# Mingze Yuan

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## Education

- **Peking University, School of Mathematical Sciences** — Beijing, China
  *B.S. in Statistics; GPA: 3.66/4.00 (Top 20%)* — *Sep 2017 - Jul 2021*
- **Peking University, Center for Data Science** — Beijing, China
  *M.S. in Data Science (Advisor: Prof. Bin Dong)* — *Sep 2021 - Present (Expected Jul 2024)*

## Research Experience

**National Engineering Laboratory for Big Data Analysis and Applications** — Beijing, China
- *Prompt engineering for GI cancer management; open-world semantic segmentation*
  *Advisor: Prof. Bin Dong, Dr. Li Zhang* — *Sep 2021 - Present*

**Medical AI R&D, Alibaba DAMO Acadamy** — Beijing, China
- *Medical OOD detection; gastric cancer screening; virtual contrast-enhanced CT translation*
  *Mentor: Dr. Le Lu* — *Jun 2022 - Present*

## Research Interests

My research pursuits are deeply rooted in computer vision, particularly applying image segmentation, generative models, and foundation models to advance healthcare practices.

## Publications

- **Mingze Yuan**, Yingda Xia, Hexin Dong, Zifan Chen, Jiawen Yao, Mingyan Qiu, Ke Yan, Xiaoli Yin, Yu Shi, Xin Chen, Zaiyi Liu, Bin Dong, Jingren Zhou, Le Lu, Ling Zhang, Li Zhang. *Devil is in the Queries: Advancing Mask Transformers for Real-world Medical Image Segmentation and Out-of-Distribution Localization.* The IEEE/CVF Conference on Computer Vision and Pattern Recognition (**CVPR**), 2023 **Highlight** (Top 2.5%).
- **Mingze Yuan**, Yingda Xia, Xin Chen, Jiawen Yao, Junli Wang, Mingyan Qiu, Hexin Dong, Jingren Zhou, Bin Dong, Le Lu, Li Zhang, Zaiyi Liu, Ling Zhang, *Cluster-Induced Mask Transformers for Effective Opportunistic Gastric Cancer Screening on Non-contrast CT Scans.* International Conference on Medical Image Computing and Computer-Assisted Intervention (**MICCAI**), 2023.
- Jiajia Yuan*, Peng Bao*, Zifan Chen*, **Mingze Yuan***, Jie Zhao, Jiahua Pan, Yi Xie, Yanshuo Cao, Yakun Wang, Zhenghang Wang, Zhihao Lu, Xiaotian Zhang, Jian Li, Lei Ma, Yang Chen, Li Zhang, Lin Shen, Bin Dong. *Advanced prompting as a catalyst: Empowering large language models in the management of gastrointestinal cancers.* **The Innovation Medicine**, 2023 (*: these authors contributed equally).
- Yutong Xie, **Mingze Yuan**, Bin Dong, Quanzheng Li. *Unsupervised Image Denoising with Score Function.* Thirty-seventh Conference on Neural Information Processing Systems (**NeurIPS**), 2023.
- Hexin Dong, Zifan Chen, **Mingze Yuan**, Yutong Xie, Jie Zhao, Fei Yu, Bin Dong, Li Zhang. *Region-Aware Metric Learning for Open World Semantic Segmentation via Meta-Channel Aggregation.* The International Joint Conference on Artificial Intelligence (**IJCAI**), 2022.
- Hexin Dong, Jiawen Yao, Yuxing Tang, **Mingze Yuan**, Yingda Xia, Jian Zhou, Hong Lu, Jingren Zhou, Bin Dong, Le Lu, Li Zhang, Zaiyi Liu, Yu Shi, Ling Zhang. *Improved Prognostic Prediction of Pancreatic Cancer Using Multi-Phase CT by Integrating Neural Distance and Texture-Aware Transformer.* International Conference on Medical Image Computing and Computer-Assisted Intervention (**MICCAI**), 2023.
- **Mingze Yuan**, Peng Bao, Jiajia Yuan, Yunhao Shen, Zifan Chen, Yi Xie, Jie Zhao, Yang Chen, Li Zhang, Lin Shen, Bin Dong, *Large Language Models Illuminate a Progressive Pathway to Artificial Healthcare Assistant: A Review.* arXiv preprint arXiv:2311.01918.
- Yutong Xie, **Mingze Yuan**, Bin Dong, Quanzheng Li. *Diffusion Model for Generative Image Denoising.* arXiv preprint arXiv:2302.02398.

## Research Projects

- **Mask transformer based method for real-world medical image segmentation & out-of-distribution localization**:
  - Proposed a mask transformer based framework, MaxQuery, and query-distribution loss that segments in-lier tumors and localize out-of-distribution (OOD) ones.
  - Outperformed nnUNet by 5.27% in DSC, and previous leading OOD localization approach by 14.69% in AUPR.
  - Paper accepted by CVPR'23 (selected as one of the 235 **highlight** papers, 10% of accepted ones, 2.5% of submissions).
- **Deep learning based algorithm for gastric cancer screening using non-contrast CT imaging**:
  - Designed a joint segmentation and classification algorithm for gastric cancer (GC) screening on non-contrast CT scans.
  - Achieved a sensitivity of 85.0% and specificity of 92.6% on an internal test set of 247 patients, and specificity of 97.7% on an external test set of 903 patients.
  - Preliminary technical paper accepted by MICCAI'23.

- **Large language models and prompt engineering based framework for gastrointestinal tumor management**:
  - Presented several prompting strategies for GI tumor treatment plan recommendation via GPT-4.
  - Designed a sophisticated prompt template and a human evaluation framework, achieved physician-level performance.
  - Paper accepted by The Innovation Medicine.
  - Conducted extensive literature review on LLMs in medicine, leading to a review paper.
- **Diffusion models based framework for virtual contrast-enhanced 3D high-quality CT synthesis**:
  - (Ongoing) Designed a two-stage cascaded framework to perform style transfer and super-resolution in sequence.
  - Generated high-quality 3D contrast-enhanced CT scans via decoupling structure-detail.
- **Deep metric learning based algorithm for open-world semantic segmentation**:
  - Proposed a region-aware metric learning method for open-world semantic segmentation.
  - Surpassed previous best anomaly segmentation by 5.0% in AUPR and incremental few-shot learning by 12.0% in mIoU.
  - Paper accepted by IJCAI'22.
- **Deep learning based algorithm for RNA velocity and dynamical modeling**:
  - Proposed a Neural ODE based framework for RNA velocity estimation by generalizing the first-order dynamical model.
  - Effectively captured cellular transitions in different biological systems and flexible to be applied to multi-omics data.
  - Paper submitted to iScience.

## Academic Service

- Journal reviewer: IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
- Conference reviewer: International Conference on Machine Learning (ICML 2023)

## Selective Honors and Awards

- **Gold Medal**, the 32nd China Mathematics Olympid (CMO), 2016
- **National Scholarship**, Peking University, 2023
- Challenge Winner Award (**Champion**), CrossMoDA, MICCAI 2022

## Skills Summary

- **Programming Languages**: Python, C/C++, Matlab, R
- **Languages**: English (TOEFL: 104, R30, L27, S21, W26)