

# Zhitong Gao

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## SUMMARY

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I am a final-year master's student in Computer Science at ShanghaiTech University. My research focuses primarily on Computer Vision and Deep Learning, where I concentrate on developing robust and safe dense prediction models under uncertainty, specializing in areas like learning with noisy labels, uncertainty estimation, out-of-distribution detection, domain generalization and test-time adaptation.

## EDUCATION

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### École Polytechnique Fédérale de Lausanne (EPFL)

Lausanne, Switzerland

*Visiting Scholar at CV Lab, supervised by Mathieu Salzmann;*

*Sep. 2023 – Apr. 2024 (Expected)*

### ShanghaiTech University

Shanghai, China

*M.S. in Computer Science, supervised by Xuming He;*

*Sep. 2021 – Jun. 2024 (Expected)*

*Cumulative GPA: 3.87/4.00; Major GPA: 3.94/4.00;*

### University of California, Berkeley

Berkeley, USA

*Participant in Summer School Session E;*

*Summer 2019*

### ShanghaiTech University

Shanghai, China

*B.E. in Computer Science; GPA: 3.62/4.00;*

*Sep. 2017 – Jun. 2021*

## PUBLICATIONS

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- **Zhitong Gao**, Shipeng Yan, Xuming He. “ATTA: Anomaly-aware Test-Time Adaptation for Out-of-Distribution Detection in Segmentation.” Conference on Neural Information Processing Systems (NeurIPS), 2023. [Paper] [Code]
- Bingnan Li, **Zhitong Gao**, Xuming He. “Gradient-Map-Guided Adaptive Domain Generalization for Cross Modality MRI Segmentation” Proceedings of Machine Learning for Health (ML4H), 2023. [Paper] [Code]
- **Zhitong Gao**, Yucong Chen, Chuyu Zhang, Xuming He. “Modeling Multimodal Aleatoric Uncertainty in Segmentation with Mixture of Stochastic Experts.” International Conference on Learning Representations (ICLR), 2023. [Paper] [Code]
- Chuanyang Hu, Shipeng Yan, **Zhitong Gao**, Xuming He. “MILD: Modeling the Instance Learning Dynamics for Learning with Noisy Labels.” International Joint Conference on Artificial Intelligence (IJCAI), 2023. [Paper] [Code]
- Shuailin Li\*, **Zhitong Gao\***, Xuming He. “Superpixel-guided Iterative Learning from Noisy Labels for Medical Image Segmentation.” International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2021. (\* indicates equal contribution.) [Paper] [Code]

## RESEARCH EXPERIENCE

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### Dense Out-of-Distribution Detection with Domain Shift.

*Advisor: Mathieu Salzmann, Xuming He*

*2023 – Present*

- Distinguish domain-level and semantic-level distribution shifts.
- Jointly study out-of-distribution detection and domain generalization.

### Domain-Robust Open-Vocabulary Semantic Segmentation.

*Advisor: Xuming He*

*2023 – Present*

- Study the performance of current open-vocabulary segmentation models under domain shift.
- Preserve the domain generalization ability during model fine tuning.

### Test-Time Adaptation for Dense Out-of-Distribution Detection.

*Advisor: Xuming He*

*2022 – 2023*

- Propose a dual-level OOD detection framework that addresses both domain shift and semantic shift in real-world scenarios, improving the accuracy of existing OOD detection models.
- Validate the effectiveness of the proposed method on multiple OOD segmentation benchmarks, including those with significant domain shifts and those without, demonstrating consistent performance gains.

- The relevant paper has been accepted in NeurIPS 2023.

## Aleatoric Uncertainty in Segmentation

Advisor: Xuming He

2021 – 2022

- Explicitly model the multimodal characteristic of aleatoric uncertainty in segmentation in a form of mixture of stochastic experts. Each expert encodes a distinct mode and its weight represents the mode probability.
- Formulate the model learning as an Optimal-Transport problem and design a Wasserstein-like loss that directly minimizes the distribution distance between the model and ground truth annotations.
- The relevant paper has been accepted in ICLR 2023.

## Segmentation of Myocardial Infarction Area from a single T2-STIR MRI image.

Advisor: Xuming He, Lianming Wu

2021 – 2022

- Design an automatic cross-modal segmentation system capable of predicting chronic myocardial infarction (MI) regions marked in LGE images based on the corresponding non-enhanced cardiac MRI images. This system needs to cope with the misalignment between the two modalities.
- The proposed model shows satisfactory performance in MI area prediction and provides a calibrated uncertainty score map that facilitates interpreting the reliability of predictions in practice.
- In submission to European Heart Journal.

## Learning Dynamics for noisy labels

Advisor: Xuming He

2021 – 2022

- Propose a novel selection metric based on the learning dynamics of each data instance. This metric provides a more robust reference for label uncertainty than small-loss trick, as it collects information across various training stages.
- Achieve the state of the art on five popular noisy image classification benchmarks including synthetic noisy datasets and real-world web data.
- The relevant paper has been accepted in IJCAI 2023.

## Learning with noisy labels in Segmentation

Advisor: Xuming He

2020 – 2021

- Adopt a superpixel representation and develop a robust iterative learning strategy that combines noise-aware training of segmentation network and noisy label refinement, both guided by the superpixels.
- This design enables us to exploit the structural constraints in segmentation labels and effectively mitigate the impact of label noise in learning.
- The relevant paper has been accepted in MICCAI 2021.

## CHALLENGES AND WORKSHOPS

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### MUAD Uncertainty Estimation for Semantic Segmentation Challenge at ICCV2023 | Report

- Top 7; Invited for oral and poster presentation at ICCV UNCV Workshop.

### Quantification of Uncertainties in Biomedical Image Quantification Challenge at MICCAI2021 | Poster

- Invited for oral and poster presentation at MICCAI 2021 Workshop.

## COURSE PROJECTS

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- **Understanding and Exploration for “Adaptive Online Learning in Dynamic Environments”** | Report
- **Generalized DUQ: Generalized Deterministic Uncertainty Quantification** | Report
- **Seek Common while Shelving Differences: A New Way for dealing with Noisy Labels** | Report

## AWARDS & ACHIEVEMENTS

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- China National Scholarship, 2023. (0.2% of candidates)
- ShanghaiTech University Outstanding Student, 2021, 2022. (10% of candidates)
- ShanghaiTech Outstanding Undergraduate Thesis, 2021. (Among Top 10 of undergraduate theses)

## ACADEMIC SERVICE

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- Peer Reviewer for CVPR 2023, NeurIPS 2023, CVPR 2024.
- Teaching Assistant for CS280 Deep Learning, 2022 Fall.