Jianfeng Cao

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EDUCATION

The Chinese University of Hong Kong
Postdoctoral Research Fellow

Hong Kong

Sep 2021 − Dec 2023 (Expected)

- **Supervisor:** Prof. Qi Dou
- **Research interests:** Biomedical image processing; Surgical video analysis

City University of Hong Kong
Ph.D. in Electronic Engineering

Hong Kong

Sep 2017 − Sep 2021

- **Supervisor:** Prof. Hong Yan
- **Research interests:** Biomedical image processing; Super-resolution; Bioinformatics

Lanzhou University
B.Sc. in Electronic Information Science and Techology

Lanzhou

Sep 2013 − Jun 2017

- **Supervisor:** Prof. Zhonglei Mei
- **Research interests:** Image processing; Computational electromagnetics

PROJECTS

Surgical video analysis | Project page
2021.09 − Now

- Established a standard dataset for surgical phase recognition with over 0.3 million annotated frames, all cases of which were conducted by expert with over a decade of experience;
- Developed leaning-based framework AI-Endo for automatically recognizing and analyzing surgical phases in ESD surgery, supporting efficient and quantitative surgical skill evaluation;
- The AI-Endo was extensively evaluated on different datasets, including ex-vivo and in-vivo animal trials, surgical cases conducted by junior surgeons, and cases from different endoscopic systems.

Fluorescent microscopy image processing | Project page
2017.09 − now

- Proposed an accurate framework for extracting cellular membranes in fluorescent microscopy, where optimization strategy based on distance map and graph clustering with weighted edges considerably reduce segmentation errors in dense cells.
- Developed the first high-throughput framework CShaper to reconstruct 3D shape of cells from the fluorescent microscopy, providing the largest morphological atlas for developmental studies in *Caenorhabditis elegans* (Standard dataset used by CNRS, France; Course example by EMBL).
- The proposed CShaper was integrated into the desktop software CShaperApp based on TensorFlow and PyQt5.

Learning-based imaging for super-resolution
2021.11 − now

- This project targets on improving the quality of **in-vivo** fluorescent microscopy, breaking the imaging limitations caused by physical diffraction limit and laser phototoxicity.
- Based on generative models, e.g. generative adversarial networks (GAN), the quality of *in-vivo* images achieves the same level as single-point images, shedding light on leveraging the performance of downstream tasks such as cell tracking and segmentation.

PROFESSIONAL EXPERIENCE

EMBL course trainer assistant: *C. elegans*: from genome editing to imaging — 2022

Graduate teaching assistant: Introduction to electronics — 2020

Graduate teaching assistant: Introduction to electronics — 2019

Graduate teaching assistant: Signal processing — 2018

Journal reviewer: IEEE Journal of Biomedical and Health Informatics, BMC Bioinformatics, Conference on Neural Information Processing Systems (NeurIPS), IEEE International Symposium on Biomedical Imaging (ISBI)

Publications

[*] Co-first authors, [#] Corresponding authors

Jianfeng Cao, Hon-Chi Yip, Yueyao Chen, Markus Scheppach, Xiaobei Luo, Hongzheng Yang, Ming Kit Cheng, Yonghao Long, Yueming Jin, Philip Wai-Yan Chiu, Yeung Yam, Helen Mei-Ling Meng, and Qi Dou. "Intelligent surgical workflow recognition for endoscopic submucosal dissection with real-time animal study", ***Nature Communications***, 14.1 (2023): 1-14.

Jianfeng Cao[*], Guoye Guan[*], Vincy Wing Sze Ho[*], Ming-Kin Wong, Lu-Yan Chan, Chao Tang, Zhongying Zhao and Hong Yan. "Establishment of a morphological atlas of the *Caenorhabditis elegans* embryo using deep-learning-based 4D segmentation." ***Nature Communications*** 11.1 (2020): 6254.

Jianfeng Cao, Ming-Kin Wong, Zhongying Zhao and Hong Yan. "3DMMS: robust 3D membrane morphological segmentation of *C. elegans* embryo." ***BMC Bioinformatics*** 20.1 (2019): 1-13.

Bin Duan, **Jianfeng Cao**, Wei Wang, Dawen Cai and Yan Yan. "Cell Instance segmentation via multi-scale non-local correlation." ***IEEE International Symposium on Biomedical Imaging***. In press, 2023.

Hongzheng Yang, Cheng Chen, Meirui Jiang, Quande Liu, **Jianfeng Cao**, Pheng Ann Heng and Qi Dou. "DLTTA: Dynamic learning rate for test-time adaptation on cross-domain medical images." ***IEEE Transactions on Medical Imaging*** 41.12 (2022): 3575-3586.

Yonghao Long, **Jianfeng Cao**, Anton Deguet, Russell H Taylor and Qi Dou. "Integrating artificial intelligence and augmented reality in robotic surgery: an initial dvrk study using a surgical education scenario." ***International Symposium on Medical Robotics (ISMR)***. IEEE, 2022.

Jianfeng Cao, and Hong Yan. "Instance segmentation with the number of clusters incorporated in embedding learning." ***International Conference on Acoustics, Speech and Signal Processing (ICASSP)***. IEEE, 2021.

Jianfeng Cao, and Hong Yan. "Manifold extraction in fluorescent stack via deep learning." ***International Conference on Signal-Image Technology & Internet-Based Systems (SITIS)***. IEEE, 2019.

Jianfeng Cao, Zhongying Zhao, and Hong Yan. "Accurate cell segmentation based on biological morphology features." ***IEEE International Conference on Systems, Man, and Cybernetics (SMC)***. IEEE, 2018.

Jianfeng Cao, Lihan Hu, Guoye Guan, Zelin Li, Zhongying Zhao, and Hong Yan. CShaperApp: extracting and analyzing cellular morphologies of developing *Caenorhabditis elegans* embryo. **Under review**.

Awards & Achievements

News report, CityU develops novel computer tool for studying cells	2021
Outstanding graduate student, Lanzhou University	2017
First-class scholarship, Lanzhou University	2016
National scholarship, Lanzhou University	2015