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Brain Auto-Segmenation for Craniotomy Project Lab Meeting

2021.04.08

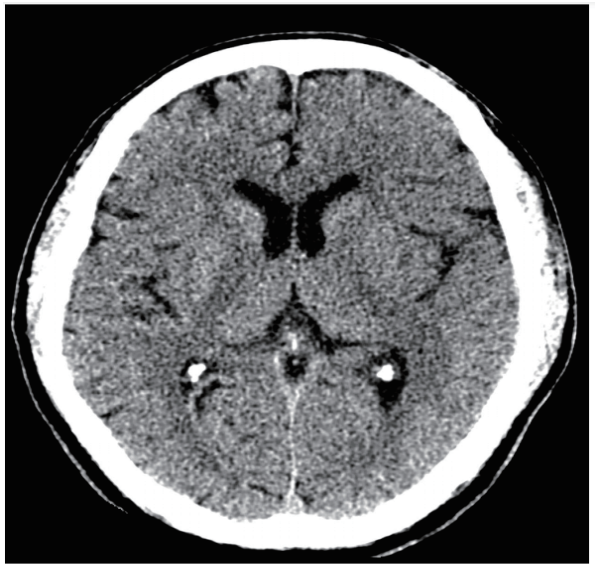
TAIL lab 정현재

Translation
Artificial
Intelligence
Lab

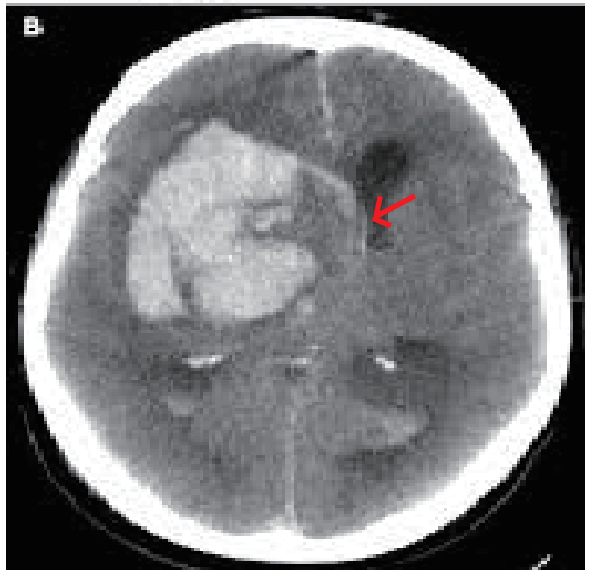
Project Outline

Main Goal

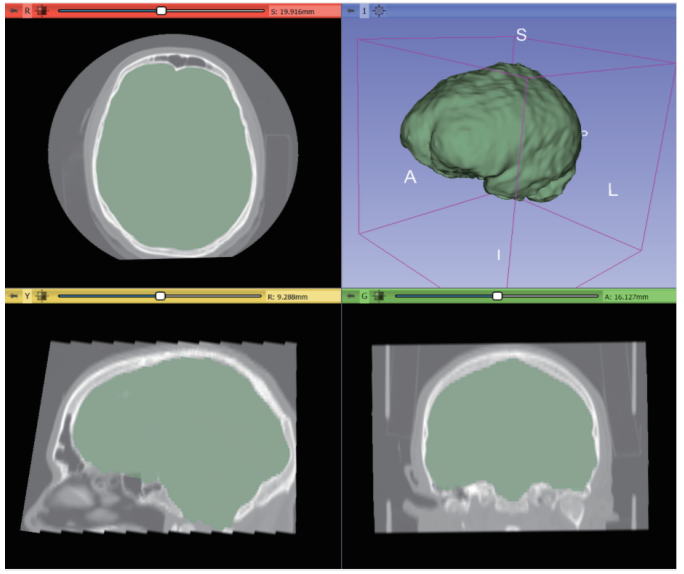
- Axial Image에서 좌뇌와 우뇌를 나누어주는 Sagittal line의 치우침 정도와 Brain Total Volume 등을 측정하여, 개두 수술을 진행을 결정한다.
- Brain, Skull Analyse Program을 개발한다.



Normal



Stroke



Brain, Skull Analyse

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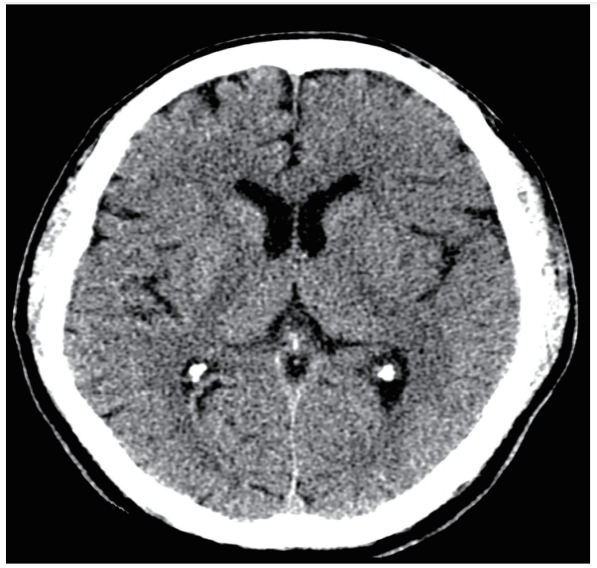

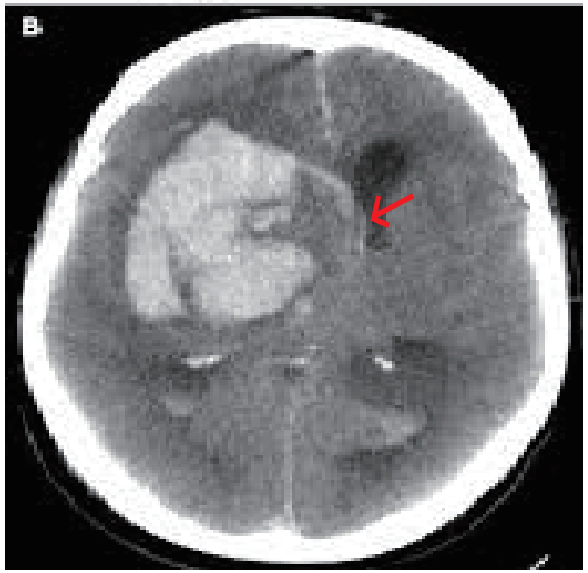

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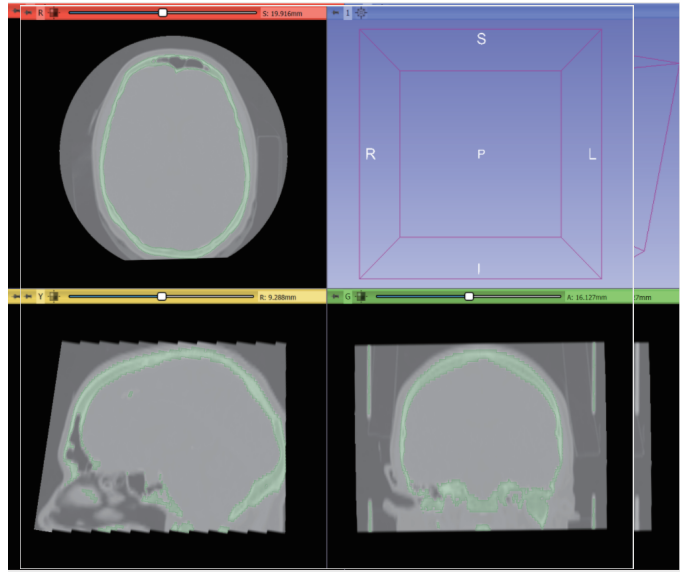
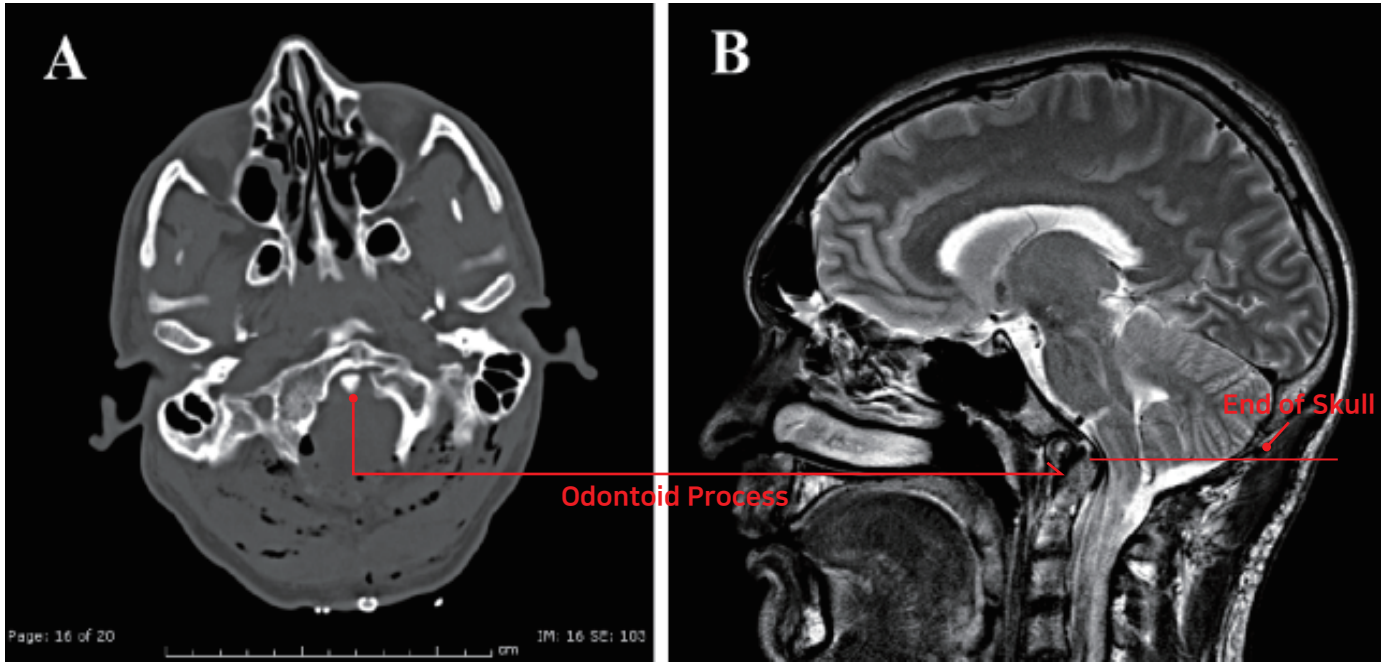


Brain, Skull Analyse

Skull Labeling Process

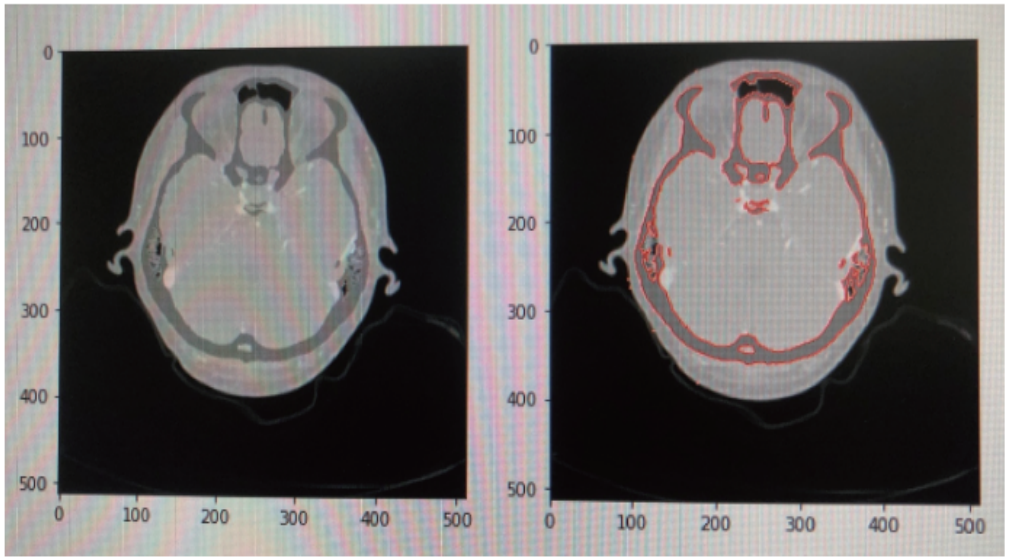
Now Processing...

Brain Volume Detect를 위해서 Auto-Segmentation을 진행중. 현재 Labeling 작업 완료
Dual Energy CT image -> Skull Labeling (Odontoid Process 전까지 Labeling 작업) (Image 240~250)



Axial Sagittal

Output



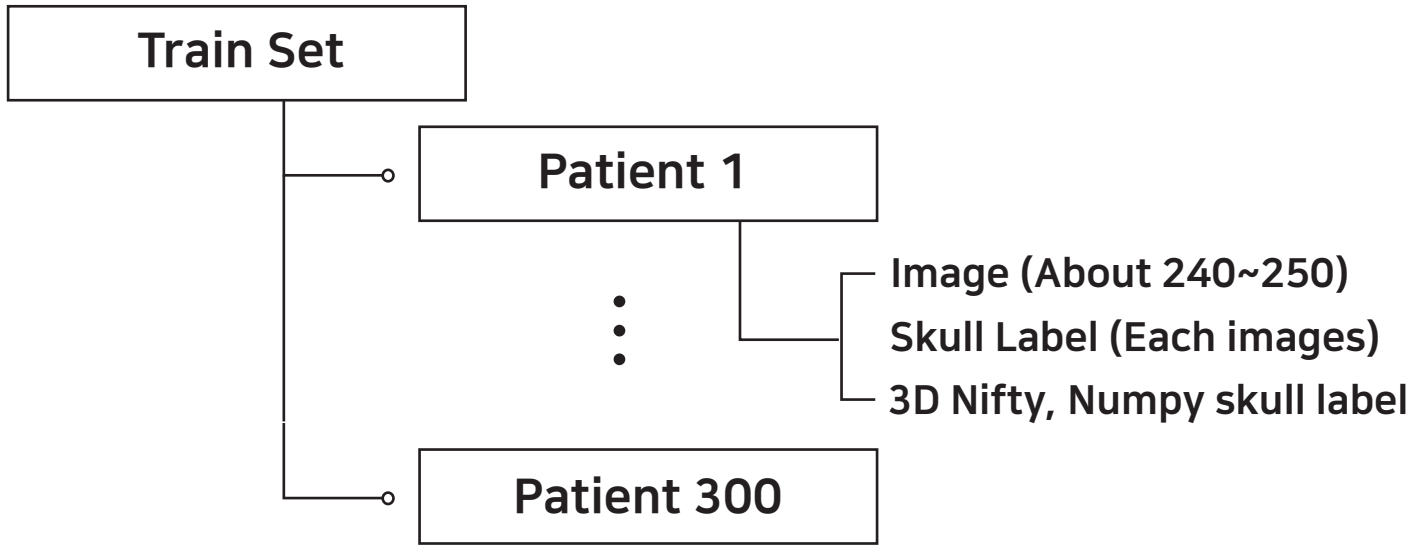
Skull Auto-Segmentation

Dataset

Train Data = Dual Energy CT Image 300 Patients with Skull Label (Total About 73500 Slice) (Almost 50~70 Age)

Predict Data = Normal + Dual Energy CT Patients Image

300 Patient → About 240~250 CT Axial Images with dicom file (512 * 512) + Each of Label Data (Skull Contour) + 2D, 3D Label Data (NIFTY, NUMPY)



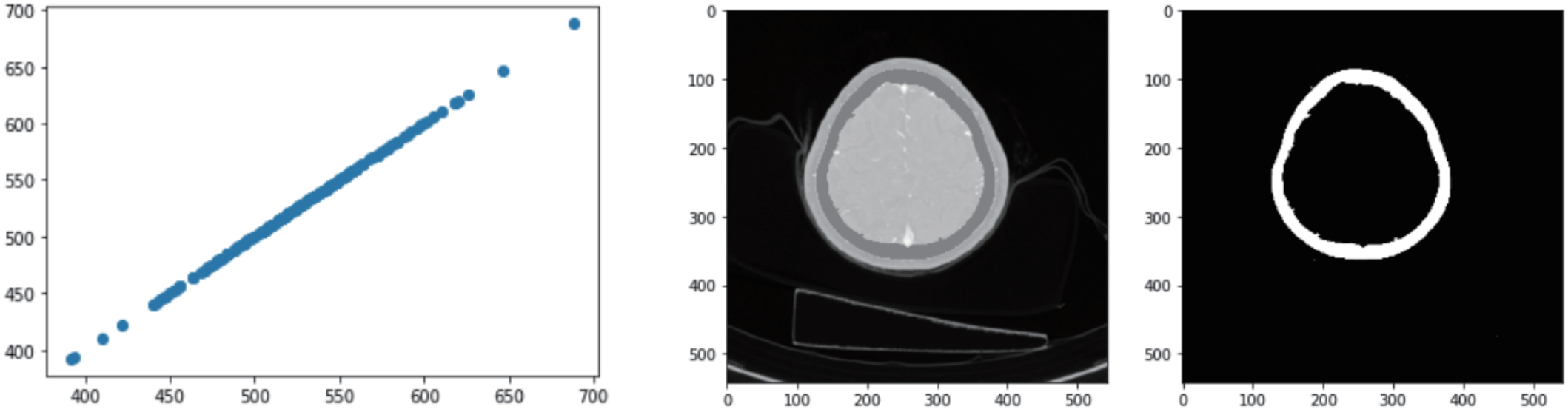
Skull Auto-Segmentation

Dataset Preprocessing

Train Data = Dual Energy CT Image 300 Patients with Skull Label (Total About 73500 Slice)

Train Test Split = 240 : 60 (8:2), Train : Validation Split = 192 : 48 (Train 8:2)

Pixel Spacing = Round off Mean pixel value (x,y,z(image thickness)) = (0.5,0.5,1)



After pixel spacing

Skull Auto-Segmentation

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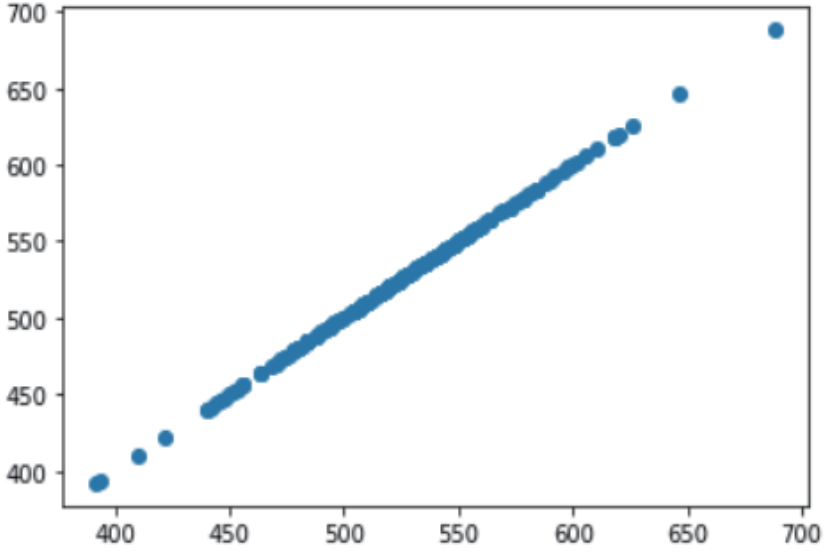

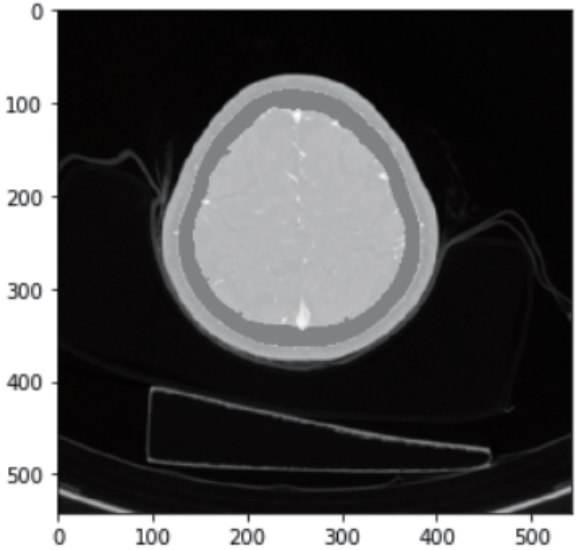

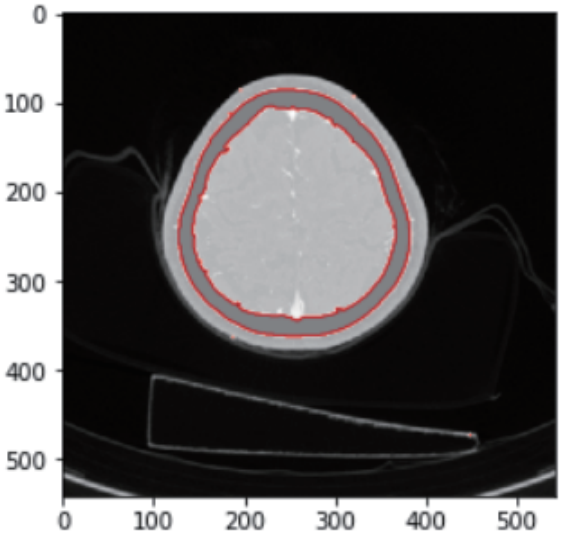

After pixel spacing

03 Dataset + Model Plan

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Skull Auto-Segmentation

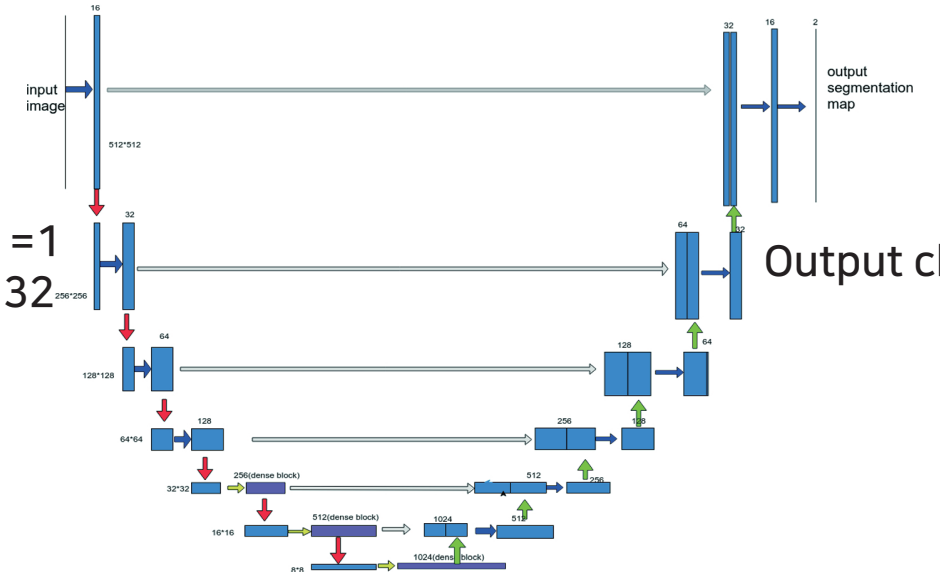
Unet

Framework = Pytorch , Train : Validation Split = 192 : 48 (Train 8:2)

Transform = Data Augmentation (Flip) , Loss =Dice_Loss

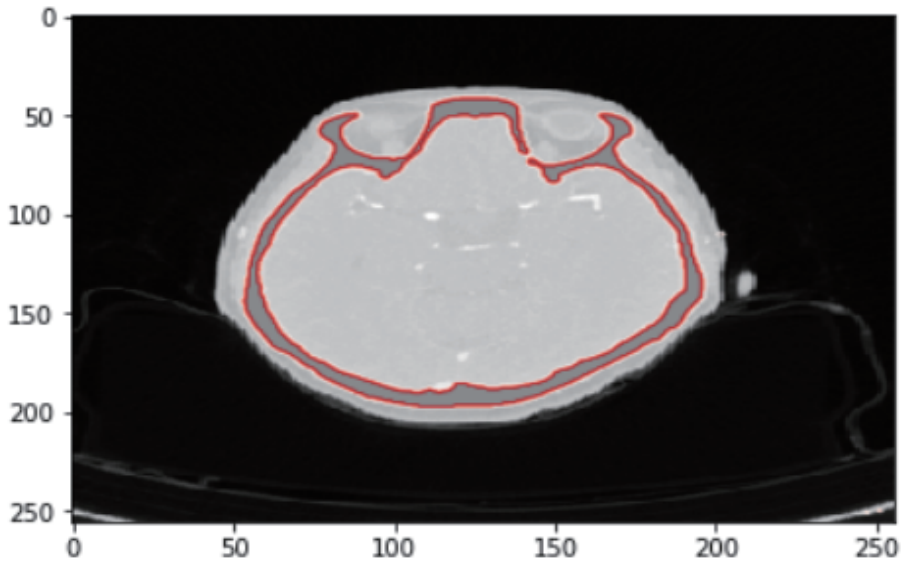
Final Dataset = Train,Valid Loader (8:2, batch_size = 32, Resize = (256,256))

Input channel =1
init feature = 32



Output channel =1

Unet



After Resize

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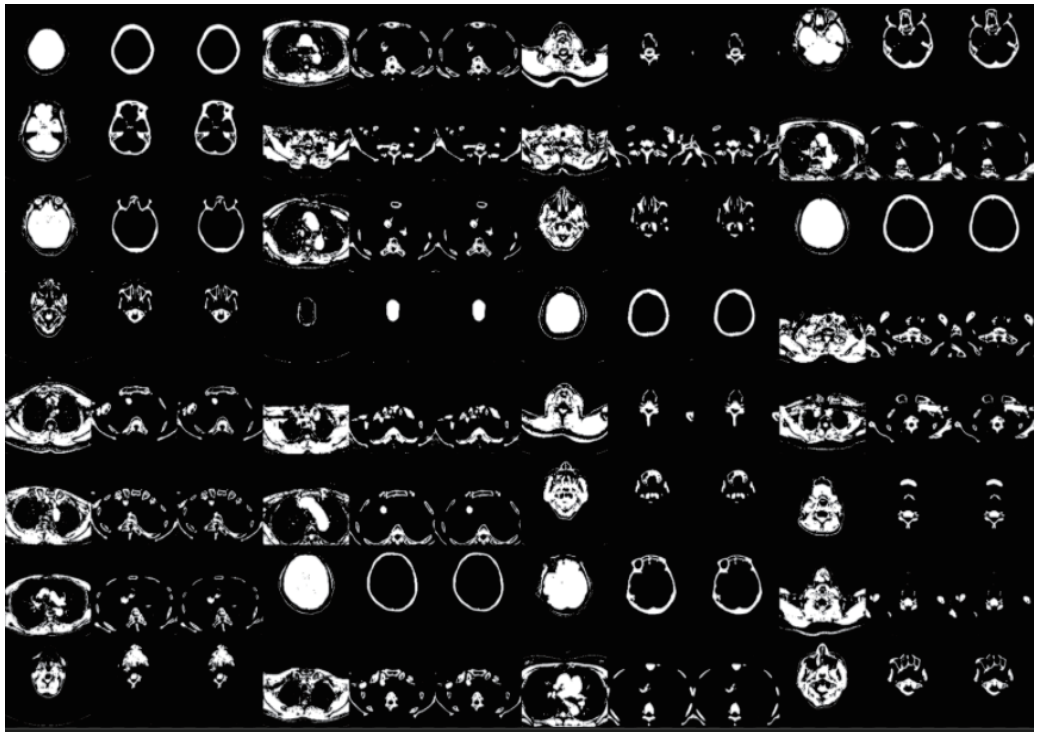
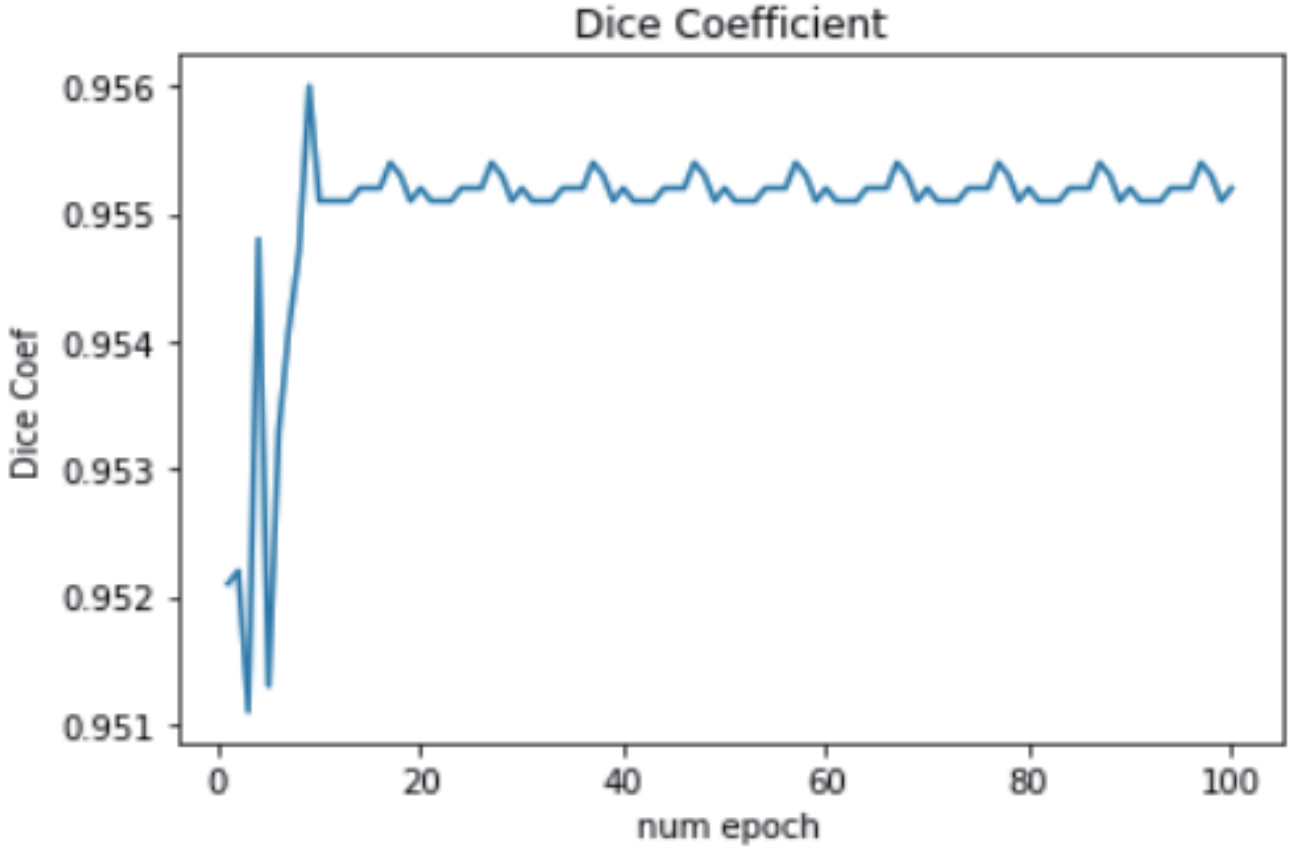
Output



(X, Output, Label)



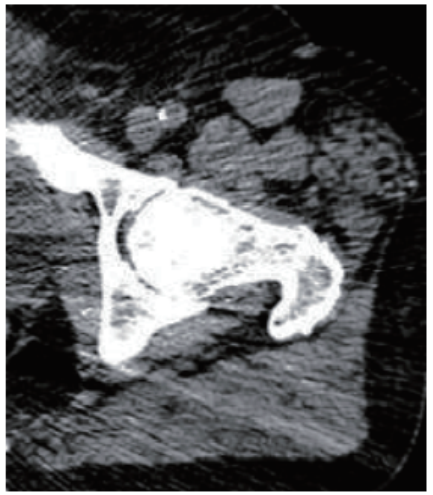
Dice coef : 0.9511 ~ 0.9560

03 Model

Super Resolution CT image Development

- Dual Energy CT 와 Normal CT (Single Energy CT)의 resolution, noise, matter color 등의 차이를 개선할 수 있는 Image Preprocessing

Dual Energy



Normal

Elsevier(2020.04): Synthesized 7T MRI from 3T MRI via deep learning
Elsevier(2017.10): A deep learning model integrating FCNNs and CRFs for brain tumor segmentation

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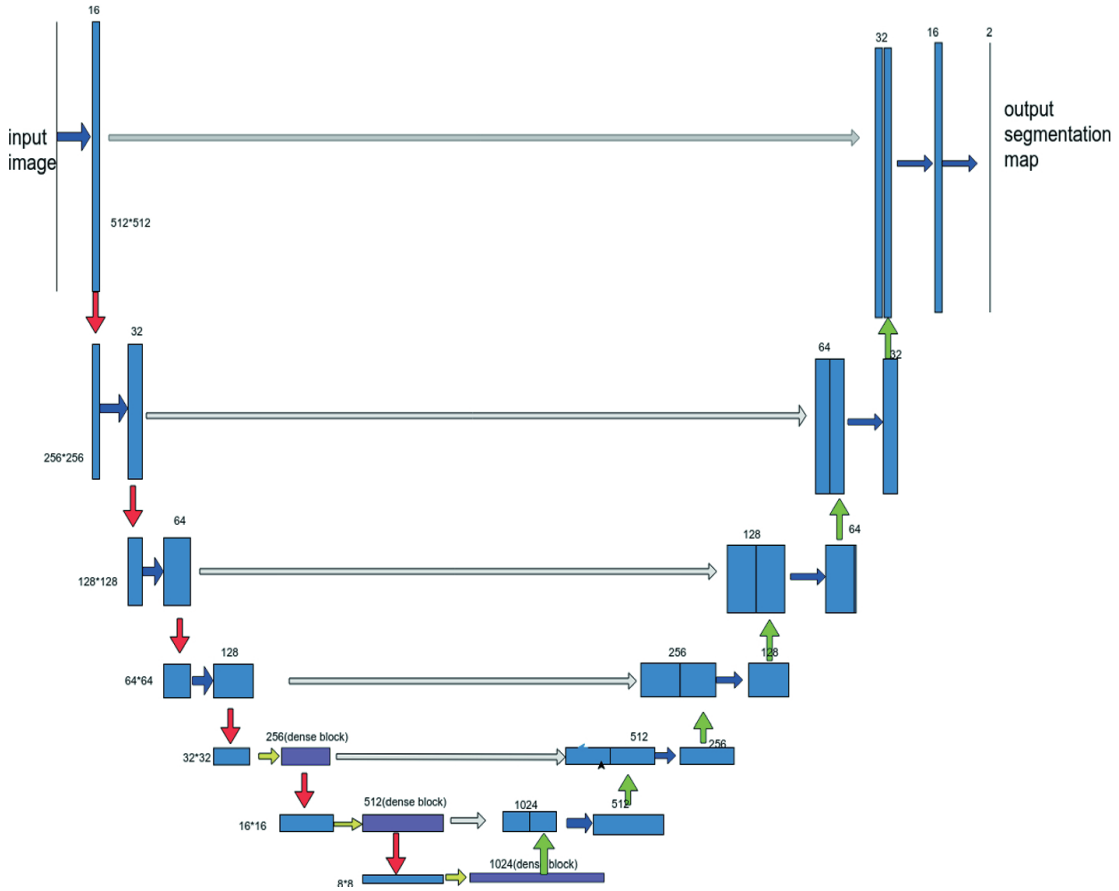
Normal & DE Both Detection Model

Dual Energy CT image



Mask Prediction

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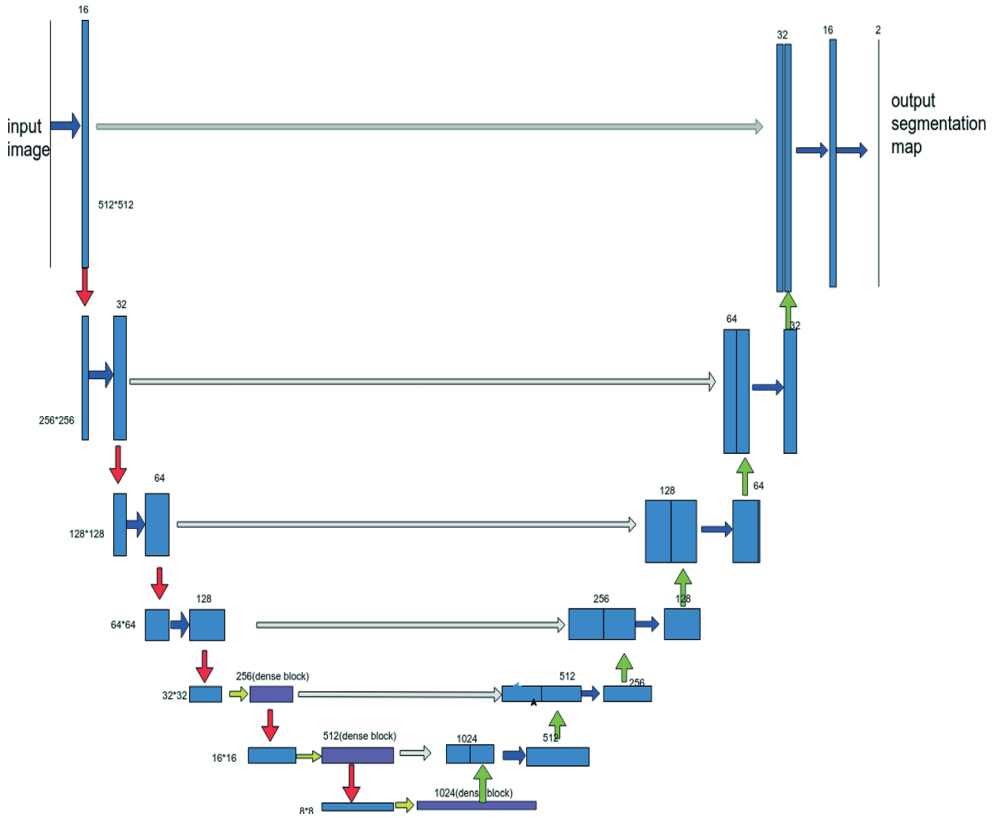
Normal & DE Both Detection Model

Dual Energy CT & Normal CT image



Mask Prediction

Elsevier (2017.07): Robust cranial cavity segmentation in CT and CT perfusion images of trauma and suspected stroke patients