BIOGRAPHICAL SKETCH

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NAME: Ziyi Huang

eRA COMMONS USER NAME (credential, e.g., agency login): ZH2343

POSITION TITLE: Researcher

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
University of Science and Technology of China, Hefei	BS	07/2016	Electronic Information Engineering
University of Michigan, Ann Arbor; Ann Arbor	MS	05/2018	Electrical and Computer Engineering
Columbia University, New York	PHD	02/2023	Electrical Engineering
Columbia University, New York	Postdoctoral Fellow	07/2023	Electrical Engineering

A. Personal Statement

I am a researcher in the Department of Software System Research at Nokia Bell Labs. My expertise primarily lies in AI for healthcare, biomedical image analysis, and data-driven decision making. I have over 8 years of experience in retinal imaging and data analysis, over 6 years of experience in optical coherence tomography (OCT) imaging and image processing, and over 5 years of experience in enhancing model reliability for safety-critical decision making. I have developed multiple machine learning frameworks to perform real-world biomedical data analysis under various imaging modalities, including retinal vessel segmentation using photoacoustic data, weakly supervised human cardiac tissue segmentation and heterogeneity analysis within OCT, fundus video analysis and feature extraction within rat models, and weakly supervised lung segmentation within human X-ray images. In summary, my research aims to develop efficient algorithms for advanced data intervention that leverage the power of machine learning, computer vision, and biomedical imaging, with the ultimate goal of improving the accuracy and efficiency of real-world clinical diagnosis. To date, I have been awarded Rising Star in Machine Learning and Systems and two doctoral fellowships to fully cover my entire doctoral research, tuition, and stipend. I have 8 peer-reviewed journal papers and 9 selective conference proceedings, many of which were accepted at top-tier journals/conferences such as LSA/IEEE-JBHI/NeurIPS/AISTATS/MICCAI.

Citations.

a. **Huang Z,** Gan Y, Lye T, Liu Y, Zhang H, Laine A, Angelini E, Hendon C. Cardiac Adipose Tissue Segmentation via Image-Level Annotations. *IEEE Journal of Biomedical and Health Informatics*, 2023.
b. **Huang Z,** Gan Y, Lye T, Zhang H, Laine A, Angelini ED, Hendon C. Heterogeneity measurement of cardiac tissues leveraging uncertainty information from image segmentation. *In Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2020.
c. **Huang Z**, Lam H, Zhang H. Efficient uncertainty quantification and reduction for over-parameterized neural networks. *Advances in Neural Information Processing Systems (NeurIPS)*, 2023.
d. **Huang Z**, Lam H, Meisami A, Zhang H, Optimal Regret is Achievable with Bounded Approximate Inference Error: An Enhanced Bayesian Upper Confidence Bound Framework. *Advances in Neural Information Processing Systems (NeurIPS)*, 2023.
e. **Huang Z,** Zhao X, Ziv O, Laurita KR, Rollins AM, Hendon CP, Automated analysis framework for in vivo cardiac ablation therapy monitoring with optical coherence tomography. *Biomedical Optics Express*, 2023.

B. Positions, Scientific Appointments, and Honors

Positions and Scientific Appointments

2023 -	Web3 Researcher, Nokia Bell Labs, New Providence, NJ
2023 -	Adjunct Faculty, Stevens Institute of Technology, Hoboken, NJ
2023 - 2023	Postdoc Research Fellow, Columbia University, New York, NY

Honors

2024	Machine Learning and Systems Rising Star
2023	NeurIPS Travel Grant
2023	Columbia Biomedical Engineering Technology Accelerator ~ $ 100,000
2021-2023	Cheung-Kong Innovation Doctoral Fellowship ~ $ 183,958
2021	ISBI Travel Grant
2020	Professional Development Scholarship
2018-2021	Graduate Research Assistant Fellowships

Committee

2024 -	Organization committee, SPIE Medical Imaging-Image Processing
2024 -	Organization committee, International Conference on Internet and Web Applications and Services
2024 -	Technical committee, International Symposium on Biomedical Imaging
2023 -	Technical committee, International Conferences on Brain Informatics

C. Contributions to Science

1. Data-Driven Decision Making. While the rise of machine learning and increasingly massive data have driven better predictions, converting predictions into decisions, and understanding the associated risk, have been less investigated. To address this need, we have developed several machine learning solutions as well as theoretical analysis frameworks to dissect the sources of model uncertainty, design learning strategies to make optimal decisions, and develop a model selection framework to select the best model in the presence of model uncertainty.

a. **Huang Z**, Lam H, Meisami A, Zhang H. Optimal regret is achievable with bounded approximate inference error: an enhanced Bayesian upper confidence bound framework. *Advances in Neural Information Processing Systems (NeurIPS)*, 2023.
b. **Huang Z**, Lam H, Zhang H. Efficient uncertainty quantification and reduction for over-parameterized neural networks. *Advances in Neural Information Processing Systems (NeurIPS),* 2023.
c. **Huang Z**, Lam H, Zhang H. Conditional coverage estimation for high-quality prediction intervals. *Journal of Systems Science and Systems Engineering*, 2023.
d. Chen H, **Huang Z**, Lam H, Qian H, Zhang H. Learning prediction intervals for regression: Generalization and calibration. *In International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2021.

2. Biomedical Data Analysis via Generative AI. Generative AI has significantly advanced the performance of computer-assisted diagnosis. Building upon pre-trained generative AI models, we have developed several multi-modal machine-learning frameworks for patients' health information collection. Integrating with a recommendation system architecture, our model could proactively pose disease-related questions to automatically collect patient's health information. We also developed a multi-modal vision-language model to effectively detect children's screen time usage. Our model could take multi-view inputs and fuse features from different views to address the temporal and spatial correlation challenges.

a. Li X, Hou X, Ravi N, **Huang Z***, Gan Y. A Two-Stage Proactive Dialogue Generator for Efficient Clinical Information Collection Using Large Language Model. *arXiv preprint arXiv:2410.03770*, 2024.
b. Hou X, Li X, **Huang Z***, Gan Y. Reinforcement Learning based Proactive Medical Dialogue System for Health Status and Medical Image Collection", To be presented at *Medical Imaging*, (MI 2025)

c. Hou X, Shen S, Li X, Gao X, **Huang Z**, Holiday SJ, Cribbet MR, White SW, Sazonov E, Gan Y. Enhancing Screen Time Identification in Children with a Multi-View Vision Language Model and Screen Time Tracker. To be presented at *IEEE-EMBS International Conference on Biomedical and Health Informatics*, 2024

3. Biomedical Data Analysis with Various Imaging Modalities. I have contributed to the development of data analytic tools on tissue segmentation, texture analysis, and video analysis using various imaging modalities, including OCT, X-ray, photoacoustic, and fundus images. Benefiting from transfer learning, our model could use a small amount of data to achieve competitive performance with fully supervised models.

a. **Huang Z,** Liu H, Zhang H, Xing F, Laine A, Angelini E, Hendon C, Gan Y. Label refinement for noisy annotation in weakly supervised segmentation. *In Medical Imaging 2024: Image Processing,* 2024.
b. **Huang Z,** Zhang H, Laine A, Angelini E, Hendon C, Gan Y*. Co-seg: An image segmentation framework against label corruption*. In 2021 IEEE 18th International Symposium on Biomedical Imaging (ISBI), 2021.
c. **Huang Z**, Gan Y, Lye T, Theagene D, Chintapalli S, Virdi S, Laine A, Angelini E, Hendon CP. Segmentation and uncertainty measures of cardiac substrates within optical coherence tomography images via convolutional neural networks. In2020 IEEE 17th International Symposium on Biomedical Imaging (ISBI), 2020.
d. Saluja D, **Huang Z,** Majumder J, Zeldin L, Yarmohammadi H, Biviano A, Wan EY, Ciaccio EJ, Hendon CP, Garan H. Automated prediction of isthmus areas in scar-related atrial tachycardias using artificial intelligence*. Journal of Cardiovascular Electrophysiology*, 2024.

4. Ophthalmology Informatics and Imaging. At the core of eye disease management lies high-quality retinal images, which facilitate disease diagnosis, progress monitoring, and treatment delivery. To address suboptimal clinical guidance for current retinal neovascularization treatment and diagnosis, we developed a multi-modality imaging system combining photoacoustic microscopy, OCT, and fluorescence microscopy to provide high-resolution, in-vivo imaging of retinal vasculature and neovascularization in rabbits. Additionally, we developed a simple yet efficient texture feature analysis algorithm to automatically select high-quality frames from fundus videos, without requiring any reference frames. Using videos from anesthetized Long Evans rat models, we demonstrate that our model can effectively distinguish high-quality frames from videos with insufficient lighting and motion artifacts.

a. Zhang W, Li Y, Nguyen VP, **Huang Z**, Liu Z, Wang X, Paulus YM. High-resolution, in vivo multimodal photoacoustic microscopy, optical coherence tomography, and fluorescence microscopy imaging of rabbit retinal neovascularization. *Light: Science & Applications*, 2018.
b. **Huang Z,** Gouya C, Attia M, Donskoy S, Ravi N, Gan Y, and Mieler J. Automated acquiring high-quality frames from smartphone-based fundus imaging system. Accepted by *Ophthalmic Technologies XXXV*, 2024
c. Nguyen VP, Li Y, Qian W, Liu B, Tian C, Zhang W, **Huang Z**, Ponduri A, Tarnowski M, Wang X, Paulus YM. Contrast agent enhanced multimodal photoacoustic microscopy and optical coherence tomography for imaging of rabbit choroidal and retinal vessels in vivo. *Scientific Reports*, 2019.
d. Tian C, Zhang W, Nguyen VP, **Huang Z**, Wang X, Paulus YM. Integrated photoacoustic microscopy, optical coherence tomography, and fluorescence microscopy for multimodal chorioretinal imaging. *In Photons Plus Ultrasound: Imaging and Sensing* 2018, SPIE.