

Aliasghar Mortazi

1988	Born in Tehran, Iran
2012	B.S., Shamsipour Technical College, Tehran, Iran
2014	M.S., Sharif University of Technology. Tehran, Iran
2018	Research Scientist Intern, Harvard Medical School, MA
2018-19	Research Scientist, University of Pennsylvania, PA
2015-19	Ph.D., University of Central Florida, Orlando, Florida

TALKS

2017	Automatically Segmenting Left Atrium and Proximal Veins with Human Level Performance, **Radiological Society of North America,** Chicago, IL
2017	Machine Learning For Cardiac MRI: **North American Society for Cardiovascular Imaging,** San Antonio, TX
2018	Automatic designing of Convolutional Neural Networks **University of Pennsylvania,** Philadelphia, PA
2019	A Post-Acquisition Standardization Method for PET Images, **University of Pennsylvania,**Philadelphia, PA

(SELECTED) AWARDS

2017	AHA CVRI Young Investigator Award finalists at NASCI
2017	Second rank in MICCAI STACOM MM-WHS challenge
2017	Merit award from Radiological Society of North America

UCF | Center for Research in Computer Vision

UNIVERSITY OF CENTRAL FLORIDA

FINAL ORAL EXAMINATION

OF

Aliasghar Mortazi

B.S., Shamsipour Technical College, Tehran, Iran, 2012
M.S., Sharif University of Technology, Tehran, Iran, 2014

FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

(COMPUTER SCIENCE)

7, November, 2019, 11:00 A.M.
ENG2 - 202A

DISSERTATION COMMITTEE

Professor Ulas Bagci, *Chairman*,
Professor Mubarak Shah,
Professor Abhijit Mahalanobis,
Professor Marianna Pensky

DISSERTATION RESEARCH IMPACT

Image segmentation plays a vital role in understanding and analysis images, specifically in medical imaging and radiology, image segmentation can help to quantifying diseases, measuring the structures volumes, and analyzing the organ morphology. Deep learning as a state-of-the-art method in the most image analysis tasks, has its own challenges in medical image segmentation such as dimensionality of images, different modalities, number of organs and their variation, varying labeling conditions. This dissertation makes contributions to tackle mentioned problems by 1) introducing 2.5D segmentation method with an adaptive fusion to address dimensionality problem in medical image analysis 2) proposing a generic method to handle different modalities in medical images with different number of target organs. 3) introducing a reinforcement learning method to learn CNN architecture with reasonable amount of resources. 4) proposing a method to train using shape prior from noisy and inexpert labels to learn in expert level.

SELECTED PUBLICATIONS(citations>85)

1. A. Mortazi, R. Karim, K. Rhode, J. Burt, and U. Bagci, "**CardiacNET: Segmentation of Left Atrium and Proximal Pulmonary Veins from MRI Using Multi-View CNN",** (MICCAI) 2017

2. A. Mortazi, J. Burt, U. Bagci, "**Deep Learning for Cardiac MRI: Automatically Segmenting Left Atrium and Proximal Veins with Human Level Performance",** RSNA 2017

3. A. Mortazi, J. Burt, and U. Bagci, "**Multi-View Deep Segmentation Networks for Cardiac Structures from MRI and CT",** (MICCAI STACOM Workshop/Challenge) 2017, (Oral)

4. A. Mortazi, G. Papadakis, U. Teomete, U. Bagci. **"Cardiac Image Analysis with Deep Learning Methods",** RSNA 2018

5. A. Mortazi and U. Bagci,"**Automatically Designing CNN Architectures for Medical Image Segmentation" ,** (MICCAI MLMI Workshop) 2018, (Oral)

6. A. Mortazi, N. Khosravan, D. Torigian, S. Kurugol, Ulas Bagci, **"Weakly Supervised Segmentation by A Deep Geodesic Prior",** (MICCAI MLMI Workshop) 2019, (Oral)

7. N. Khosravan, A. Mortazi, M. Wallace, U. Bagci, **"PAN: Projective Adversarial Network for Medical Image Segmentation",** (MICCAI) 2019

8. X. Zhuang, L. Li, C. Payer, D. Stern, M. Urschler, M. P Heinrich, J. Oster, C. Wang, O. Smedby, C. Bian, X. Yang, P. Heng, A. Mortazi, U. Bagci, and et al., "**Evaluation of Algorithms for Multi-Modality Whole Heart Segmentation",**(Medical Image Analysis) 2019

9. J. Burt, N. Torosdagli, N. Khosravan, H. RaviPrakash, A. Mortazi, C. Rogers, F. Tissavirasingham, S. Hussein, U. Bagci**. "Deep Learning Beyond Cats and Dogs: Recent Advances in Diagnosis Breast Cancer with Dee Neural Networks",** (British Journal of Radiology) 2018.

DISSERTATION

OPTIMIZATION ALGORITHMS FOR DEEP LEARNING BASED MEDICAL IMAGE SEGMENTATIONS

Medical image segmentation is one of the fundamental processes to understand and assess the functionality of different organs and tissues as well as quantifying diseases and helping treatment planning. With ever increasing number of medical scans, automated, accurate, and efficient medical image segmentation is as unmet need for improving healthcare.

Recently, deep learning has emerged as one of the most powerful methods for almost all image analysis tasks such as segmentation, detection, and classification and so in medical imaging. In this regard, this dissertation introduces new algorithms to perform medical image segmentation for different (a) imaging modalities, (b) number of objects, (c) dimensionality of images, and (d) under varying labeling conditions.

First, we study dimensionality problem by introducing a new 2.5D segmentation engine that can be used for single and multi-object setting. We propose new fusion strategies as well as loss functions for deep neural networks to generate satisfactory delineations.

Later, we expand the proposed idea into 3D and 4D medical images and develop a "budget (computational) friendly" architecture search algorithm to make this process self-contained and fully automated without scarifying accuracy. Instead of manual architecture design, which is often based on plug-in and out and expert experience, the new algorithm provides an automated search of successful segmentation architecture within a short period of time.

Finally, we study further optimization algorithms on label noise issue and improve overall segmentation problem by incorporating prior information about label noise and object shape information. For first time in literatures, we obtained shape prior from inexpert and noisy labels by deep geodesic features and incorporate obtained prior in the segmentation network to do expert-level annotation by using inexpert labels.

We conclude the thesis work by studying different network and hyperparameter optimization settings that are fine-tuned for varying conditions for medical images in particular. The optimization methods as the engine of deep networks in training are studied and introduced for medical image segmentation. Applications are chosen from cardiac scans (images) and efficacy of the proposed algorithms are demonstrated on several data sets.