USC Viterbi School of Engineering
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Seminar

Learning Efficiently in Data-Scarce Regimes

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Abstract: The unprecedented processing demand, posed by the explosion of big data, challenges researchers to design efficient and adaptive machine learning algorithms that do not require persistent retraining and avoid learning redundant information. Inspired from learning techniques of intelligent biological agents, identifying transferable knowledge across learning problems has been a significant research focus to improve machine learning algorithms. In this talk, we explain how the challenges of knowledge transfer can be addressed through embedding spaces that capture and store hierarchical knowledge.

We first focus on the problem of cross-domain knowledge transfer. We explore the problem of zero-shot image classification, where the goal is to identify images from unseen classes using semantic descriptions of these classes. We train two coupled dictionaries that align visual and semantic domains via an intermediate embedding space. We then extend this idea by training deep networks that match data distributions of two visual domains in a shared cross-domain embedding space.

We then investigate the problem of cross-task knowledge transfer in sequential learning settings. Here, the goal is to identify relations and similarities of multiple machine learning tasks to improve performance across the tasks. We first address the problem of zero-shot learning in a lifelong machine learning setting, where the goal is to learn tasks with no data using high-level task descriptions. Our idea is to relate high-level task descriptors to the optimal task parameters through an embedding space. We then develop a method to overcome the problem of catastrophic forgetting within a continual learning setting of deep neural networks by enforcing the tasks to share the same distribution in the embedding space.

Finally, we focus on current research directions to expand past progress and plans for future research directions. Through this talk, we demonstrate that despite major differences, problems within the above learning scenarios can be tackled using a unifying strategy that allows transferring knowledge effectively.

Bio: Mohammad Rostami is a research assistant professor at the USC CS department and a research lead at the USC Information Sciences Institute. He received Ph.D. degree in Electrical and Systems Engineering from the University of Pennsylvania in August 2019. He also received an M.S. degree in Robotics and M.A. degree in Philosophy at Penn. Before Penn, he obtained an M.Sc. degree in Electrical and Computer Engineering from the University of Waterloo, and his B.Sc. degree in Electrical Engineering and B.Sc. degree in Mathematics from the Sharif University of Technology. His current research area is machine learning in time-dependent and data-scarce regimes.

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