ELEC4010N Final Project

HUANG, Jiajun (20694015)

WU, Yongjin (20564741)

Project 1: Semi-Supervised Learning

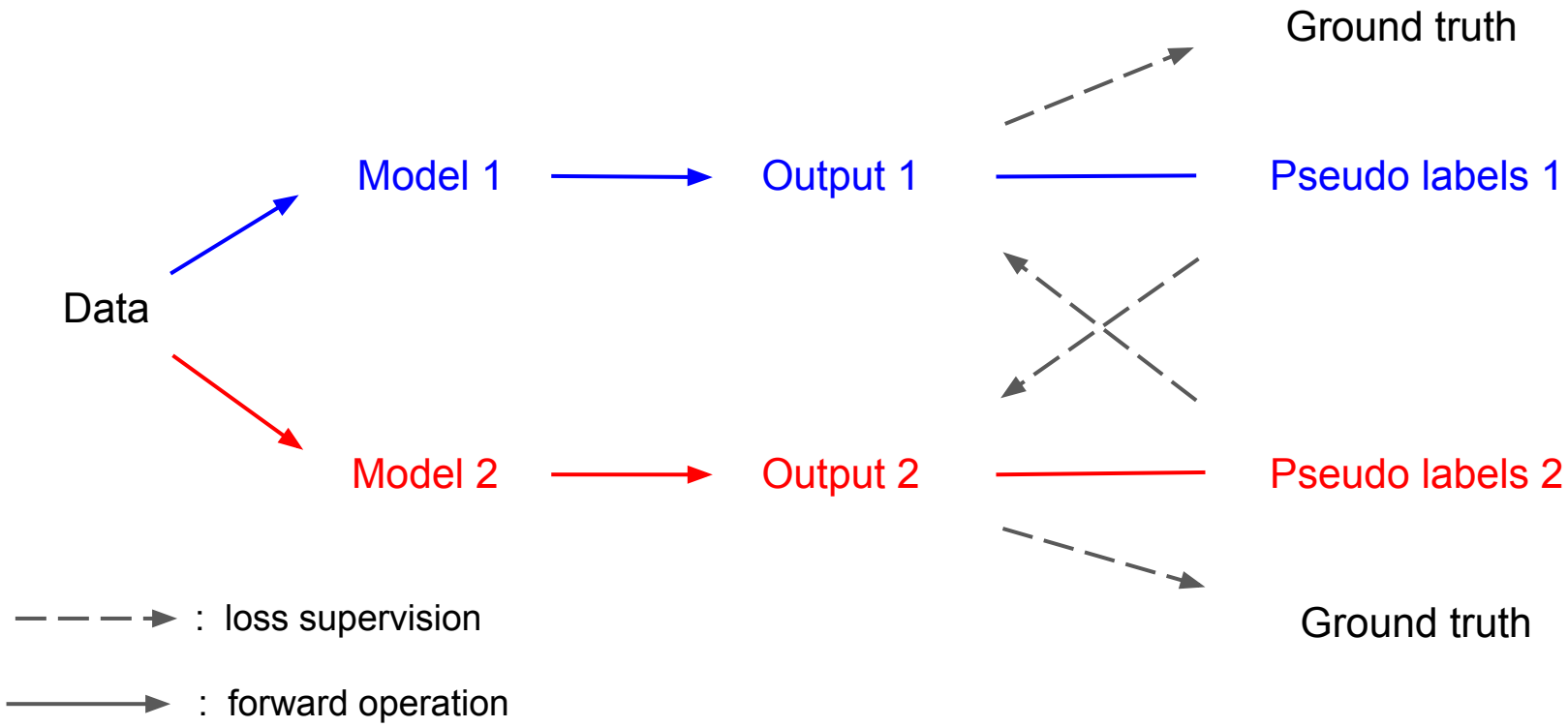
Semi-Supervised Classification

Semi-Supervised learning

Why we need semi-supervised learning?

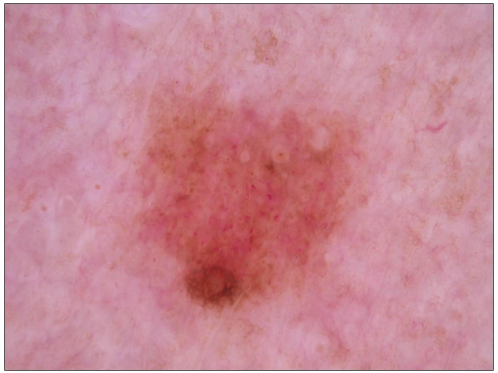
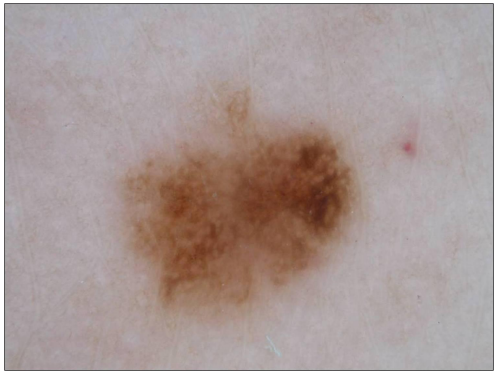
- Limited labelled data
- Accuracy improvement with lower cost
- Reduce labelling effort
- Down-to-earth application

Cross Pseudo Supervision (CPS)



Dataset

- Lesion dataset used in Assignment 2 (benign or malignant)
- 900 training images
- 379 testing images

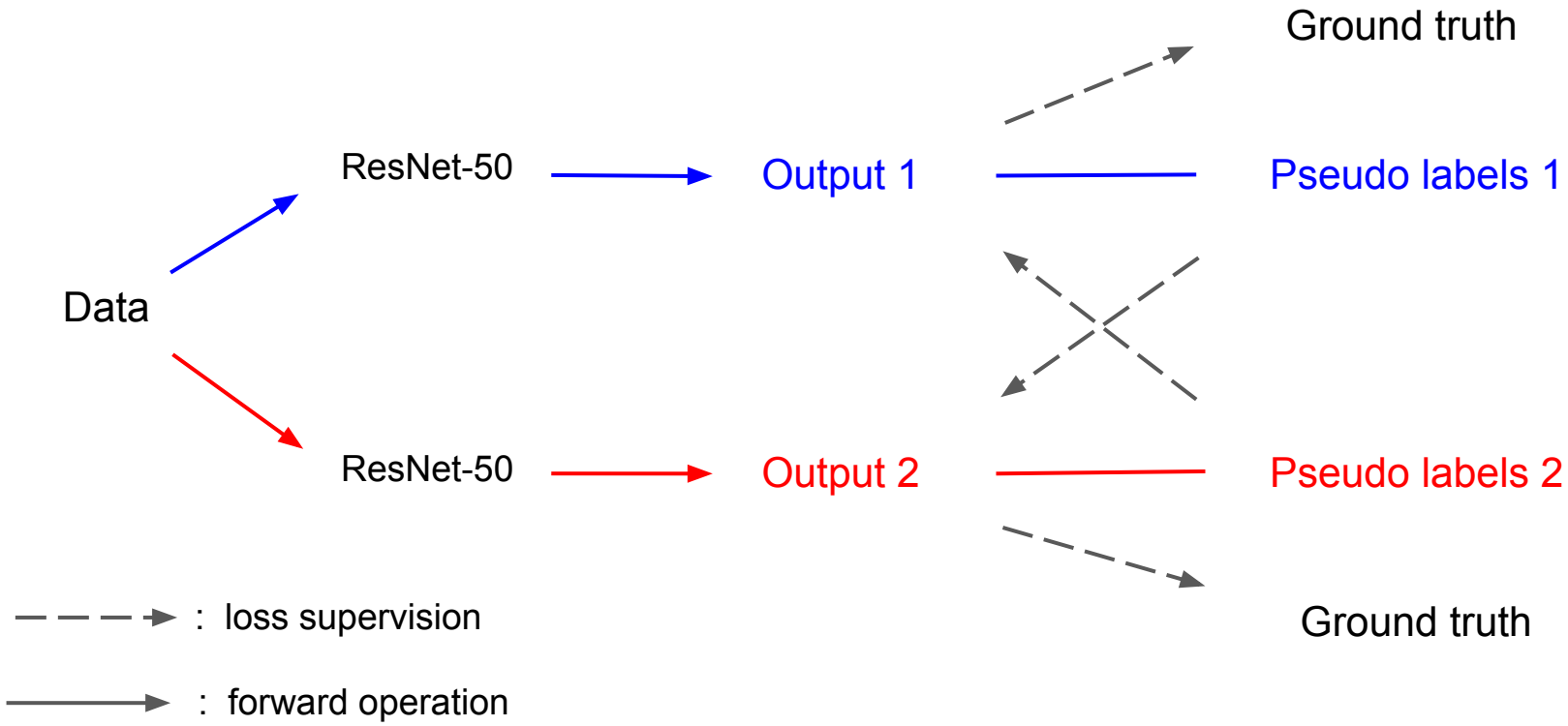
Baseline

- ResNet-50 classification network
- 270 labelled training images
- 90 validation images
- 379 testing images

Implementation of our project

- ResNet-50 classification network trained by CPS method
- 270 labelled training images
- 540 unlabelled training images
- 90 validation images
- 379 testing imagess

Cross Pseudo Supervision (CPS)



Results

	Trial 1	Trial 2	Trial 3	Trial 4
Baseline AUC	0.7549	0.7475	0.7913	0.7790
CPS AUC	0.7824	0.7507	0.8137	0.7835
Baseline ACC	0.7916	0.7968	0.8259	0.8074
CPS ACC	0.8259	0.8153	0.8443	0.8127

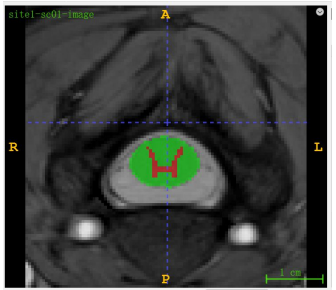
Project 2: Domain Generalization

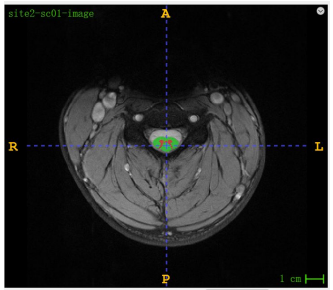
On SCGM (spinal cord gray matter segmentation)

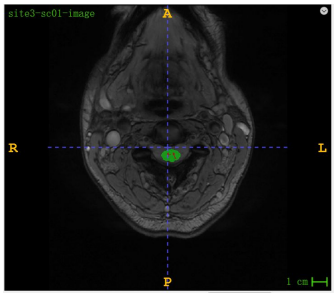
Spinal cord grey matter segmentation challenge - ScienceDirect

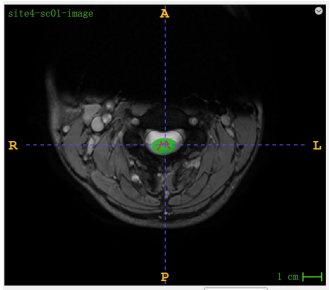
Task

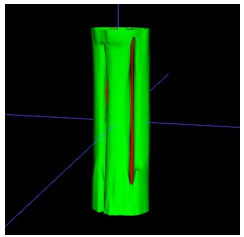
- DG: several different but related domains are given. How to learn a model that can generalize to an unseen test domain?
- Image: MRI from 4 hospitals
- Label: Spinal Cord (SC) & Grey Matter (GM)
- Train & Val – 3 hospitals. Test – 1 left hospital





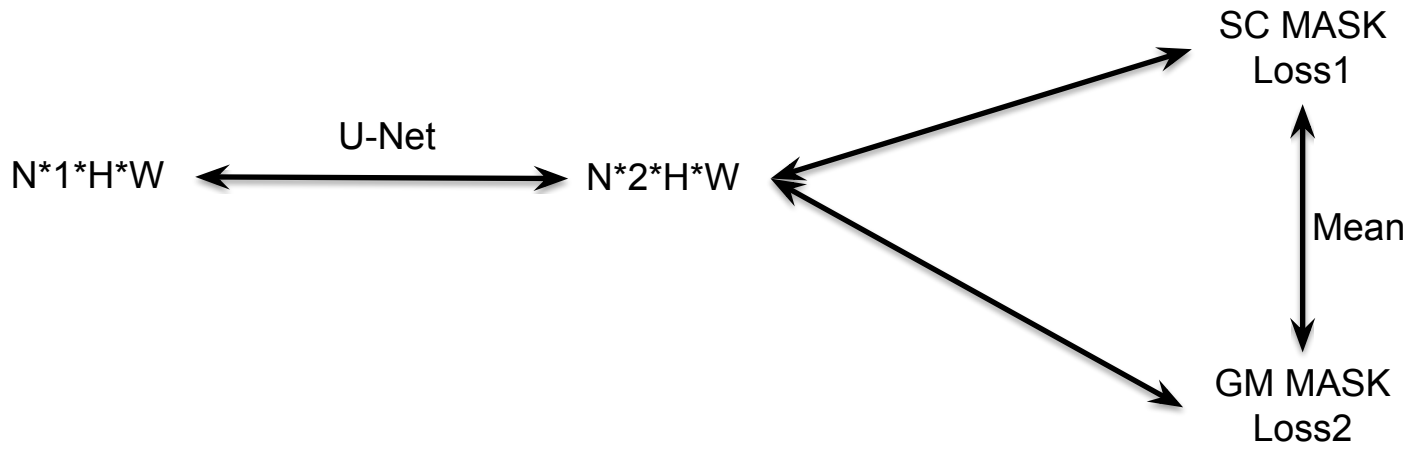






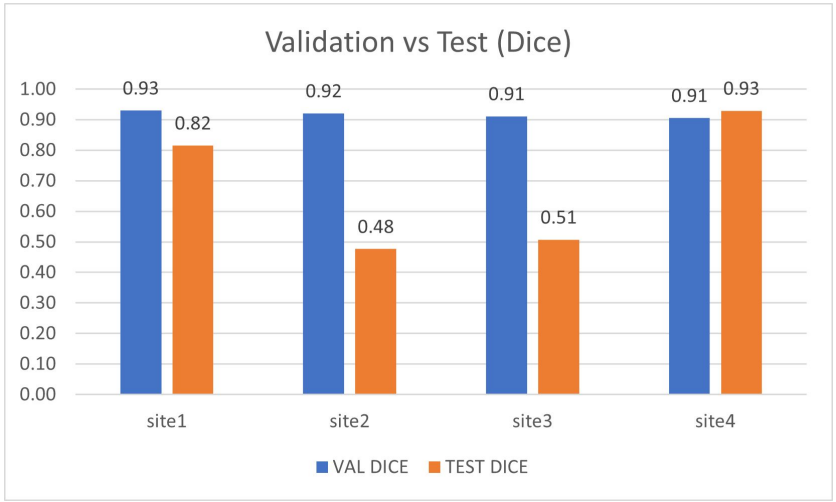
Baseline

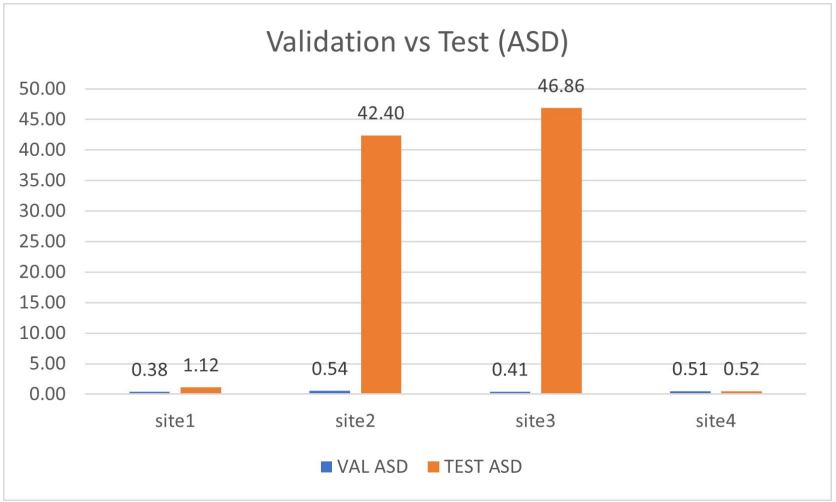
- Model: 2-D U-Net with ResNet50 as encoder.
- Loss: Dice loss (averaged between 2 labels)



Baseline Result

- Cannot generalize to an unseen domain well.



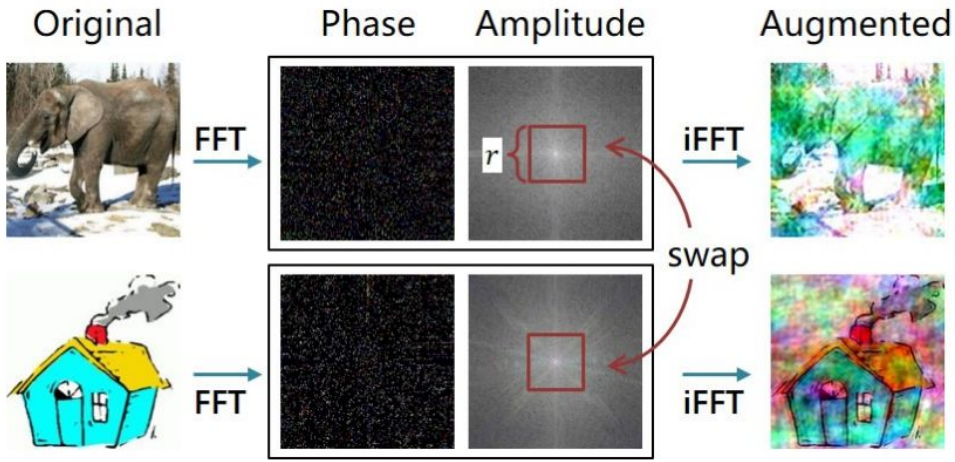


FACT

- In Fourier Transformation:

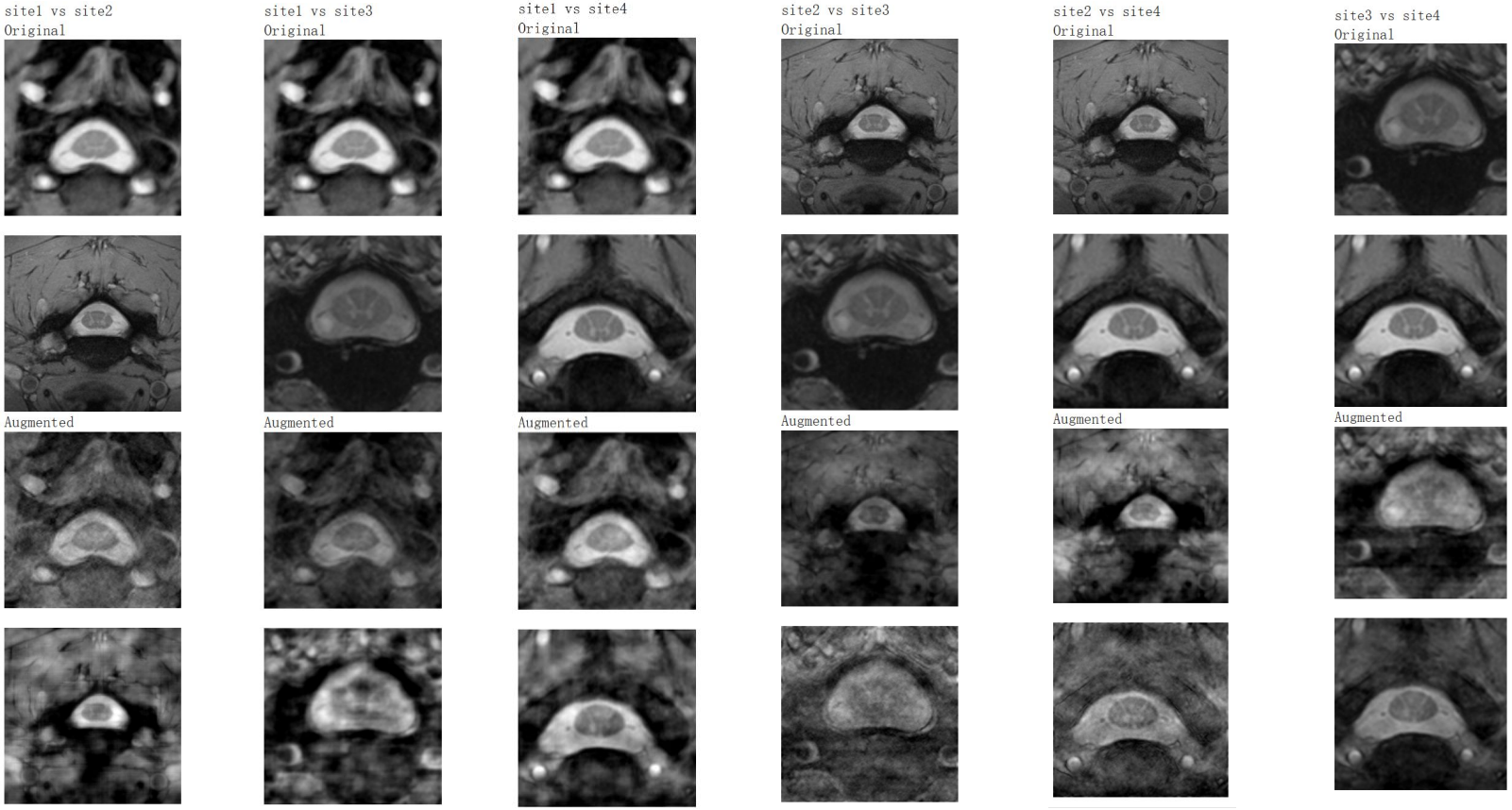
  phase - high-level semantics

  amplitude - low-level statistics



A Fourier-Based Framework for Domain Generalization (thecvf.com)

FACT Result


site1 vs site2
Original
site1 vs site3
Original
site1 vs site4
Original
site2 vs site3
Original
site2 vs site4
Original
site3 vs site4
Original
Augmented
Augmented
Augmented
Augmented
Augmented
Augmented

FACT Result

- With augmented data, FACT model has better generalization ability.