NYU TANDON SCHOOL OF ENGINEERING

MERIIT Lab - STEM Talk Series

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Title: Learning Strong Inference Models in Small Data Domains: Towards Robust Human Pose Estimation

Prof. Sarah Ostadabbas,

Assistant Professor,
Electrical & Computer Engineering Department
Northeastern University
Boston, MA 02115
Office: 520 ISEC (Northeastern University Interdisciplinary Science & Engineering Complex)
Office Phone: 617-373-4992
ostadabbas@ece.neu.edu
http://www.northeastern.edu/ostadabbas/

Abstract -- Recent efforts in machine learning (especially with the new waves of deep learning introduced in the last decade) have obliterated records for regression and classification tasks that have previously seen only incremental accuracy improvements. There are many other fields that would significantly benefit from machine learning (ML)-based inferences where data collection or labeling is expensive, such as healthcare. In these domains (i.e., Small Data domains), the challenge we now face is how to learn efficiently with the same performance with fewer data. Many applications will benefit from a strong inference framework with deep structure that will: (i) work with limited labeled training samples; (ii) integrate explicit (structural or data-driven) domain knowledge into the inference model as editable priors to constrain search space; and (iii) maximize the generalization of learning across domains. In this talk, I explore a generalized ML approach to solve the small data problem in the context of human pose estimation with several medical applications. There are two basic approaches to reduce data needs during model training: (1) decrease inference model learning complexity via data-efficient machine learning, and (2) incorporate domain knowledge in the learning pipeline through the use of data-driven or simulation-based generative models. In this talk, I present my recent work on merging the benefits of these two approaches to enable the training of robust and accurate (i.e., strong) inference models that can be applied on real-world problems dealing with data limitation. My plan to achieve this aim is structured in four research thrusts: (i) introduction of physics- and/or data-driven computational models here referred to as weak generator to synthesize enough labeled data in an adjacent domain; (ii) design and analysis of unsupervised domain adaptation techniques to close the gap between the domain adjacent and domain-specific data distributions; (iii) combined use of the weak generator, a weak inference model and an adversarial framework to refine the domain adjacent dataset by employing a set of unlabeled domain-specific dataset; and (iv) development and analysis of co-labeling/active learning techniques to select the most informative datasets to refine and adapt the weak inference model into a strong inference model in the target application.

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Bio: Professor Ostadabbas is an assistant professor in the Electrical and Computer Engineering Department of Northeastern University (NEU), Boston, Massachusetts, USA. Professor Ostadabbas joined NEU in 2016 from Georgia Tech, where she was a post-doctoral researcher following completion of her PhD at the University of Texas at Dallas in 2014. At NEU, Professor Ostadabbas is the director of the Augmented Cognition Laboratory (ACLab) with the goal of enhancing human information-processing capabilities through the design of adaptive interfaces via physical, physiological, and cognitive state estimation. These interfaces are based on rigorous models adaptively parameterized using machine learning and computer vision algorithms. In particular, she has been integrating domain knowledge with machine learning by using physics-based simulation as generative models for bootstrapping deep learning recognizers. Professor Ostadabbas is the co-author of more than 70 peer-reviewed journal and conference articles and her research has been awarded by the National Science Foundation (NSF), Mathworks, Amazon AWS, Biogen, and NVIDIA. She co-organized the Multimodal Data Fusion (MMDF2018) workshop, an NSF PI mini-workshop on Deep Learning in Small Data, the 2019 CVPR workshop on Analysis and Modeling of Faces and Gestures (AMFG2019) and she is the program chair of the Machine Learning in Signal Processing (MLSP2019). Prof. Ostadabbas is an associate editor of the IEEE Transactions on Biomedical Circuits and Systems, on the Editorial Board of the IEEE Sensors Letters and Digital Biomarkers Journal, and has been serving in several signal processing and machine learning conferences as a technical chair or session chair. She is a member of IEEE, IEEE Computer Society, IEEE Women in Engineering, IEEE Signal Processing Society, IEEE EMBS, IEEE Young Professionals, International Society for Virtual Rehabilitation (ISVR), and ACM SIGCHI.

ZOOM Link

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Meeting will be recorded.

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