深度學習於醫學影像分析—**Deep learning in medical image analysis**
Spring 2021

Homework 3, due on 2021/6/7

1. This homework is for analyzing sonography images obtained from scanning up from the lower neck. The goal is to **segment the carotid artery** from the image, which is a typical **semantic segmentation** problem.

2. We had taken sonography videos from left and right necks of three volunteers. We randomly extracted 100 image frames from each volunteer's video to from in total 300 training sonography images. The test data were taken from another volunteer and 100 test sonography images were created. We had asked several radiologists to label carotid artery area from each image frame.

3. The zipped file "**hwk03_data.rar**", which can be downloaded from e3 (https://e3.nycu.edu.tw/) under "Homework 3", contains all datasets for this homework.

   All training data are in the folder "**train**". Under the training data folder, there are two sub-folders "**pre**" and "**post**", which contains original sonography images and carotid artery labels, respectively. File names of training sonography images and their corresponding carotid artery labels can be found in the file "**train_path.csv**".

   Original sonography images of test data can be found under the folder "**test\pre**", and the file "**test_path.csv**" has the file names of test data.

4. This homework aims to develop predictive models to **label carotid artery areas of input sonography images**. You are ask to:

   a. Use the fully convolutional network (FCN) to build up your prediction model.

   b. Try out FCN-32 (without skip connections) and FCN-16 and FCN-8 (with skip connections) schemes to upsample the coarse feature maps into a full-resolution segmentation map.

5. For each upsampling scheme, load test sonography images into your prediction model to generate their predicted carotid artery labels. Save predicted carotid artery labels as "(test_file_name)_ROI.bmp", e.g., the out label for the test data "**frame1.bmp**" is "**frame1.bmp_ROI.bmp**".

    Collect all predicted carotid artery labels from schemes FCN-32, FCN-16, and FCN-8 under folds "**FCN-32**", "**FCN-16**", and "**FCN-8**", respectively. Create a zipped file containing all three folders and upload this zipped file.

    Please also upload the Python codes of your solution (saved as a .ipynb file) and its compiled html file.

6. 另外，繳交格式希望大家上傳壓縮檔(學號.zip)，裡面包含三個資料夾分別是 FCN-32, FCN-16, FCN-8，每個裡面包含一個叫 post 的資料夾放的是你們預測出來的 bmp 檔，檔名的部分請存成 framexx.bmp_ROI.bmp，即像 train_path.csv 裡所對應的一樣，如果不對的話可能導致無法評分請多注意!此外請再附上 report.pdf、學號.ipynb、學號.html，其中 report.pdf 只需要回答：
    -   4a.請說明 FCN 和 CNN 之間的差別即這樣的目的是甚麼?
    -   4b.請比較使用不同 FCN 結果之間的差別。