

**Qing Liu** Email: qingliu.research@gmail.com Homepage: <https://qliu24.github.io>

My research focuses on Computer Vision, particularly leveraging generative models for image editing tasks such as inpainting, outpainting, and super-resolution. My goal is to develop intelligent image editing tools that enhance controllability and foster creativity for users.

Additionally, I work on object recognition and parsing with weak supervision, covering areas such as weakly supervised learning, domain adaptation (learning from synthetic data), and few-shot/zero-shot learning. My research aims to improve data efficiency and enhance the robustness of deep learning models, making them more applicable to real-world scenarios.

## WORK EXPERIENCE

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### Senior Research Scientist/Engineer, Adobe

11/29/2021 - Present

345 Park Ave, San Jose, CA 95110

I work in the Imaging and Languages Organization at Adobe Research, where I focus on advancing deep learning-based image editing technologies and integrating them into high-impact features for Adobe products like Photoshop and Lightroom. Leveraging my computer vision expertise, I design and implement cutting-edge deep learning models, evaluating their performance against existing techniques. Our novel findings are published in top-tier computer vision journals and conferences, and we develop interactive web demos to showcase real-world applications. To transition research into Adobe products, I also work on model deployment for cloud services and mobile devices, ensuring seamless integration and scalability.

### Research Intern, Facebook

05/18/2020-09/11/2020

1 Hacker Way, Menlo Park, CA 94025

I worked for the Facebook AI video team and my responsibility was to conduct computer vision research using video data and deep learning models. I performed a detailed literature search and proposed a novel algorithm for weakly supervised instance segmentation for video objects. I implemented the model using python packages and ran the experiments on GPU clusters. Experimental comparisons with other existing methods were also carried out by me. The model achieved state of the art performance and the work was accepted by the 2021 Conference on Computer Vision and Pattern Recognition.

### Applied Scientist Intern, Amazon

06/03/2019-09/06/2019

410 Terry Ave N, Seattle, WA 98109

I worked for the Amazon AWS ReKognition team and my responsibility was to develop a computer vision model that can quickly adapt to unseen object classes. The model should also achieve better performance when more data was processed sequentially. I formulated the problem as a new task for computer vision that combines incremental learning and meta-learning together. I designed a new algorithm that involved prototype based few-shot classification and knowledge distillation, and I implemented it using python and deep learning packages. The proposed method outperformed existing solutions by a large margin and the work was accepted by the 2020 European Conference on Computer Vision.

### Applied Scientist Intern, Amazon

05/28/2018-08/24/2018

410 Terry Ave N, Seattle, WA 98109

I worked for the Amazon Transaction Risk Management Systems team and my intern project was "Ladder Neural Network for Continuous Fraud Detection and Queue Rate Reduction". I used a semi-supervised deep generative model to fit the user transaction data which achieved better performance than the traditional methods on fraud detection using much less labeled data. I implemented the model using python and deep learning packages and experimented with multiple variations. My project won the 2018 Amazon TRMS Science Fair gold award and was deployed into the production line.

## EDUCATION

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**Johns Hopkins University**, Baltimore, MD

GPA: 4.00

PhD in Computer Science

2016/09 – 2021/11

MSE in Computer Science

2015/01 – 2016/05

**The University of Texas at Dallas**, Richardson, TX

GPA: 3.85

MS in Molecular and Cell Biology

2011/08 – 2013/05

**Peking University**, Beijing, China

BS in Chemistry and Psychology

2005/09 – 2010/07

## RECENT RESEARCH PROJECT HIGHLIGHTS

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### Generative Image Layer Decomposition with Visual Effects

Recent advances in diffusion-based generative models have improved image editing, but precise control over layered composition remains challenging. We present LayerDecomp, a generative framework that produces clean backgrounds and high-quality transparent foregrounds with preserved visual effects like shadows and reflections. To train the model effectively, we introduce a scalable pipeline for generating synthetic multi-layer data and augment it with real-world images. We also propose a consistency loss to guide training without ground-truth foreground layers. LayerDecomp outperforms existing methods on object removal and spatial editing benchmarks, enabling more flexible and photorealistic layer-wise editing.

### FINECAPTION: Compositional Image Captioning Focusing on Wherever You Want at Any Granularity

Large Vision-Language Models (VLMs) have advanced multimodal tasks but still struggle with fine-grained compositional understanding of image regions, such as aligning segmentation masks with semantics. Compositionality—understanding novel combinations of visual and textual elements—is key to improving this. We propose FINECAPTION, a VLM designed to handle arbitrary masks and high-resolution images for compositional image captioning at multiple granularities. To support this, we introduce COMPOSITIONCAP, a dataset focused on attribute-aware regional captioning. Experiments show FINECAPTION outperforms existing models and reveal gaps in current VLMs’ handling of compositional visual prompts.

### Object-level Scene Deocclusion

We introduce PACO, a self-supervised foundation model for object-level scene deocclusion. PACO combines a parallel variational autoencoder, which encodes complete object features, with a visible-to-complete generator that predicts full-view representations from partial views and text prompts. To train PACO without manual annotations, we construct a large-scale dataset of 500k samples. At inference, a layer-wise strategy improves efficiency while preserving quality. Experiments on COCOA and real-world scenes show PACO significantly outperforms existing methods and generalizes to novel categories and cross-domain scenes. We also showcase its applicability to single-view 3D reconstruction and object recomposition.

### UniHuman: A Unified Model for Editing Human Images in the Wild

We propose UniHuman, a unified model for diverse human image editing tasks in real-world scenarios. To boost generation quality and generalization, we incorporate guidance from human visual encoders and a lightweight pose-warping module that handles various pose representations and unseen textures. To bridge

gaps between benchmarks and real-world data, we curated 400K high-quality human image-text pairs for training and 2K images for out-of-domain testing, covering diverse clothing, backgrounds, and age groups. UniHuman outperforms task-specific models on both test sets and is preferred by users in 77% of cases.

## PUBLICATIONS

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- Jinrui Yang, **Qing Liu**, Yijun Li, Soo Ye Kim, Daniil Pakhomov, Mengwei Ren, Jianming Zhang, Zhe Lin, Cihang Xie, Yuyin Zhou. *Generative Image Layer Decomposition with Visual Effects*. CVPR 2025.
- Hang Hua, **Qing Liu**, Lingzhi Zhang, Jing Shi, Zhifei Zhang, Yilin Wang, Jianming Zhang, Jiebo Luo. *FINECAPTION: Compositional Image Captioning Focusing on Wherever You Want at Any Granularity*. CVPR 2025.
- Xi Chen, Zhifei Zhang, He Zhang, Yuqian Zhou, Soo Ye Kim, **Qing Liu**, Yijun Li, Jianming Zhang, Nanxuan Zhao, Yilin Wang, Hui Ding, Zhe Lin, Hengshuang Zhao. *UniReal: Universal Image Generation and Editing via Learning Real-world Dynamics*. CVPR 2025.
- Shaoteng Liu, Tianyu Wang, Jui-Hsien Wang, **Qing Liu**, Zhifei Zhang, Joon-Young Lee, Yijun Li, Bei Yu, Zhe Lin, Soo Ye Kim, Jiaya Jia. *Generative Video Propagation*. CVPR 2025.
- Xin Yu, Tianyu Wang, Soo Ye Kim, Paul Guerrero, Xi Chen, **Qing Liu**, Zhe Lin, Xiaojuan Qi. *Objectmover: Generative object movement with video prior*. CVPR 2025.
- Hanrong Ye, Jason Kuen, **Qing Liu**, Zhe Lin, Brian Price, Dan Xu. *Seggen: Supercharging segmentation models with text2mask and mask2img synthesis*. ECCV, 2024.
- Yuming Jiang, Nanxuan Zhao, **Qing Liu**, Krishna Kumar Singh, Shuai Yang, Chen Change Loy, and Ziwei Liu. *GroupDiff: Diffusion-Based Group Portrait Editing*. ECCV, 2024.
- Jing Gu, Nanxuan Zhao, Wei Xiong, **Qing Liu**, Zhifei Zhang, He Zhang, Jianming Zhang, HyunJoon Jung, Yilin Wang, Xin Eric Wang. *Swapanything: Enabling arbitrary object swapping in personalized image editing*. ECCV, 2024.
- Zhengzhe Liu, **Qing Liu**, Chirui Chang, Jianming Zhang, Daniil Pakhomov, Haitian Zheng, Zhe Lin, Daniel Cohen-Or, Chi-Wing Fu. *Object-level Scene Deocclusion*. SIGGRAPH 2024.
- Nannan Li, **Qing Liu**, Krishna Kumar Singh, Yilin Wang, Jianming Zhang, Bryan A. Plummer, Zhe Lin. *UniHuman: A Unified Model for Editing Human Images in the Wild*. CVPR 2024.
- Jaskirat Singh, Jianming Zhang, **Qing Liu**, Cameron Younger Smith, Zhe Lin, Liang Zheng. *SmartMask: Context Aware High-Fidelity Mask Generation for Fine-grained Object Insertion and Layout Control*. CVPR 2024.
- Bowen Zhang, **Qing Liu**, Jianming Zhang, Yilin Wang, Liyang Liu, Zhe Lin, Yifan Liu. *Amodal Scene Analysis via Holistic Occlusion Relation Inference and Generative Mask Completion*. AAAI 2024 (Oral).
- Jing Gu, Yilin Wang, Nanxuan Zhao, Tsu-Jui Fu, Wei Xiong, **Qing Liu**, Zhifei Zhang, He Zhang, Jianming Zhang, HyunJoon Jung, Xin Eric Wang. *PHOTOSWAP: Personalized Subject Swapping in Images*. NeurIPS 2023.
- Yu Zeng, Zhe Lin, Jianming Zhang, **Qing Liu**, John Collomosse, Jason Kuen, Vishal M. Patel. *SceneComposer: Any-Level Semantic Image Synthesis*. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2023.
- Tai-Yu Pan, **Qing Liu**, Wei-Lun Chao, Brian L. Price. *Towards Open-World Segmentation of Parts*. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2023.
- **Qing Liu**, Adam Kortylewski, Zhishuai Zhang, Zizhang Li, Mengqi Guo, Qihao Liu, Xiaoding Yuan, Jiteng Mu, Weichao Qiu, Alan Yuille. *Learning Part Segmentation through Unsupervised Domain Adaptation from Synthetic Vehicles*. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2022.
- **Qing Liu**, Vignesh Ramanathan, Dhruv Mahajan, Alan Yuille, Zhenheng Yang. *Weakly Supervised Instance Segmentation for Videos with Temporal Mask Consistency*. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2021.

- Nicholas Ichien\*, **Qing Liu\***, Shuhao Fu, Keith J Holyoak, Alan Yuille, Hongjing Lu. *Visual analogy: Deep learning versus compositional models*. Proceedings of the 43rd Annual Meeting of the Cognitive Science Society. 2021.
- Adam Kortylewski, **Qing Liu**, Angtian Wang, Yihong Sun, Alan Yuille. *Compositional convolutional neural networks: A robust and interpretable model for object recognition under occlusion*. International Journal of Computer Vision (2020): 1-25.
- **Qing Liu**, Orchid Majumder, Alessandro Achille, Avinash Ravichandran, Rahul Bhotika, Stefano Soatto. *Incremental Meta-Learning via Indirect Discriminant Alignment*. Proceedings of the European Conference on Computer Vision. 2020.
- Adam Kortylewski, Ju He, **Qing Liu**, Alan Yuille. *Compositional Convolutional Neural Networks: A Deep Architecture with Innate Robustness to Partial Occlusion*. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2020.
- Adam Kortylewski, **Qing Liu**, Huiyu Wang, Zhishuai Zhang, Alan Yuille. *Combining Compositional Models and Deep Networks For Robust Object Classification under Occlusion*. Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision. 2020.
- **Qing Liu**, Lingxi Xie, Huiyu Wang, Alan Yuille. *Semantic-Aware Knowledge Preservation for Zero-Shot Sketch-Based Image Retrieval*. Proceedings of the IEEE/CVF International Conference on Computer Vision. 2019.
- **Qing Liu\***, Yutong Bai\*, Lingxi Xie, Yan Zheng, Weichao Qiu, Alan Yuille. *Semantic Part Detection via Matching: Learning to Generalize to Novel Viewpoints from Limited Training Data*. Proceedings of the IEEE/CVF International Conference on Computer Vision. 2019.
- Adam Kortylewski, **Qing Liu**, Huiyu Wang, Zhishuai Zhang, Alan Yuille. *Localizing Occluders with Compositional Convolutional Networks*. Proceedings of the IEEE/CVF International Conference on Computer Vision Workshop. 2019.
- Hongjing Lu, **Qing Liu**, Nicholas Ichien, Alan L. Yuille, Keith J. Holyoak. *Seeing the Meaning: Vision meets Semantics in Solving Pictorial Analogy Problems*. Proceedings of the 41st Annual Meeting of the Cognitive Science Society. 2019.
- Boyang Deng, **Qing Liu**, Siyuan Qiao, Alan Yuille. *Few-shot Learning by Exploiting Visual Concepts within CNNs*. arXiv preprint arXiv: 1711.08277.