Submission requirement: a.) report contains the results (metrics, plot, segmentation examples); b.) code with a readme file.

Problem 1 (30%)

Please read the `README.md` file before coding. In this problem, you are required to implement a 3D segmentation network (e.g., 3d unet), including the model, dataloader, training/testing **(15%)**. In addition, you need to

1. Report 4 evaluation metrics on the test set: dice (≥ 81%), jaccard, the average surface distance (ASD) and the 95% Hausdorff Distance (95HD); **(5%)**
2. Plot the the training loss curve; **(5%)**
3. Show at least 4 segmentation results (2D slices) compared with the ground-truth label (i.e., 4 2D slices with GT and predictitons). **(5%)**

> Here are some hints for you to improve the overall performance:
>
> 1. model: batch normalization, residual design
> 2. augmentation: random crop, flip, rotation
> 3. loss function: dice loss, cross entropy loss
> 4. optimizer: SGD/Adam, learning rate decay
> 5. testing: crop + sliding window

Problem 2 (35%)

Skin Lession Dataset. In this dataset, there are totally 404 images, 305 for training and 99 for test. Each image has a diseases label (from 0 to 6). There are 7 classes in this dataset. See in `datas`.

In this problem, you are required to implement a classfication network (e.g., ResNet50) to classify the skin diseases, including the model, dataloader, training/testing **(10%)**. In addition, you need to

1.) Report accuracy on the test set, and achieve at least 80% accuracy. **(5%)**

2.) Add the contrastive loss to the standard cross-entropy loss **(10%)** and report the result **(5%)**.

3.) Plot the the training & test loss curves, training & test accuarcy curves for 1.) and 2.); **(5%)**

> Here are some hints for you to improve the overall performance:

> a.) model: batch normalization, residual design b.) augmentation: random crop, flip, rotation c.) loss function: cross entropy loss, contrastive loss d.) optimizer: SGD/Adam, learning rate decay

Problem 3 (35%)

Surgical Dataset. There are 6 videos in this dataset, which are sampled from Cholec80. Among them, 1-5 videos for training, and 41 video for test. For training easily, for each video, we sample every 100frames. See in `datas`.

In this problem, you are required to implement a temporal recognition network (e.g., ResNet50+LSTM) to classify the surgical phase recognition, including the model, dataloader, training/testing. In addition, you need to

1.) Use ResNet50 to classify the each frames **(10%)** and report accuracy on the test set, and achieve at least 70% accuracy **(5%)**.

2.) Use ResNet50 to extract features for each frame and LSTM to capture temporal frames among at least three (you can choose a larger number) nearby frames, i.e., the *i*-th, (*i+1*)-th and (*i+2*) frames **(10%)**. Achieve at least 70% accuracy **(5%)**.

3.) Plot the the training & test loss curves, training & test accuarcy curves for 1.) and 2.). **(5%)**

Here are some hints for you:

> You should load three neaby frames in each iteration of the dataloader. So assume batch size equals to B. In each interation, the dataloader should load $(B, N, 3, H, W)$, where N is the number of nearby frames.