

Fanjie Kong

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Google Scholar: <https://scholar.google.com/citations?user=FeEmViIAAAAJ&hl=en>

RESEARCH INTEREST

- Machine learning, deep learning
- Computer vision, vision-language modeling, natural language processing
- Trustworthy AI, Fairness, Interpretability
- Object detection, semantic segmentation
- Computation & data Efficiency

TECHNICAL SKILLS

- Computer programming: C/C++, Python, MATLAB, Java
- Machine learning framework: PyTorch, TensorFlow, scikit-learn, Detectron2
- Cloud platform: AWS, Azure
- Distributed Deep Learning: Distributed Data-Parallel Training (DDP), Collective Communication (c10d)
- Web development: Django, PHP

EDUCATION

Core Courses: Computer Vision, Machine Learning, Numerical Analysis, Introduction to Algorithm, Data Structure, Advanced Operating Systems, Health Data Science, Principle of Database, Linear Algebra, Probability Theory and Statistics

Duke University

Ph.D. in Electrical and Computer Engineering

Sep.2020-May.2024(Expected)

Advisor: Prof. Ricardo Henao

Duke University

Master of Science in Biomedical Engineering

Sep.2018-May.2020

GPA: 4.0/4.0

Northeastern University, Shenyang, China

Bachelor of Engineering in Biomedical Engineering

Sep.2015-Jun.2018 (Top class 3-year program)

WES GPA: 3.94/4.00; Average Score: 92.9; Rank: 1/135.

INDUSTRIAL EXPERIENCES

Applied Scientist Intern, Amazon AWS AI Lab, Seattle, WA, U.S.

May. 2023-Nov. 2023

- Developed a novel object detection training approach that leverages region-level synthetic captions generated by vision-language models to augment textual understanding of object detection models, outperforming existing methods in open-world detection.
- Proposed a novel hyperbolic learning loss to align synthetic captions with corresponding image patches.

Applied Scientist Intern, Amazon.com, Seattle, WA, U.S.

May. 2022-Aug. 2022

- Developed an interactive dashboard to provide insights for digital marketing content creation.
- Improved the performance of multimodal neural network with Vision Transformer and CLIP pretraining.
- Implemented a variety of attribution methods (Integrated Gradients, KernelShap, DeepLIFT, LIME, et al.) to interpret predictions from text and image input.

Applied Scientist Intern, Amazon.com, Seattle, WA, U.S.

June. 2021-Sep. 2021

- Built a domain-aware multimodal neural network for multimedia web content data analysis and mining.

Research and Development Engineer Intern, Neusoft Holdings Co., Ltd., Shenyang, China

Jul. 2017-Sep. 2017

- Built an Android App for doctors to manage their medical images and for patients to look up their diagnostics

Research and Development Engineer Intern, Neusoft Holdings Co., Ltd., Shenyang, China

Jul. 2016-Sep. 2016

- Built a software to recognize the characters on license plates based on images captured by road cameras

PUBLICATIONS

- **Fanjie Kong**, Yanbei Chen, Jiarui Cai, Davide Modolo, *Hyperbolic Learning with Synthetic Captions for Open-World Detection* accepted by CVPR 2024
- **Fanjie Kong**, Shuai Yuan, Weituo Hao, Ricardo Henao, *Mitigating Test-Time Bias for Fair Image Retrieval*, accepted by NeurIPS 2023.
- **Fanjie Kong**, Yuan Li, Fiez Tanner, Nassif Houssam, Ricardo Henao, *Neural Insights for Digital Marketing Design*, accepted by KDD 2023.
- **Fanjie Kong**, Ricardo Henao, *Efficient Classification of Very Large Images with Tiny Objects*, accepted by CVPR 2022

- Colin L Cooke, **Fanjie Kong**, Amey Chaware, et al., *Physics-enhanced machine learning for virtual fluorescence microscopy*, accepted by ICCV 2021
- Dong Wang, Yuewei Yang, Chenyang Tao, **Fanjie Kong**, Ricardo Henao, Lawrence Carin, *Proactive Pseudo-Intervention: Causally Informed Contrastive Learning For Interpretable Vision Models*, submitted to TMLR
- Sreekanth Vemulapalli, **Fanjie Kong**, *Machine Learning Computer Vision for Point of Care Decision Support of Echocardiographic Identification of Hypertrophic Cardiomyopathy*, accepted by Circulation(IF 29.69)
- **Fanjie Kong**, Xiao-Yang Liu, Ricardo Henao, *Quantum Tensor Network in Machine Learning: An Application to Tiny Object Classification*, accepted by NeurIPS 2020 Workshop on Quantum Tensor Networks in Machine Learning
- **Fanjie Kong**, Jordan Malof, Bohao Huang, Leslie Collins, Kyle Bradbury, *Synthinel-1: A collection of synthetic images for semantic segmentation of buildings in overhead imagery*, accepted by IEEE Winter Conference on Applications of Computer Vision (WACV), 2020
- **Fanjie Kong**, Cheng Chen, Bohao Huang, Leslie Collins, Kyle Bradbury, Jordan Malof, *Training a Single Multi-class Convolutional Segmentation Network Using Multiple Datasets with Heterogeneous Labels: Preliminary Results*, accepted by IEEE International Geoscience and Remote Sensing Symposium Conference (IGARSS), 2019
- Chen Li, **Fanjie Kong**, Kai Wang, Aidong Xu, Gexiang Zhang, et al., *Microscopic Machine Vision Based Degradation Monitoring of Low-voltage Electromagnetic Coil Insulation Using Ensemble Learning in a Membrane Computing Framework*, accepted by IEEE Access
- Colin Cooke, **Fanjie Kong**, Rong Xu, Amey Chaware, Roarke Horstmeyer, et al., *Physics-enhanced machine learning for microscope image segmentation*, submitted to IEEE Transactions on Computational Imaging
- Chen Li, Dan Xue, **Fanjie Kong**, Zhijie Hu, et al., *Cervical Histopathology Image Classification Using Ensembled Transfer Learning*, accepted by International Conference Information Technology in Biomedicine(ITIB), 2019
- Kai Wang, Haifeng Guo, Aidong Xu, Zhihua Liu, Chen Li, **Fanjie Kong**, Shouliang Qi, *Degradation Monitoring of Low-Voltage Electromagnetic Coil Insulation Based on Microscopic Image Analysis*, accepted by IEEE International Conference on Prognostics and Health Management (PHM), 2018

RESEARCH EXPERIENCES

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|---|---|
| <p>Code Interpretation and Generation using Transformer
 Computer Science Department, Duke University</p> <ul style="list-style-type: none"> • Enhance the performance of text-to-code and code-to-text generation by incorporating program syntax diagram into the self-attention modules of the transformer. • The resulting model assists beginners to learn SQL codes. | <p>May. 2022 – Jan. 2023
 Advisor: Prof. Bhuwan Dhingra & Prof. Sam Wiseman</p> |
| <p>Mitigating Social Bias in Multimodality Models
 Electrical & Computer Engineering Department, Duke University</p> <ul style="list-style-type: none"> • Building an efficient annotating framework for mitigating social bias in deep multimodal neural network using Multiple Instances Learning. | <p>Jan. 2023 – Jun. 2023
 Advisor: Prof. Ricardo Henao</p> |
| <p>Identification of Hypertrophic Cardiomyopathy using 3D Echocardiographic Neural Network
 Electrical & Computer Engineering Department, Duke University</p> <ul style="list-style-type: none"> • Proposed an efficient 3D neural network model to classify echocardiographic videos with respect to hypertrophic cardiomyopathy. | <p>Nov. 2021-May. 2022
 Advisor: Prof. Ricardo Henao</p> |
| <p>Efficient Classification of Very Large Images with Tiny Objects
 Electrical & Computer Engineering Department, Duke University</p> <ul style="list-style-type: none"> • Proposed a novel nested zoom-in neural network to efficiently classify high-resolution images with tiny ROIs. | <p>Oct. 2019-Oct. 2021
 Advisor: Prof. Ricardo Henao</p> |
| <p>Domain Adaptation in Satellite Image Segmentation Using Synthetic Data
 Duke Applied Machine Learning Lab, Duke University</p> <ul style="list-style-type: none"> • Utilized virtual environments to capture synthetic overhead imagery for training segmentation CNNs. • Contributed a synthetic image dataset that improved the performance of CNNs in domain adaptation problem. • Implemented neural style transfer model CycleGAN to transfer the synthetic images into a more realistic style. • Contributed a style-transferred synthetic dataset that boosted the performance of CNN more significantly. | <p>Apr. 2019-Jan. 2020
 Advisor: Prof. Jordan Malof</p> |
| <p>Training Segmentation Convolutional Neural Networks with Heterogeneous Labels
 Duke Applied Machine Learning Lab, Duke University</p> <ul style="list-style-type: none"> • Proposed a class-asymmetric loss function to help segmentation CNN gain better performance when it is trained on datasets with heterogeneous labels. | <p>Sep. 2018-Jan. 2019
 Advisor: Prof. Jordan Malof</p> |

Learning Microscopy imaging by Convolutional Neural Network (Sponsored by Dean's Research Award) Jan. 2019-May. 2020
Duke Computational Optics Lab, Duke University *Advisor: Prof. Roarke Horstmeyer*

- Designed an image-formation module for CNN to jointly optimize the physical setup of an optical microscope and microscopic image segmentation accuracy.

Monitoring Electromagnetic Coil Based on Microscopic Image Analysis and Machine Learning *May. 2017-May. 2018*
Institute of Automation, Chinese Academy of Sciences(CAS) *Advisor: Dr. Kai Wang*

- Contributed codes for monitoring degradation phases of electromagnetic coils and provide early warning of impending breakdown of the coils.
- Integrated multiple machine learning and pattern recognition methods in a membrane computing framework to predict the degradation states of the coils by their microscopic images.

Classification of Microscopic Histopathology Images based on Deep Learning *Sep. 2017-May. 2018*
Microscopic Image and Medical Image Analysis Group, Northeastern University *Advisor: Prof. Chen Li*

- Developed a program to automatically classify the histopathology images of cervical cancer using convolutional neural network, serving as my final-year thesis defense for my bachelor degree.

HONORS & AWARDS

- Dean's Research Award for Master's Students, Duke University
- Meritorious Winner, Mathematical Contest in Modeling (MCM) in 2017 (Top 8%, worldwide)
- National Scholarship (twice, 1%), Ministry of Education China
- First Class Scholarship (twice, 1%), Northeastern University in China
- Third Winner, Large Scale Image Classification Contest held by Future Lab in China

REVIEWER SERVICE

- EMNLP 2023
- CVPR 2024
- ICLR 2024