ELEC4840 Project: Skin Lesion Classification

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Introduction

Topic Selection

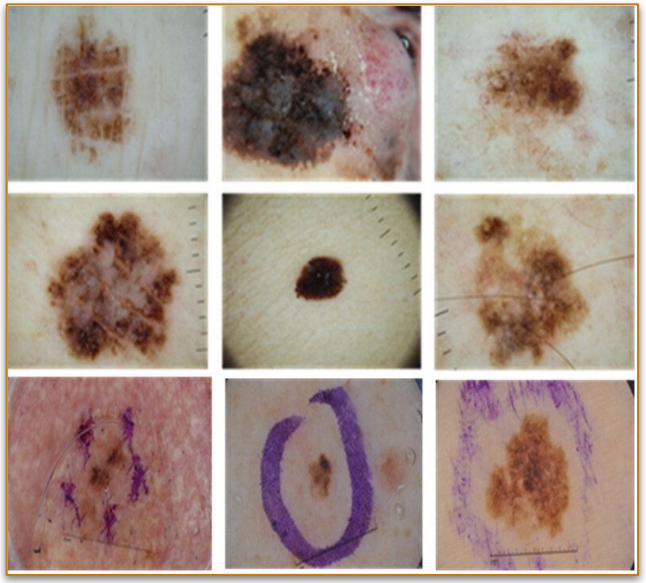
Skin Lesion Classification

Data

ISIC 2016 Challenge Dataset (Labeled) + ISIC 2017 Challenge Dataset (Unlabeled)

Goal

Improve performance from baseline supervised learning using Semi-Supervised Learning and Domain Generalization



Baseline Model

Dataset Partition

720 training data, 180 validation data, 379 testing data

Model and Hyper-parameters

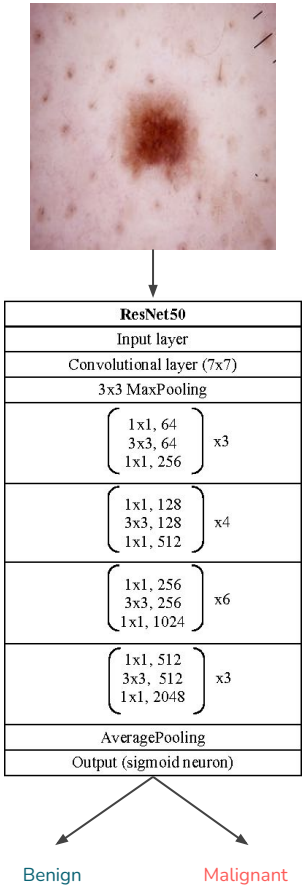
Resnet-50

Learning rate = 0.1, Loss Function = BCELoss, Epochs = 10

Optimizer = Adam (momentum of 0.9)

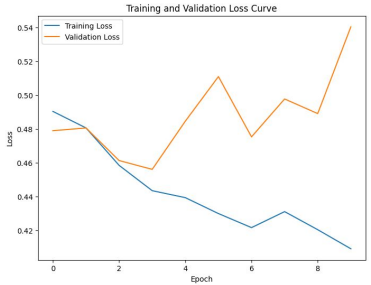
Method Description

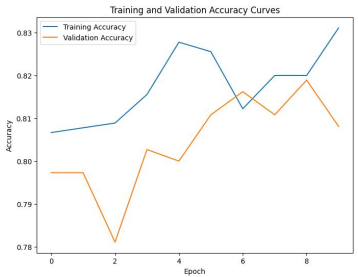
Supervised learning

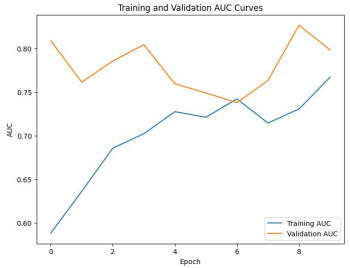


Baseline Results

Testing Accuracy	Testing AUC
77.7%	79.4%







Semi-Supervised Learning with Pseudo Labeling Method

Method Description

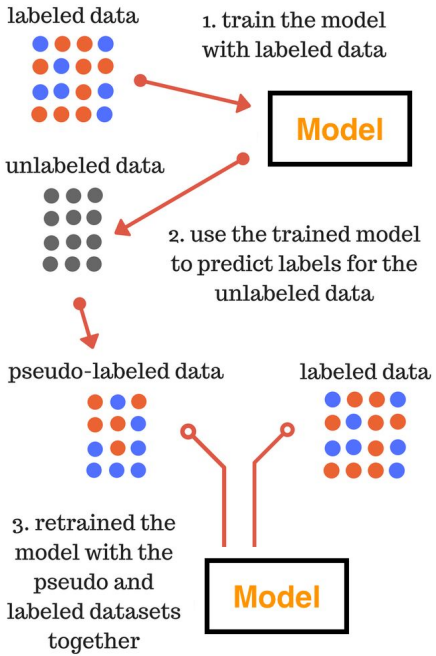
Train model on labeled data to generate pseudo-labels for unlabeled data, then train model on pseudo-labels

Dataset

Included 2000 unlabeled data from ISIC 2017 training dataset with ISIC 2016 as labeled

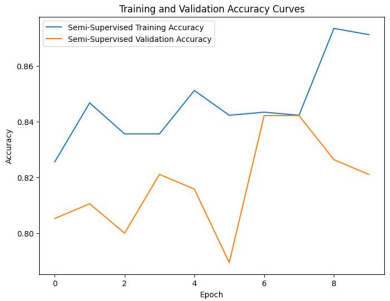
Model and Hyper-parameters

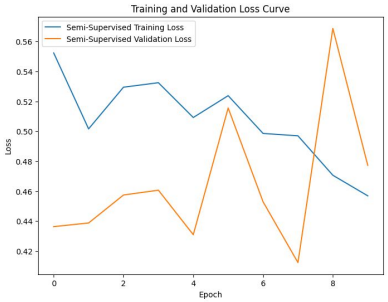
Mostly same as baseline, total loss adds pseudo label loss and labeled loss

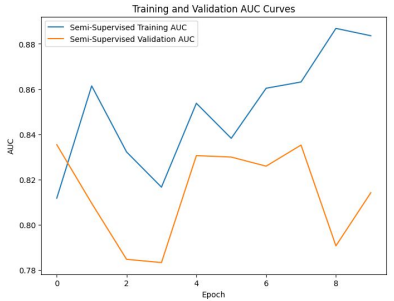


Pseudo-Labeling Method Results

Testing Accuracy	Testing AUC
81.4%	82.1%



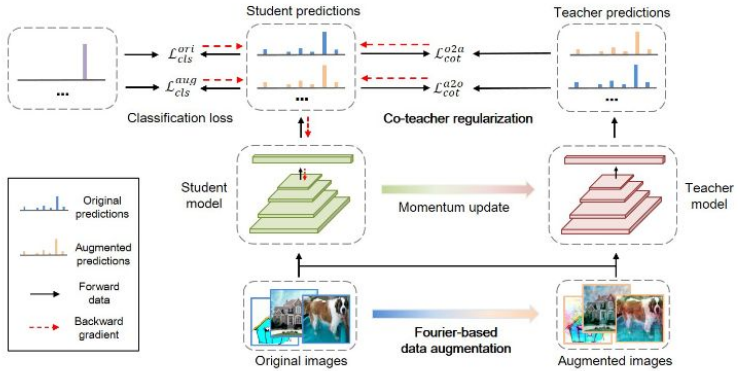




Domain Generalization with FACT Method

Method Description

Apply Fourier-based Augmentation to data and use Co-Teacher Regularization



Dataset

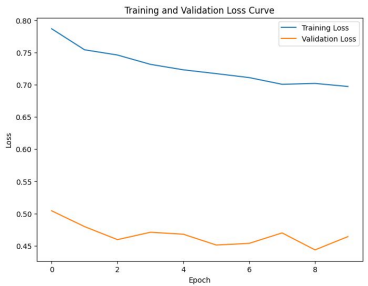
2016 ISIC Challenge

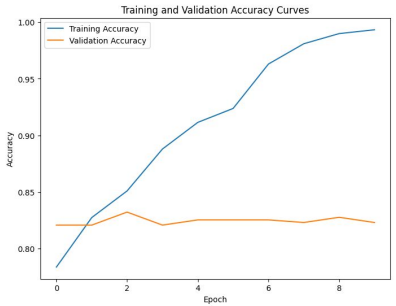
Model and Hyper-parameters

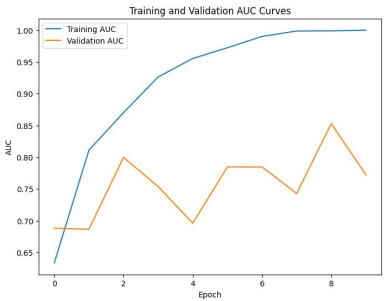
Similar to Baseline, change loss function to Cross-Entropy Loss

FACT Framework Method Results

Testing Accuracy	Testing AUC
71.4	80.5%







Result Comparison

Method	AUC	Accuracy
Baseline Model	77.7%	79.8%
Pseudo-Labeling	81.4%	82.1%
FACT Framework	71.4%	80.5%

Conclusion

Able to gain beat baseline with pseudo-labeling, but unable to get better performance with FACT framework

Could improve performance by trying different hyper-parameters, improving augmentation, trying different methods, etc.

Thank You!

References

Gutman, David; Codella, Noel C. F.; Celebi, Emre; Helba, Brian; Marchetti, Michael; Mishra, Nabin; Halpern, Allan. "Skin Lesion Analysis toward Melanoma Detection: A Challenge at the International Symposium on Biomedical Imaging (ISBI) 2016, hosted by the International Skin Imaging Collaboration (ISIC)". eprint arXiv:1605.01397. 2016.

Codella N, Gutman D, Celebi ME, Helba B, Marchetti MA, Dusza S, Kalloo A, Liopyris K, Mishra N, Kittler H, Halpern A. "Skin Lesion Analysis Toward Melanoma Detection: A Challenge at the 2017 International Symposium on Biomedical Imaging (ISBI), Hosted by the International Skin Imaging Collaboration (ISIC)". arXiv: 1710.05006 [cs.CV]

Xu, Q., Zhang, R., Zhang, Y., Wang, Y., Tian, Q.: A fourier-based framework for domain generalization. In: Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. pp. 14383–14392 (2021)