Yunhan Zhao

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Education

- **University of California, Irvine** Irvine, CA
  Ph.D. in Computer Science, advisor: Charless Fowlkes *Aug. 2019 – May. 2024*
- **Johns Hopkins University** Baltimore, MD
  Master of Science in Applied Mathematics and Statistics; Optimization and Operations Research Track *Aug. 2018 – May. 2019*
  Master of Science in Robotics; Perception and Cognitive Track *Aug. 2016 – May. 2018*
- **Binghamton University, State University of New York** Binghamton, NY
  Bachelor of Science in Mechanical Engineering; GPA: 3.85; Summa Cum Laude *Aug. 2014 – May. 2016*

Research Experience

- **University of California, Irvine** Irvine, CA
  Research Assistant, Advisor: Charless Fowlkes *Jun. 2019 - Present*
  - Revealed the fact that depth predictors are strongly biased to the camera poses delivered from the training data. We propose perspective-aware data augmentation (PDA) and camera pose prior encoding (CPP), two simple yet extremely approaches to mitigate the camera pose bias. From experimental results, the proposed methods greatly improve the performance and generalization ability of depth predictors. Finally, the best performance is achieved by jointly applying PDA and CPP.
  - Studied supervised domain adaptation problems with a small amount of real data and large amount of synthetic data. Proposed attend, remove, complete (ARC) that improves depth predictor by removing "hard" regions in the scene. We introduce an attention module that generates a learnable binary mask with Gumbel max trick to remove parts of images. Then, a inpainting module that adopts cycle constraints is subsequently applied to fill-in missing values in the images. Quantitatively and qualitative results shown that ARC beats state-of-the-art depth predictors trained with unsupervised domain adaptation methods.
- **Johns Hopkins University, CCVL** Baltimore, MD
  Research Assistant, Advisor: Alan Yuille *Feb. 2018 - May. 2019*
  - Proposed introspective transformer networks (ITNs) that boost the classification performance by complementing training sets with self-generated samples. By utilizing the min-max objective function, ITN manages to search and generate samples that have the maximal difference with training samples while still within the same categories. ITN is built upon introspective neural networks (INNs) that retain a CNN discriminator which is itself a generator. ITN achieved the state-of-the-art classification performances on several benchmark datasets, e.g., MNIST, SVHN and Cifar-10. In addition, ITN beats standard data augmentation in the classification tasks, which further demonstrates the efficiency of ITN in searching the sample space.
- **Massachusetts Institute of Technology, CoCoSci** Cambridge, MA
  Student Researcher, Advisor: Joshua Tenenbaum *Jun. 2018 - Sep. 2018*
  - Proposed a model that solves the meta few-shot learning problems with minimal supervision while capable of generating samples from highly structural latent space. Our approach is built upon prototypical networks (PNs) that computes the soft assignments based on the Euclidean distance in the latent space. Our approach shines in the way that we construct an external memory that efficiently adjusts the latent features with the previous aggregated knowledge. In addition, the memory block is proposed under the unsupervised condition, which requires no labels during the entire learning process. Experimental results indicate our method achieved close to state-of-the-art classification performance on the Omniglot and Mini-ImageNet dataset.
- **Johns Hopkins University, CIS** Baltimore, MD
  Research Assistant, Advisor: Rene Vidal *May. 2017 - Dec. 2017*
  - Proposed a novel deep neural network: Deep MagNet that specifically solves cross-modality domain adaptation problems. Deep MagNet extends domain adaptation problems by transferring knowledge between significantly different domains, such as transferring knowledge between sketches and RGB images. Deep MagNet adopts Maximum Mean Discrepancy (MMD) loss at different levels of the network architecture to capture diverse domain invariant features. Deep MagNet shows better performance against the state-of-the-art methods on five cross-modality transferring tasks. The experiments include transferring between Office-Caltech, Sketch-250, Caltech-250 and CAD rendering images.

Projects

- **Variational Autoencoder (VAE) for Image Completion**
  - Extended standard VAE to four different variations for image completion task, which means the inputs are partially occluded images and the desired outputs are complete images. Discovered the relationship between conditions in conditional variational autoencoder (CVAE) and the quality of generated images in image completion tasks.
- **Deep Canonical Correlation Analysis (DCCA) Meets Sequential Data**

- Integrated DCCA with different encoder-decoder frameworks and validated the efficiency of hidden features extracted from RNN and LSTMs with the COCO dataset. Explored multiple LSTMs based encoder-decoder for the task of image captioning and learning unsupervised video representations.

- **Effectiveness of Features Learned by CNN in Deep Q-Learning**
  - Applied several variations of deep Q-networks to the video game: Breakout to evaluate the efficiency and effectiveness of different convolutional features. Evaluated the performance of several types of convolutional features of deep Q-networks against handcrafted pixel-level features with Tensorflow.

- **Object Tracking and Motion Planning with UR5**
  - Implemented computer vision and hand-eye calibration algorithms to track the desired object and accurately placed the object into given location with UR5. Studied the motion planning problem and successfully designed an algorithm that guides the robot escape the maze while holding the object.

Publications

1. **Yunhan Zhao**, Shu Kong, and Charless Fowlkes. When perspective comes for free: Improving depth prediction with camera pose encoding. *arXiv preprint arXiv:2007.03887*, 2020

2. **Yunhan Zhao**, Shu Kong, Daeyun Shin, and Charless Fowlkes. Domain decluttering: Simplifying images to mitigate synthetic-real domain shift and improve depth estimation. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pages 3330–3340, 2020

3. **Yunhan Zhao**, Ye Tian, Charless Fowlkes, Wei Shen, and Alan Yuille. Resisting large data variations via introspective transformation network. In *The IEEE Winter Conference on Applications of Computer Vision*, pages 3080–3089, 2020

4. **Yunhan Zhao**, Haider Ali, and Rene Vidal. Stretching domain adaptation: How far is too far? *Technical Report*, December 2017