Sheng Cheng

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EDUCATION

Doctor of Philosophy, Computer Science   Advisors: Yezhou Yang, Yi Ren
Arizona State University — 2019 - Current
Master of Engineering, Electrical and Computer Engineering
University of Illinois Urbana-Champaign — 2016 - 2018
Bachelor of Science, Optical and Electronics
Huazhong University of Science and Technology — 2012 - 2016

RESEARCH INTEREST

Visual reasoning and understanding; Vision & Lanugage; Generative AI; Self-supervised learning; Robust and interpretable representation learning; AI in science.

COMPUTER SKILLS

Java, Python, R, Matlab, Tensorflow, Pytorch

PROFESSIONAL EXPERIENCE

Amazon Alexa — May - Aug 2023
Applied research intern
Zero-shot mask annotation free open-vocabulary semantic segmentation by the text-to-image model.

UltruFit.ai — May - Aug 2022
Software Engineer
Developing a real-time system evaluating and scoring the human exercises by cameras.

Hikvision Research — Feb - May 2019
Research Intern
Research on a new metric for super-resolution based on one-to-many mapping nature.

PUBLICATIONS & PREPRINTS

- "Revising Text-to-Image Prior for Improved Text Conditioned Image Generations." Maitreya Patel, Changhoon Kim, Sheng Cheng, Chitta Baral, Yezhou Yang, arXiv:2312.04655, NeurIPS Diffusion workshop.

- "Adversarial Bayesian Augmentation for Single-Source Domain Generalization." Sheng Cheng, Tejas Gokhale, Yezhou Yang, ICCV 2023.

- "WOUAF: Weight Modulation for User Attribution and Fingerprinting in Text-to-Image Diffusion Models." Changhoon Kim, Kyle Min, Maitreya Patel, Sheng Cheng, Yezhou Yang, arXiv:2306.04744, NeurIPS Diffusion workshop.

- "Self-supervised Learning to Discover Physical Objects and Predict Their Interactions from Raw Videos." Sheng Cheng, Yezhou Yang, Yang Jiao, Yi Re. Neurips AI4Science workshop. Submitted to journal.

- "SSR-GNNs: Stroke-based Sketch Representation with Graph Neural Networks." Sheng Cheng, Yi Ren, Yezhou Yang, CVPR Workshop 2022.

- "Data-Driven Learning of Three-Point Correlation Functions as Microstructure Representations." Sheng Cheng, Yang Jiao, Yi Ren, Acta Materialia 2022

- "Evaluating the Robustness of Bayesian Neural Networks Against Different Types of Attacks." Yutian Pang, Sheng Cheng, Jueming Hu, Yongming Liu, CVPR Workshop 2021

- "A New Super-Resolution Measurement of Perceptual Quality and Fidelity" Sheng Cheng, Zhe Hu, Ruoyu Sun, arXiv:2303.06207.

Awards & Services

- 2023-24 ASU Graduate College Travel Award
- 2022, 2023 CVPR workshop Reviewer; 2024 CVPR Reviewer

RESEARCH PROJECT

Zero-shot image segmentation by Text-to-Image model without mask annotation
- Leverages CLIP model to filter the existing classes in the image
- Extracts the heatmap of attention layers per classes label from T2I model
- Aligns the heatmap and segmentation maps extracted from unsupervised segmentation method

Self-supervised object discovery and dynamics prediction from videos
- Proposes effective learning architecture, loss, and algorithm for solving the challenge posed by the joint learning the segmentation and dynamics.
- Empirically shows that the correct dynamical model is necessary for correct object segmentation and our proposed trainable dynamical model can improve the accuracy of object discovery.
- Shows that our framework achieves state of art object segmentation and dynamical prediction as well as strong generalization and scalability.

Adversarial Bayesian Augmentation for single source domain generalization
- Proposes a adversarial Bayesian convolutional neural network for data augmentation, and improves the accuracy on single source domain generalization
- Empirically shows that the proposed model outperforms all existing state-of-art data augmentation method on three domain generalization tasks: style generalization, superclass generalization, medical image generalizaiton.

Stroke based sketch representation with GNN
- Proposes models which are innately robust to rotations and translations, while maintaining acceptable classification accuracy.
- Shows that the proposed models are robust to parametric and topological attacks without robust training.
- Generates novel sketches distinguishable from the existing set.

A new metric for super-resolution problem
- Analyze the evaluation problem based on the one-to-many mapping nature of SR, and propose a novel distribution-based metric for SR.
- Conduct human subject study. The proposed metric is highly correlated with the human perceptual quality, and better than most existing metrics. The proposed metric has a higher correlation with the fidelity measure compared to the perception based metrics.
- Train SR networks using proposed metric for better perceptual quality.