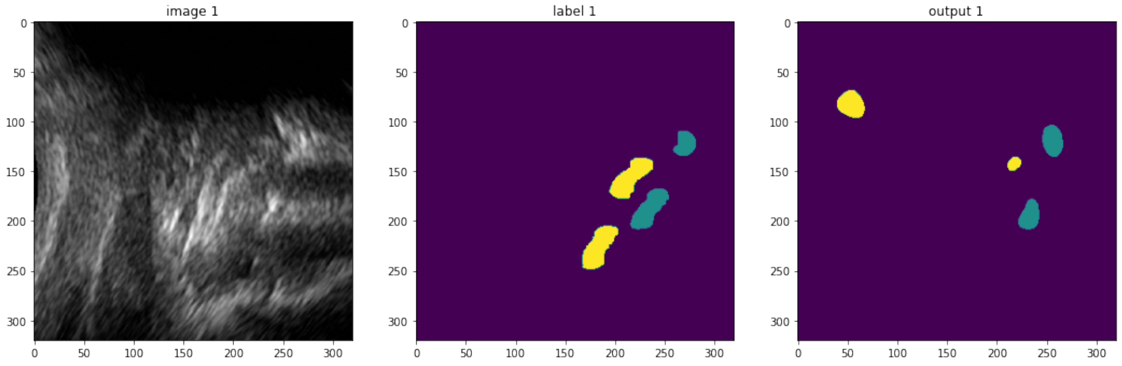
```
*************
Prior = [1.0, 1.2, 1.0]
   VFOLD = 0 of 15
```



```
247ns_image_2734882394424_CLEAN.nii.gz
```

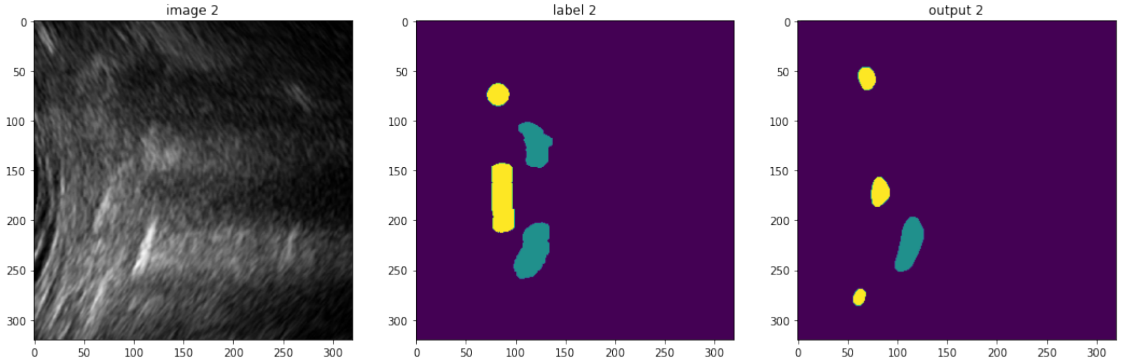


```
 * ROI Number of not-sliding / sliding pixel = 39774 20389
   ROI = Not Sliding
   Correct


** Frame Winner = Not Sliding ( NS = 1 of 1 )
   Correct


247ns_image_2743083265515_CLEAN.nii.gz
```

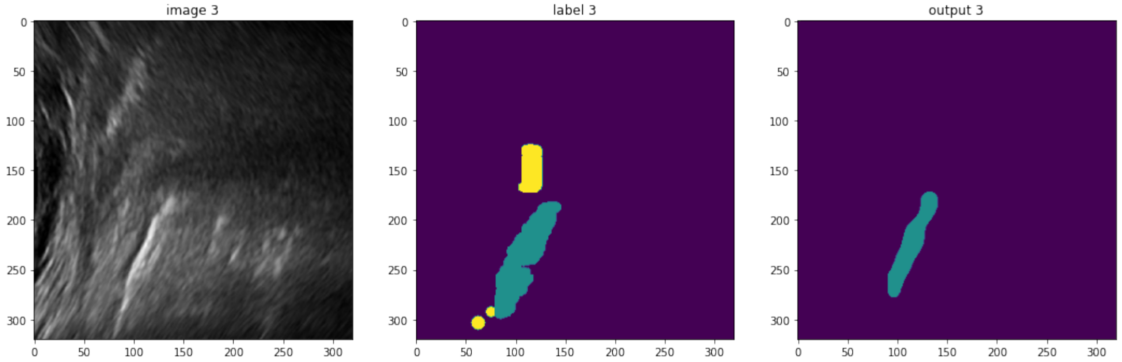


```
 * ROI Number of not-sliding / sliding pixel = 40592 53184
   ROI = Sliding
   False Negative


** Frame Winner = Sliding ( NS = 0 of 1 )
   Frame False Negative = 247ns_image_2743083265515_CLEAN.nii.gz


*** Patient Winner = Not Sliding ( NS = 1 of 2 )
```

```
    Correct


236s_iimage_1139765223418_CLEAN.nii.gz
```

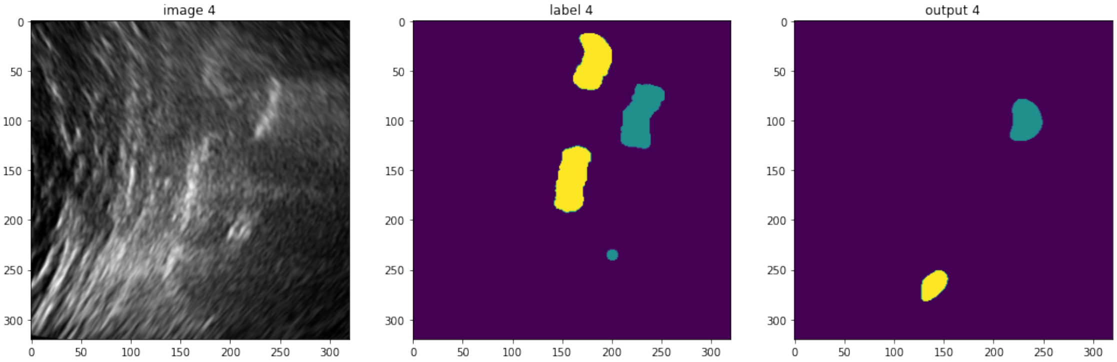


```
  * ROI Number of not-sliding / sliding pixel = 33704 57716
    ROI = Sliding
    Correct


 ** Frame Winner = Sliding ( NS = 0 of 1 )
    Correct


236s_iimage_1327616672148_clean.nii.gz
```

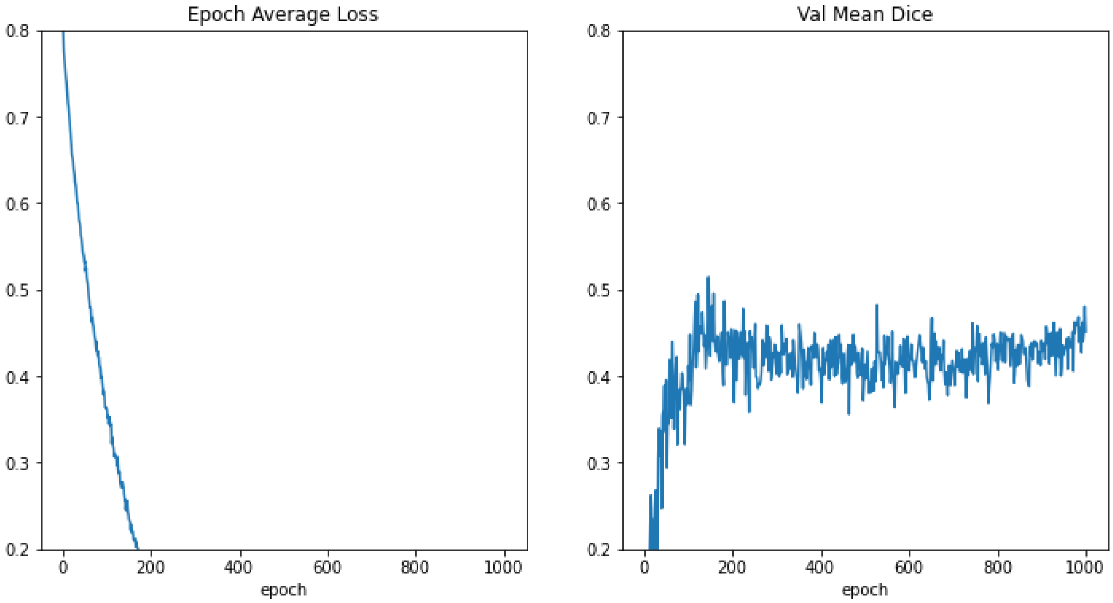


```
  * ROI Number of not-sliding / sliding pixel = 0 87861
    ROI = Sliding
    Correct
```

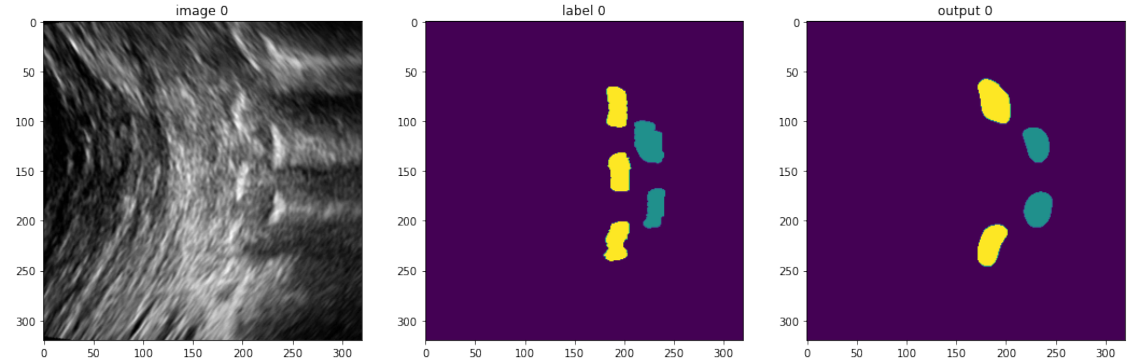
```
 ** Frame Winner = Sliding ( NS = 0 of 1 )
    Correct


*** Patient Winner = Not Sliding ( NS = 1 of 4 )
    Patient False Positive = 236s_iimage_1327616672148_clean.nii.gz


237s_iimage_24164968068436_CLEAN.nii.gz
```



```
  * ROI Number of not-sliding / sliding pixel = 25875 59056
    ROI = Sliding
    Correct


 ** Frame Winner = Sliding ( NS = 0 of 1 )
    Correct


*** Patient Winner = Not Sliding ( NS = 1 of 5 )
    Patient False Positive = 237s_iimage_24164968068436_CLEAN.nii.gz


   VFOLD = 1 of 15
```

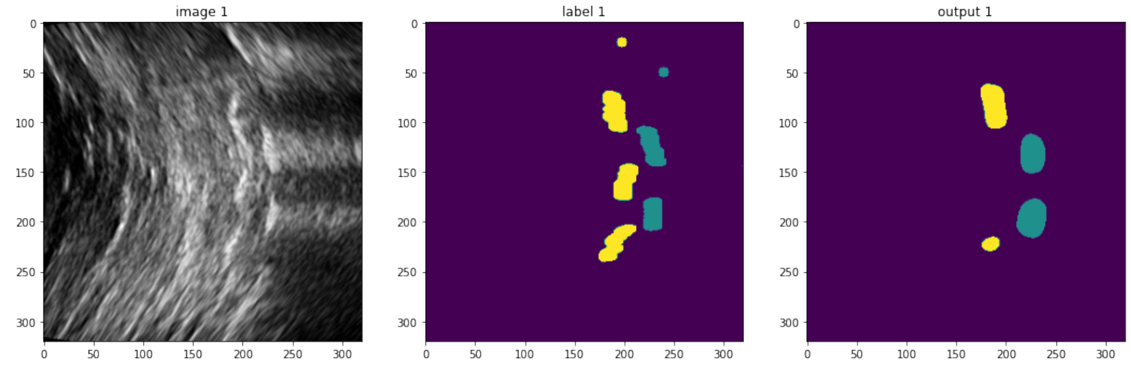


```
025ns_Image_262499828648_clean.nii.gz
```

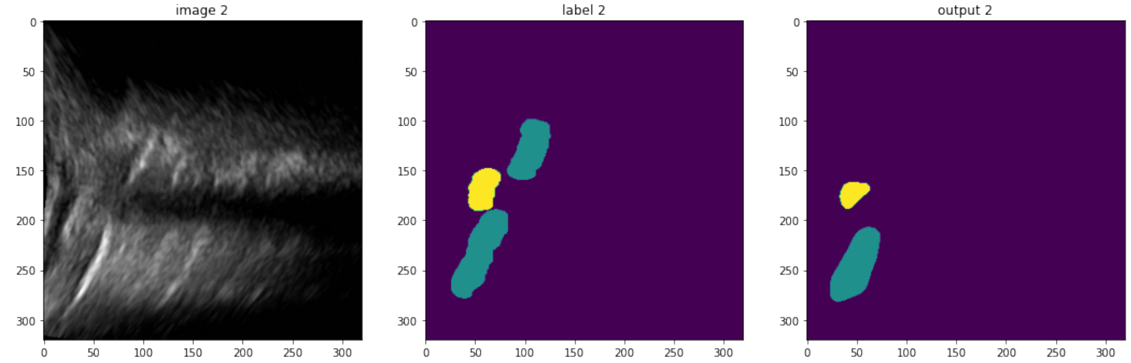


```
 * ROI Number of not-sliding / sliding pixel = 75004 74096
   ROI = Not Sliding
   Correct


** Frame Winner = Not Sliding ( NS = 1 of 1 )
   Correct
```

```
025ns_image_267456908021_clean.nii.gz
```

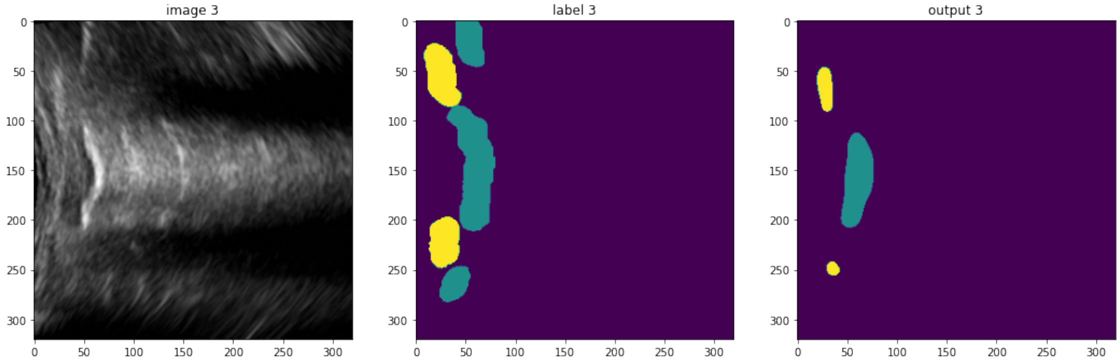


```
  * ROI Number of not-sliding / sliding pixel = 71734 81485
    ROI = Sliding
    False Negative


 ** Frame Winner = Sliding ( NS = 0 of 1 )
    Frame False Negative = 025ns_image_267456908021_clean.nii.gz


*** Patient Winner = Not Sliding ( NS = 1 of 2 )
    Correct


004s_iimage_73815992352100_clean.nii.gz
```

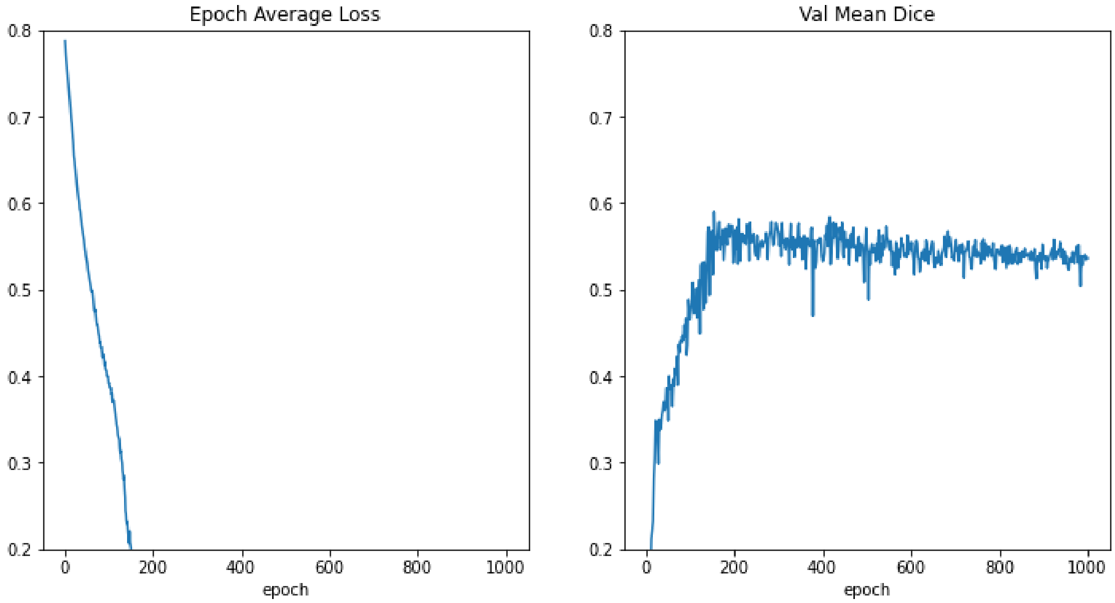


```
  * ROI Number of not-sliding / sliding pixel = 30196 101374
    ROI = Sliding
    Correct


 ** Frame Winner = Sliding ( NS = 0 of 1 )
```

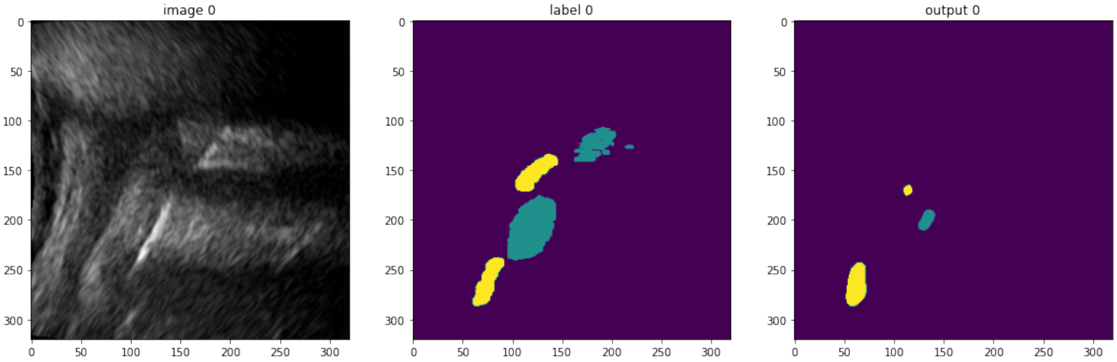
```
    Correct


004s_iimage_74132233134844_clean.nii.gz
```



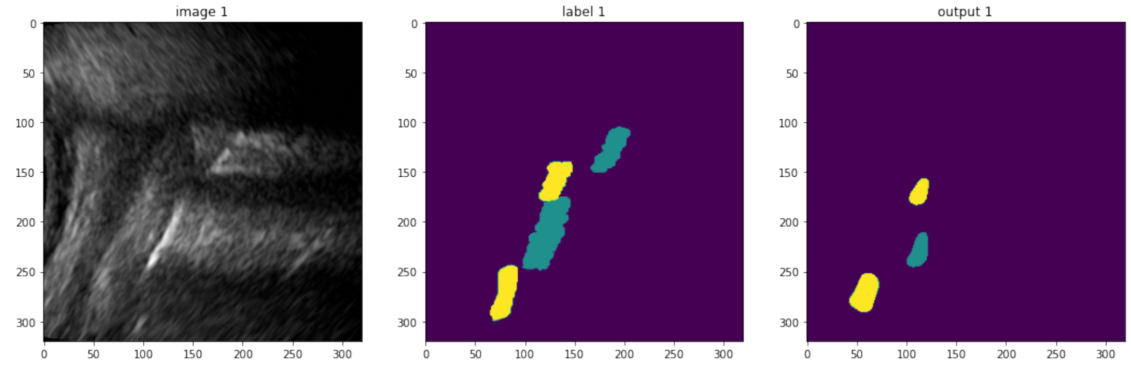
```
  * ROI Number of not-sliding / sliding pixel = 23924 93740
    ROI = Sliding
    Correct


 ** Frame Winner = Sliding ( NS = 0 of 1 )
    Correct


*** Patient Winner = Not Sliding ( NS = 1 of 4 )
    Patient False Positive = 004s_iimage_74132233134844_clean.nii.gz


   VFOLD = 2 of 15
```



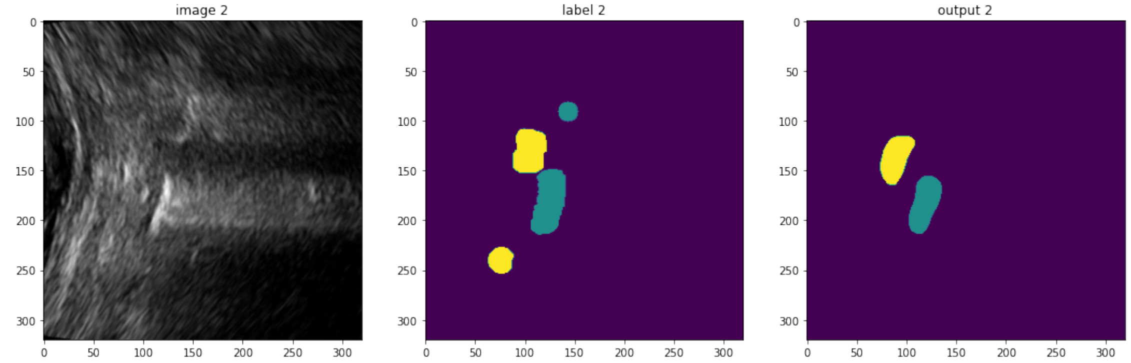
```
026ns_image_1083297968960_clean.nii.gz
```



```
  * ROI Number of not-sliding / sliding pixel = 45113 20801
    ROI = Not Sliding
    Correct


 ** Frame Winner = Not Sliding ( NS = 1 of 1 )
    Correct


026ns_image_1087766719219_clean.nii.gz
```

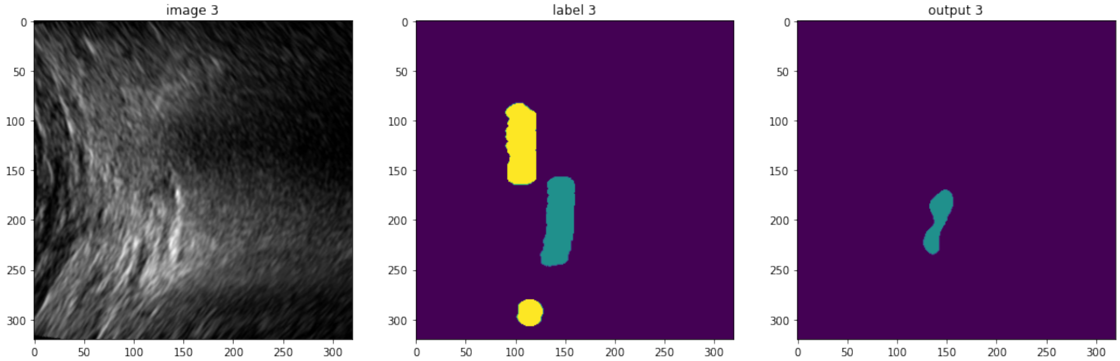


```
  * ROI Number of not-sliding / sliding pixel = 52214 26703
    ROI = Not Sliding
    Correct


 ** Frame Winner = Not Sliding ( NS = 1 of 1 )
    Correct


*** Patient Winner = Not Sliding ( NS = 2 of 2 )
    Correct


019s_iimage_10705997566592_CLEAN.nii.gz
```

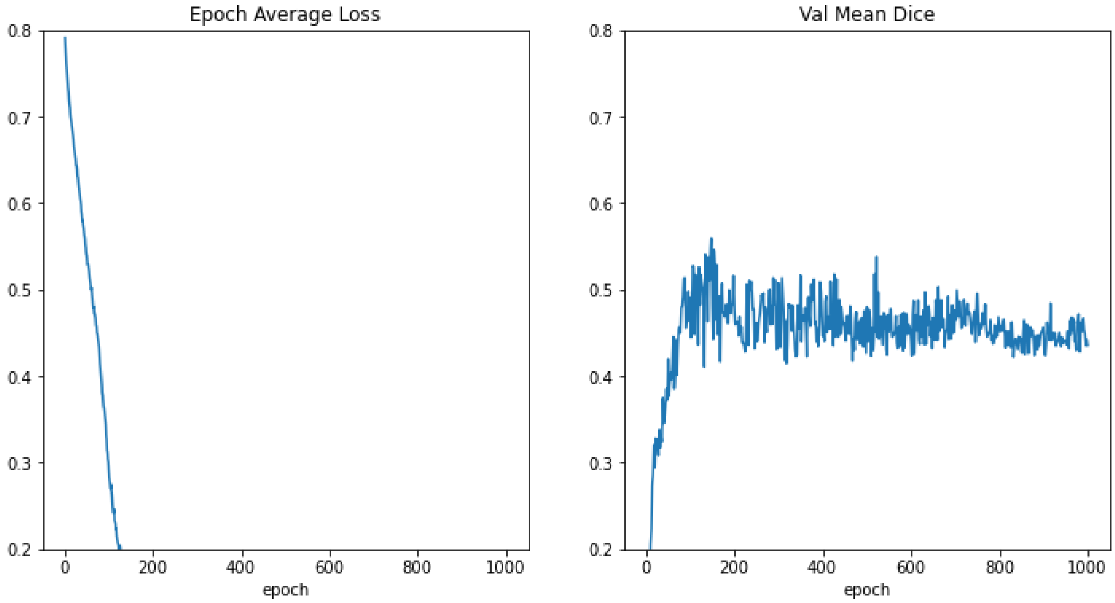


```
  * ROI Number of not-sliding / sliding pixel = 60262 62620
    ROI = Sliding
    Correct


 ** Frame Winner = Sliding ( NS = 0 of 1 )
```

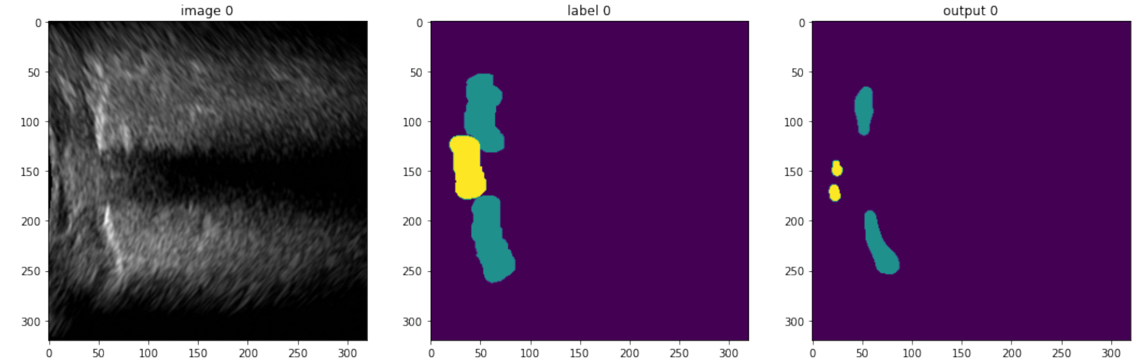
```
    Correct


019s_iimage_10891015221417_clean.nii.gz
```



```
  * ROI Number of not-sliding / sliding pixel = 0 31804
    ROI = Sliding
    Correct


 ** Frame Winner = Sliding ( NS = 0 of 1 )
    Correct


*** Patient Winner = Not Sliding ( NS = 2 of 4 )
    Patient False Positive = 019s_iimage_10891015221417_clean.nii.gz


   VFOLD = 3 of 15
```



```
027ns_image_4641643404894_CLEAN.nii.gz
```



```
* ROI Number of not-sliding / sliding pixel = 25360 72307
  ROI = Sliding
  False Negative
```

[1]:

```
import ipyparams
currentNotebook = ipyparams.notebook_name

from datetime import datetime
now = datetime.now()
```

```
experimentName = currentNotebook+now.strftime("-%Y.%m.%d_%H.%M.pdf")

cmd = "jupyter nbconvert "+currentNotebook+" --output "+experimentName+" --to␣
 ↪pdf"
import subprocess
subprocess.call(cmd, shell=True)
```

```
<IPython.core.display.Javascript object>
```

```
usage: jupyter-nbconvert [-h] [--debug] [--show-config] [--show-config-json]
                         [--generate-config] [-y] [--execute] [--allow-errors]
                         [--stdin] [--stdout] [--inplace] [--clear-output]
                         [--no-prompt] [--no-input]
                         [--allow-chromium-download]
                         [--log-level NbConvertApp.log_level]
                         [--config NbConvertApp.config_file]
                         [--to NbConvertApp.export_format]
                         [--template TemplateExporter.template_name]
                         [--template-file TemplateExporter.template_file]
                         [--writer NbConvertApp.writer_class]
                         [--post NbConvertApp.postprocessor_class]
                         [--output NbConvertApp.output_base]
                         [--output-dir FilesWriter.build_directory]
                         [--reveal-prefix SlidesExporter.reveal_url_prefix]
                         [--nbformat NotebookExporter.nbformat_version]
                         [extra_args [extra_args …]]
jupyter-nbconvert: error: argument --NbConvertApp.output_base: expected one
argument
```

```
[1]: 2
```

```
[ ]:
```