Hongyi Pan, Ph.D.

Postdoctoral Research Fellow
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Email: zephyrphy@gmail.com **Phone**: +1-(312)-284-9511
Address: 737 N Michigan Ave, Chicago, Illinois, USA, 60611
Lindekin: www.linkedin.com/in/hongyi-pan-67a2b1181
Google Scholar: scholar.google.com/citations?user=23I1CMYAAAAJ
GitHub: github.com/phy710 **Homepage**: phy710.github.io

Education

University of Illinois Chicago — Chicago, Illinois, USA
Ph.D. in Electrical and Computer Engineering, GPA: 4.0/4.0. — August 2019 – August 2023
Advisor: Ahmet Enis Cetin (IEEE Fellow)

University of Illinois Chicago — Chicago, Illinois, USA
Master in Electrical and Computer Engineering, GPA: 4.0/4.0. — August 2017 – May 2019

Chang'an University — Xi'an, Shaanxi, China
Bachelor in Automation, GPA: 85.3/100 (3.6/4.0). — September 2014 – July 2018

Work Experience

Northwestern University — Chicago, Illinois, USA
Postdoctoral Research Fellow. Advisor: Ulas Bagci. — June 2023 – Present
Topic: Federated learning, domain generalization, eye-tracking-based medical image analysis.

InnoPeak Technology (OPPO US Research Center) — Bellevue, Washington, USA
Engineering Intern. Advisor: Xihua Dong. — May 2022 – August 2022
Topic: Attention-based variable rate super-sampling (VRSS) for graphics rendering.

University of Illinois Chicago — Chicago, Illinois, USA
Teaching Assistant and Research Assistant. Advisor: Ahmet Enis Cetin. — August 2019 – May 2023
Topic: Wildfire detection, $\ell 1$-norm kernel PCA, orthogonal-transform-based neural network layer.

Research Interests

Machine learning, signal processing, biomedical image analysis

Editorial Services

Associate Editor, Signal, Image and Video Processing — June 2023 – Present

Selected Honors and Awards

UIC Graduate Student Award for Exceptional Research Promise — May 2022

Teaching Experience

Guest lecturer at Northwestern University
BME 495: Deep Learning for Biomedical Imaging — Spring 2024

Teaching assistant at University of Illinois Chicago
ECE 266: Introduction to Embedded Systems — Fall 2019
ECE 317: Digital Signal Processing I — Spring 2020, Summer 2021
ECE 407: Pattern Recognition I — Spring 2022
ECE 415: Image Analysis and Computer Vision I — Fall 2020, Fall 2021, Fall 2022
ECE 491: Digital Speech Processing — Fall 2020, Fall 2021, Fall 2022
ECE 491: Introduction to Neural Networks — Spring 2021, Spring 2022, Spring 2023

Selected Research Projects

Federated Domain Generalization for Medical Image Analysis June 2023 – Present

The goal of this project is to develop a Federated domain generalization for medical image analysis tasks. We improved the main-steam Fourier-transform-based domain generalization using a soft-thresholding function. Premilinary work is presented in [C16].

Eye-Tracking-Based Medical Image Analysis February 2023 – Present

The goal of this project is to develop an AI system to integrate computer-aided detection and diagnosis systems with radiologists' perceptive knowledge and patterns via eye-tracking. In [C11], we utilized eye gaze as a novel interactive prompt by leveraging the real-time interactive prompting feature of META's Segment Anything Model (SAM) for image segmentation. We presented the GazeSAM system to enable users to collect target segmentation masks by simply looking at the region of interest. In [C13], we proposed a novel gaze-guided graph neural network (GazeGNN) for chest X-ray image classification.

Orthogonal Transform Based Neural Network Layers March 2021 – April 2023

We proposed a family of orthogonal-transform-based neural network layers based on the convolution theorem. Related peer-reviewed papers include [C3, C5, C6, C8, C9, J4, J10]. Specifically, we presented a discrete-cosine-transform-based layer to improve the autoencoder network in [C8]. Moreover, we presented the relationship between a Hadamard-transform (HT)-based layer and the quantum computation in [C9], and we proposed a CMOS analog implementation for the HT-based layer in [J10].

L_1-Norm Kernel PCA March 2021 – May 2023

We proposed a family of multiplication-free ℓ_1-norm kernel principal component analysis (PCA) methods in [C2] and implemented the power iteration algorithm for these kernels in [C4]. Applications include chemical sensor anomaly detection [J5] and array processing [C10].

Neural Network Based Wildfire Detection May 2018 – January 2021

We deployed a MobileNet-V3-based real-time wildfire detection model on Nvidia Jetson Nano. It obtained satisfactory results on the HPWREN wildfire surveillance database. Related peer-reviewed papers include [J1, J3, C1].

Peer-Reviewed Publications (*: equal contribution, [J]: journal, [C]: conference)

[C16] **Hongyi Pan**, Bin Wang, Zheyuan Zhang, Xin Zhu, Debesh Jha, Ahmet Enis Cetin, Concetto Spampinato, Ulas Bagci (2024): Domain Generalization with Fourier Transform and Soft Thresholding. **IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)**.

[C15] Xin Zhu, **Hongyi Pan**, Shuaiang Rong, Ahmet Enis Cetin (2024): Electroencephalogram Sensor Data Compression Using An Asymmetrical Sparse Autoencoder With A Discrete Cosine Transform Layer. **IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)**.

[C14] Xin Zhu, **Hongyi Pan**, Salih Atici, Ahmet Enis Cetin (2024): Stein Variational Gradient Descent-based Detection For Random Access With Preambles In MTC. **IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)**.

[C13] Bin Wang*, **Hongyi Pan***, Armstrong Aboah, Zheyuan Zhang, Elif Keles, Drew Torigian, Baris Turkbey, Elizabeth Krupinski, Jayaram Udupa, Ulas Bagci (2024): GazeGNN: A Gaze-Guided Graph Neural Network for Chest X-Ray Classification. **IEEE/CVF Winter Conference on Applications of Computer Vision (WACV)**.

[J10] Nastaran Darabi, Maeesha Binte Hashem, **Hongyi Pan**, Ahmet Cetin, Wilfred Gomes, Amit Ranjan Trivedi (2024): Adc/dac-free analog acceleration of deep neural networks with frequency transformation. **IEEE Transactions on Very Large Scale Integration Systems (TVLSI)**.

[J9] Xin Zhu, Daoguang Yang, **Hongyi Pan**, Hamid Reza Karimi, Didem Ozevin, and Ahmet Enis Cetin (2024): A novel asymmetrical autoencoder with a sparsifying discrete cosine Stockwell transform layer for gearbox sensor data compression. **Engineering Applications of Artificial Intelligence (EAAI)**.

[J8] Ziliang Hong, Emadeldeen Hamdan, Yifei Zhao, Tianxiao Ye, **Hongyi Pan**, Ahmet Enis Cetin (2024): Wildfire

detection via transfer learning: a survey. **Signal, Image and Video Processing (SIVP)**.
[C12] Salih Furkan Atici, **Hongyi Pan**, Mohammed H. Elnagar, Veerasathpurush Allareddy, Rashid Ansari, Omar Suhaym, Ahmet Enis Cetin (2023): A Collaborative Fusion of Vision Transformers and Convolutional Neural Networks in Classifying Cervical Vertebrae Maturation Stages. **IEEE International Conference on Electronics, Circuits and Systems (ICECS)**.
[C11] Bin Wang, Armstrong Aboah, Zheyuan Zhang, **Hongyi Pan**, Ulas Bagci (2023): GazeSAM: Interactive Image Segmentation with Eye Gaze and Segment Anything Model. **NeurIPS Workshop Gaze Meets ML**.
[C10] **Hongyi Pan**, Erdem Koyuncu, Ahmet Enis Cetin (2023): Robust Array Signal Processing Using L1-Kernel-Based Principal Component Analysis. **IEEE-APS Topical Conference on Antennas and Propagation in Wireless Communications (APWC)**.
[C9] **Hongyi Pan**, Xin Zhu, Salih Furkan Atici, Ahmet Cetin (2023): A hybrid quantum-classical approach based on the Hadamard transform for the convolutional layer. **International Conference on Machine Learning (ICML)**.
[C8] **Hongyi Pan***, Xin Zhu*, Zhilu Ye*, Pai-Yen Chen, and Ahmet Enis Cetin (2023): Real-time wireless ecg-derived respiration rate estimation using an autoencoder with a dct layer. **IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)**.
[C7] Salih Atici*, **Hongyi Pan***, Mohammed H. Elnagar, Veerasathpurush Allareddy, Omar Suhaym, Rashid Ansari, Ahmet Enis Cetin (2023): Classification of the Cervical Vertebrae Maturation (CVM) Stages Using the Tripod Network. **IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)**.
[C6] Ahmet Enis Cetin, **Hongyi Pan** (2023): Hybrid Binary Neural Networks: A Tutorial Review. **IEEE VLSI Test Symposium**.
[J7] Tong Wah Lim, **Hongyi Pan**, Mi Pan, Michael Francis Burrow, Colman McGrath (2023): Agreement in quantification of removable prosthesis plaque area coverage using a semi-automated planimetric assessment method. **Journal of Dentistry**.
[J6] Minye Yang, Zhilu Ye, **Hongyi Pan**, Mohamed Farhat, Ahmet Enis Cetin, Pai-Yen Chen (2023): Electromagnetically unclonable functions generated by non-Hermitian absorber-emitter. **Science Advances**.
[C5] **Hongyi Pan**, Diaa Badawi, Chang Chen, Adam Watts, Erdem Koyuncu, Ahmet Enis Cetin (2022): Deep Neural Network with Walsh-Hadamard Transform Layer For Ember Detection during a Wildfire. **IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshop**.
[C4] **Hongyi Pan**, Diaa Badawi, Runxuan Miao, Erdem Koyuncu, Ahmet Enis Cetin (2022): Multiplication-avoiding variant of power iteration with applications. **IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)**.
[J5] **Hongyi Pan**, Diaa Badawi, Ishaan Bassi, Sule Ozev, Ahmet Enis Cetin (2022): Detecting anomaly in chemical sensors via L1-kernel-based principal component analysis. **IEEE Sensors Letters**.
[J4] **Hongyi Pan**, Diaa Badawi, Ahmet Enis Cetin (2022): Block walsh–hadamard transform-based binary layers in deep neural networks." **ACM Transactions on Embedded Computing Systems (TECS)**.
[C3] **Hongyi Pan**, Diaa Badawi, Ahmet Enis Cetin (2021): Fast Walsh-Hadamard Transform and Smooth-Thresholding Based Binary Layers in Deep Neural Networks. **IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshop**.
[C2] **Hongyi Pan**, Diaa Badawi, Erdem Koyuncu, and A. Enis Cetin (2021): Robust Principal Component Analysis Using a Novel Kernel Related with the L_1-Norm. **European Signal Processing Conference (EUSIPCO)**.
[C1] **Hongyi Pan**, Diaa Badawi, Ahmet Enis Cetin (2021): Fourier domain pruning of mobilenet-v2 with application to video based wildfire detection. **International Conference on Pattern Recognition (ICPR)**.
[J3] **Hongyi Pan**, Diaa Badawi, Ahmet Enis Cetin (2020): Computationally efficient wildfire detection method using a deep convolutional network pruned via fourier analysis. **Sensors**.
[J2] Diaa Badawi, **Hongyi Pan**, Sinan Cem Cetin, and A. Enis Çetin (2020): Computationally efficient spatio-temporal dynamic texture recognition for volatile organic compound (voc) leakage detection in industrial plants. **IEEE Journal of Selected Topics in Signal Processing (J-STSP)**.
[J1] **Hongyi Pan**, Diaa Badawi, Xi Zhang, Ahmet Enis Cetin (2020): Additive neural network for forest fire detection. **Signal, Image and Video Processing (SIVP)**.

ArXiv Publications

[A4] **Hongyi Pan**, Xin Zhu, Salih Atici, Ahmet Enis Cetin (2023): Orthogonal transform domain approaches for the convolutional layer. *arXiv:2303.06797*.
[A3] **Hongyi Pan**, Xin Zhu, Salih Atici, Ahmet Enis Cetin (2022): DCT Perceptron Layer: A Transform Domain Approach for Convolution Layer. *arXiv:2211.08577*.
[A2] **Hongyi Pan**, Salih Atici, Ahmet Enis Cetin (2022): Multipod convolutional network. *arXiv:2210.00689*.
[A1] Salih Atici, **Hongyi Pan**, Ahmet Enis Cetin (2022): Normalized Stochastic Gradient Descent Training of Deep Neural Networks. *arXiv:2212.09921*.

Reviewer Services

Journals: Signal, Image and Video Processing; Fire Technology; IEEE Sensors Journal; IEEE Transactions on Neural Networks and Learning Systems; IEEE Transactions on Medical Imaging; IEEE Journal of Biomedical and Health Informatics; ACM Transactions on Embedded Computing Systems; Plos Ones; Medical Image Analysis; Computerized Medical Imaging and Graphics.

Conferences: IEEE International Conference on Acoustics, Speech, and Signal Processing; International Conference on Machine Learning.

Skills

Programming Languages: Python, MATLAB, C, C++, LaTex.
Scientific Tools/Software: PyTorch, TensorFlow, MATLAB, Octave, Docker, Microsoft Office, Photoshop, Altium Designer, Multisim, Proteus, SolidWorks, Onshape, LTSpice, ...
Operating Systems: Windows, Linux.
Microcontrollers: Raspberry Pi, Nvidia Jetson Nano, Arduino, STM32, MSP430, 80C51.
Musical Instrument: Piano.

Membership

IEEE Student Member 2022 – 2023
IEEE Signal Processing Society (SPS) Member 2023 – Present
IEEE Member 2024 – Present

Language

Mandarin Chinese (native), English (fluent).