Ce Zhang

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Education

- **Carnegie Mellon University, Pittsburgh, United States** *Aug 2023 - Present*
  M.Sc. in Machine Learning, School of Computer Science Research Advisor: Prof. Katia Sycara GPA: 3.89/4.00
  Courses: Introduction to Machine Learning, Convex Optimization, Probability Graphical Models, Probability and Mathematical Statistics, Machine Learning in Practice, Intermediate Deep Learning, Independent Research.
- **Southern University of Science and Technology (SUSTech), Shenzhen, China** *Aug 2019 - Jun 2023*
  B.Eng. in Communication Engineering (Summa Cum Laude), College of Engineering GPA: 3.91/4.00 Rank: 1/30
  Selected Courses: Data Structures and Algorithm Analysis (100), Linear Algebra (100), Introduction to Computer Programming (98), Artificial Intelligence (96), Probability and Statistics (96).

Selected Publications (*Equal Contribution)

- **Ce Zhang**, Simon Stepputtis, Katia Sycara, Yaqi Xie. Enhancing Vision-Language Few-Shot Adaptation with Negative Learning. In *IEEE/CVF Winter Conference on Applications of Computer Vision* (*WACV*), 2025. Also presented at *ICLR 2024 Workshop on Mathematical and Empirical Understanding of Foundation Models*. [PDF] [Code]
- **Ce Zhang**, Simon Stepputtis, Katia Sycara, Yaqi Xie. Dual Prototype Evolving for Test-Time Generalization of Vision-Language Models. In *Conference on Neural Information Processing Systems* (*NeurIPS*), 2024. Also presented at *ICML 2024 Workshop on Foundation Models in the Wild*. [PDF] [Project] [Code]
- **Ce Zhang**, Simon Stepputtis, Joseph Campbell, Katia Sycara, Yaqi Xie. HiKER-SGG: Hierarchical Knowledge Enhanced Robust Scene Graph Generation. In *IEEE/CVF Conference on Computer Vision and Pattern Recognition* (*CVPR*), 2024. Also presented at *NeurIPS 2023 New Frontiers in Graph Learning Workshop*. [PDF] [Project] [Code]
- **Ce Zhang**, Kailiang Wu, and Zhihai He. Critical Sampling for Robust Evolution Operator Learning of Unknown Dynamical Systems. *IEEE Transactions on Artificial Intelligence* (*IEEE TAI*), 2023. Also presented at *First Workshop on Out-of-Distribution Generalization in Robotics at CoRL 2023.* [PDF]
- Yi Zhang*, **Ce Zhang***, Zihan Liao, Yushun Tang, and Zhihai He. BDC-Adapter: Brownian Distance Covariance for Better Vision-Language Reasoning. In *British Machine Vision Conference* (*BMVC*), 2023. [PDF] [Project]
- Yushun Tang, **Ce Zhang**, Heng Xu, Shuoshuo Chen, Jie Cheng, Luziwei Leng, *et al.* Neuro-Modulated Hebbian Learning for Fully Test-Time Adaptation. In *IEEE/CVF Conference on Computer Vision and Pattern Recognition* (*CVPR*), 2023. [PDF]
- Xueting Hu, **Ce Zhang**, Yi Zhang, Bowen Hai, Ke Yu, and Zhihai He. Learning to Adapt CLIP for Few-Shot Monocular Depth Estimation. In *IEEE/CVF Winter Conference on Applications of Computer Vision* (*WACV*), 2024. [PDF]
- Yi Zhang, **Ce Zhang**, Ke Yu, Yushun Tang, Zhihai He. Concept-Guided Prompt Learning for Generalization in Vision-Language Models. In *AAAI Conference on Artificial Intelligence* (*AAAI*), 2024. [PDF]
- Zhehan Kan, Shuoshuo Chen, **Ce Zhang**, Yushun Tang, *et al.* Self-Correctable and Adaptable Inference for Generalizable Human Pose Estimation. In *IEEE/CVF Conference on Computer Vision and Pattern Recognition* (*CVPR*), 2023. [PDF]

Preprints (*Equal Contribution)

- **Ce Zhang***, Zifu Wan*, Zhehan Kan, Martin Q. Ma, Simon Stepputtis, Deva Ramanan, Russ Salakhutdinov, Louis-Philippe Morency, *et al.* Self-Correcting Decoding with Generative Feedback for Mitigating Hallucinations in Large Vision-Language Models. Under review in *International Conference on Learning Representations* (*ICLR*), 2025. Review scores: 6, 6, 6, 6. Also presented at *NeurIPS 2024 Workshop on Responsibly Building the Next Generation of Multimodal Foundational Models*.

Work Experience

Research Assistant at Advanced Agent Robotics Technology Lab, Carnegie Mellon University *Aug 2023 - Present*
Research Advisor: Prof. Katia Sycara *Pittsburgh, United States*

- My main duty is to develop generalizable and robust visual perception systems for practical robotics applications.
- Developed a self-correcting mechanism for large vision-language models to enhance their real-world reliability.
- Enhanced vision-language models to generalize to out-of-distribution domains through few-shot/test-time adaptation.
- Designed a hierarchical inference approach for accurate scene graph generation under real-world corruptions.

Research Experience

#1. Self-Correcting Decoding with Generative Feedback for Mitigating Hallucinations in LVLMs *Jun 2024 - Oct 2024*

- Introduced self-correcting Decoding with Generative Feedback (DeGF), a training-free algorithm that incorporates feedback from text-to-image generative models into the decoding process to mitigate hallucinations in LVLMs.
- Demonstrated generative models can provide self-feedback for mitigating hallucinations at response/token levels.
- Outperformed state-of-the-art approaches in effectively mitigating hallucinations in LVLMs across five benchmarks.

#2. Dual Prototype Evolving for Test-Time Generalization of Vision-Language Models *Feb 2024 - May 2024*

- Proposed Dual Prototype Evolving (DPE) that effectively accumulates task-specific knowledge from multi-modalities.
- Introduced and optimized learnable residuals for each test sample to align the prototypes across modalities.

- Outperformed state-of-the-art methods across 15 datasets while maintaining competitive computational efficiency.

#3. Enhancing Vision-Language Few-Shot Adaptation with Negative Learning *Dec 2023 - Apr 2024*
- Explored the negative inference capabilities of VLMs, and introduced a unique dual-path adaptation approach for CLIP.
- Proposed a plug-and-play instance reweighting technique to mitigate the impact of noisy samples.
- Outperformed other methods in both adaptation performance and generalizability across 15 diverse recognition tasks.

#4. HiKER-SGG: Hierarchical Knowledge Enhanced Robust Scene Graph Generation *Aug 2023 - Nov 2023*
- Proposed a novel method for generating scene graphs through a hierarchical inference approach over structured domain knowledge, allowing it to gradually specify increasingly granular classifications through iterative sub-selection.
- Introduced a new synthetic VG-C benchmark for practical SGG, containing 20 challenging image corruptions.
- Outperformed SOTA methods on SGG tasks, while providing a zero-shot baseline for SGG from corrupted images.

#5. Concept-Guided Prompt Learning for Generalization in Vision-Language Models *May 2023 - Sep 2023*
- Created a low-level visual concept cache to enable concept-guided prompting for vision-language models.
- Incorporated rich multi-level visual semantics to optimize the textual features using a vision-to-language projector.
- Verified the effectiveness on base-to-novel generalization, cross-dataset transfer, and domain generalization tasks.

#6. Learning to Adapt CLIP for Few-Shot Monocular Depth Estimation *Mar 2022 - Jul 2023*
- Explored the monocular depth estimation task using vision-language models in a new few-shot setting.
- Designed learnable prompts and learnable depth codebooks to adapt the CLIP model for different scenes effectively.
- Outperformed the previous SOTA by 10.6% MARE and achieved performance comparable to fully-supervised methods.

#7. BDC-Adapter: Brownian Distance Covariance for Better Vision-Language Reasoning *Feb 2023 - Jun 2023*
- Introduced BDC to vision-language reasoning to provide a more robust metric for measuring feature dependence.
- Integrated BDC prototype similarity reasoning and multi-modal reasoning network prediction to adapt CLIP efficiently.
- Achieved SOTA performance on CLIP-based few-shot learning, domain generalization, and visual reasoning tasks.

#8. Neuro-Modulated Hebbian Learning for Fully Test-Time Adaptation *May 2022 - Nov 2022*
- Explored neurobiology-inspired Hebbian learning for effective early-layer representations for test-time adaptation.
- Combined unsupervised Hebbian learning with a learned neuro-modulator to capture feedback from external responses.
- Outperformed the previous state-of-the-art by 1.4%, 2.4%, 2.3% on CIFAR10-C, CIFAR100-C and ImageNet-C datasets.

#9. Critical Sampling for Robust Evolution Behavior Learning of Unknown Dynamical Systems *Jan 2022 - Oct 2022*
- Introduced a joint spatial-temporal evolution network for robust learning the evolution operator with very few samples.
- Discovered new locations adaptively to collect most critical samples based on multi-step reciprocal prediction error.
- Reduced the numbers of samples needed for robust learning of evolution behaviors of PDE systems by up to 100 times.

#10. Self-Correctable and Adaptive Inference for Generalizable Human Pose Estimation *Feb 2022 - Aug 2022*
- Designed a self-supervised prediction-feedback-correction scheme to adjust the prediction results during test-time.
- Introduced a self-supervised feedback error to perform quick adaptation of the correction network during inference.
- Achieved state-of-the-art performance on public MS COCO test-dev dataset, with average precision gain of 1.4%.

Project Experience

#1. Emperical Analysis of Deep Learning Models on Neural Machine Translation | Python *Oct 2023 - Dec 2023*
- Implemented recurrent neural network and Transformer with second-order AdaHessian optimizer from scratch.
- Adopted Llama-2-7B and Llama-2-70B models for translation tasks via in-context learning and low-rank fine-tuning.
- Achieved a BLEU score of 41.06 using our implemented Transformer and 20.49 BLEU with a fine-tuned Llama-2 model.

#2. Calculator and Music Player Applications Design | Kotlin, Android Studio *Feb 2022 - Jun 2022*
- Designed numerical and operational buttons and supported advanced mathematical operations (e.g. factorial, square root). Designed seek bar, song list, functional buttons, and supported page jumping for the music player application.
- Developed light and dark mode user interfaces for both applications. Adapted to different real mobile devices.

Honors and Awards

- *Top 10 Summa Cum Laude Graduates* (highest distinction, top 1%), SUSTech *Jun 2023*
- *Honorary Undergraduate Thesis* (top 5%), SUSTech *Jun 2023*
- *Top 10 Undergraduate Graduates* (top 2%), College of Engineering, SUSTech *May 2023*
- *National Scholarship* (top 0.2%), Ministry of Education of the People's Republic of China *Nov 2022*
- *School Motto Scholarship Special Award* (top 1%), SUSTech *Nov 2022*
- *Outstanding Teaching Award*, SUSTech *Jan 2022 & Jun 2022*
- *The First Prize of Outstanding Student Scholarship* (top 5%), SUSTech *Nov 2020 & Nov 2021 & Nov 2022*

Academic Service

- Journal Reviewer: *IEEE TCSVT, IEEE TMM, IEEE TAI*
- Conference Reviewer, *ICLR 2025, WACV 2025, ICASSP 2025, BMVC 2024 (Outstanding Reviewer), ICME 2024-2025*
- Teaching Assistant, *Linear Algebra @ SUSTech for 3 semesters (Fall 2021, Spring 2022, Fall 2022)*