

# Yunan Wu

Ph.D. Candidate  
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## Summary

Motivated Machine Learning track Ph.D. with 6+ years of experience in crafting cutting-edge AI solutions for product applications. Proficient in project design, algorithm development and testing using C++, and deploying neural networks using Tensorflow, PyTorch and JAX. Adept at cross-disciplinary collaboration and leadership, as demonstrated by 20+ publications, 12+ conference presentations, and a granted patent spanning medical healthcare, video editing and advertising domains.

## Interests

Medical Signal and Imaging Processing (CT, X-Ray, MRI, Pathology)  
Artificial Intelligence in Healthcare (Computer Aided Diagnosis/Prognosis, Precision Medicine)  
Data Science (Stock, Economy, Astrophysics)  
Machine Learning and Deep Learning (Un/Semi/Weakly Supervised Learning, Segmentations/Detection/Classification, Interpretation/Visualization)  
Human Computer Interaction (Camera, Virtual Reality, Self-driving Car)

## Education

**Ph.D. in Electrical Computer Engineering** 2020 - 2024 (Expected)

*Northwestern University, McCormick School of Engineering, Evanston, IL, USA*

Advisor: Aggelos K. Katsaggelos, Ph.D.

Research Topics: Image/Video Processing, Diffusions, Model Optimization, Computer Vision, Multi-modal

**M.S. in Biomedical Engineering** 2018 - 2020

*Northwestern University, McCormick School of Engineering, Evanston, IL, USA*

Advisor: Aggelos K. Katsaggelos, Ph.D. and Todd B Parrish, Ph.D.

Thesis: Geometric Deep Learning in Prediction of Fluid Intelligence

Research Topics: Graph CNNs, Large Language Models, Generative Models, Data Mining, Reinforced Learning

**B.A. in Electrical Engineering** 2014 - 2018

*Southern Medical University, Guangzhou, Guangdong, China*

Advisor: Feng Yang, Ph.D.

Thesis: Deep Convolutional Neural Networks in ECG Anomaly Detection

Relevant Courses: Digital Image Processing, Data Structure, Distributed Computing, Probability and Statistics

## Internship

HCI Software Technician

2022.06 - 2022.09

*The Roux Institute, Portland, ME, USA*

Advisor: Clifton Forlines, Ph.D.

Developed a cheaper and easier-to-use technology that can compete with expensive devices by providing researchers with physiological signals from sensors to measure users' cognitive and emotional workload in real-time as they are engaged in a task. Details included:

- Collected biometric measurements from Emotubit and Empatica E4 along with established EEG measurements from Emotiv.
- Built Machine Learning models to map physiological signals to cognitive and emotional scores of excitement, focus, engagement and stress.
- A conference paper was accepted for PerCom 2023.

### **AI Medical Imaging Research Assistant**

2019.11.11 - 2020.05.2

*Rush University Medical Center, Chicago, IL, USA*

Advisor: Jie Deng, Ph.D. and Mark Supanich, Ph.D.

Developed a deep learning-based workflow to assist radiologists in diagnosing diseases quickly and accurately, thereby advancing the development of artificial intelligence imaging healthcare. Details included:

- Knee injury, developed convolutional neural networks to classify anterior cruciate ligament (ACL) tear.
- Breast tumor, designed a computer aided system with evidence-based confidence level analyses to detect malignant breast tumors.
- Liver tumor, developed a deep learning model to differentiate levels of malignant liver tumors.

## **Research Experience**

### **AI in Astrophysics - Gravitational Wave Detection Pipeline Developer**

*Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA)*

2021.09 - Present

Gravity Spy is an innovative citizen-science project to use Machine Learning to help scientists find gravitational waves. This project is to build our understanding of how to enable non-expert volunteers in a citizen-science project to contribute to analyses of large volumes of data by searching for potentially causal relations. It contributes to the LIGO project by supporting the critical work of detector characterization and improvement, thus indirectly advancing gravitational wave research. [\[Read more here.\]](#)

- Accomplished a 4% increase in glitch classification (anomaly detection) performance in daily LIGO data in the ongoing O4 run by developing a Transformer-based ML classifier with multi-modal fusion strategies for multi-time window input.
- Implemented the detection pipeline on the Zooniverse platform using Django, drawing in over 30,000 citizen science volunteers who contributed to more than 7 million glitch classifications through web-based participation.

### **AI in Healthcare - AI Algorithm Designer for Medical Imaging and Neurological Studies**

*Feinberg School of Medicine, Northwestern University*

2018.12 - Present

Use artificial intelligence to implement efficient computer aided diagnosis systems, including CT hemorrhage detection, MRI brain tumor segmentation, brain cognitive intelligence prediction, breast tumor detection, liver tumor detection, COVID-19 positive prediction, COVID-19 death prognosis, etc. [Read more here.]

- Developed Graph Neural Networks to predict cognitive intelligence using MRI-based anatomic shape representations in children and adults on large open source ABCD and HCP data, achieving top rank in the ABCD-NP-Challenge 2019.
- Designed a weakly-supervised Bi-LSTM network for hemorrhage detection, reducing false-positive interruptions in radiologists' workflows with 5x faster diagnostic speed and achieving intellectual property recognition with a granted patent.

## AI in Art - Pigment Identification and Analysis in Artworks

*Art Institute of Chicago*

2020.10 - 2022.05

Implement automatic pigment identification strategies to directly tackle the complex structure of real paintings, e.g. pigment mixtures and layered pigments, based on non-invasive XRF imaging, in particular targeting the paintings' complex layered structure to the XRF response. [Read more here.]

- Achieved non-invasive pigment identification in artworks measured by the application of PyMCA for X-ray fluorescence (XRF) spectroscopy to analysis the complexity of multiple layers on real paintings in 19th century.
- Pioneered the application of Transfer Learning to 1D XRF spectra data for pigment classification, resulting in a remarkable 27% improvement in identification performance.

## AI in Human Computer Interaction

Snappy bird AI game based on reinforcement learning

04/2019 - 07/2019

Real-time photo background removal online app

12/2018 - 03/2019

## Publication

**Refereed Journal Articles - [1][2][3][4][5][6][7][8][9][10][11][12][13]**

**Refereed Conference Articles - [14] [15][16][17][18][19][20][21][22]**

## References

- [1] M. Zevin, C. B. Jackson, Z. Doctor, **Wu, Yunan**, C. Østerlund, L. C. Johnson, C. P. L. Berry, K. Crowston, S. B. Coughlin, V. Kalogera, S. Banagiri, D. Davis, J. Glanzer, R. Hao, A. K. Katsaggelos, O. Patane, J. Sanchez, J. Smith, S. Soni, L. Trouille, M. Walker, I. Aerith, W. Domainko, V.-G. Baranowski, G. Niklasch, B. Téglás, Gravity spy: Lessons learned and a path forward (2023). *arXiv*: 2308.15530.
- [2] **Wu, Yunan**, B. M. Rocha, E. Kaimakamis, G.-A. Cheimariotis, G. Petmezas, E. Chatzis, V. Kilintzis, L. Stefanopoulos, D. Pessoa, A. Marques, P. Carvalho, R. P. Paiva, S. Kotoulas, M. Bitzani, A. K. Katsaggelos, N. Maglaveras, A deep learning method for predicting the covid-19 icu patient outcome fusing x-rays, respiratory sounds, and icu parameters, *Expert Systems with Applications* (2023) 121089.
- [3] **Wu, Yunan**, A. Dravid, R. M. Wehbe, A. K. Katsaggelos, Deepcovid-fuse: A multi-modality deep learning model fusing chest x-rays and clinical variables to predict covid-19 risk levels, *Bioengineering* 10 (5) (2023) 556.
- [4] **Wu, Yunan**, J. Liu, G. M. White, J. Deng, Image-based motion artifact reduction on liver dynamic contrast enhanced mri, *Physica Medica* 105 (2023) 102509.

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- [6] M. López-Pérez, A. Schmidt, **Wu, Yunan**, R. Molina, A. K. Katsaggelos, Deep gaussian processes for multiple instance learning: Application to ct intracranial hemorrhage detection, *Computer Methods and Programs in Biomedicine* 219 (2022) 106783.
- [7] **Wu, Yunan**, J. Wu, Y. Dou, N. Rubert, Y. Wang, J. Deng, A deep learning fusion model with evidence-based confidence level analysis for differentiation of malignant and benign breast tumors using dynamic contrast enhanced mri, *Biomedical Signal Processing and Control* 72 (2022) 103319.
- [8] B. Xu, **Wu, Yunan**, P. Hao, M. Vermeulen, A. McGeachy, K. Smith, G. Rayner, K. Eremin, G. Verri, F. Willomitzer, et al., Can deep learning assist automatic identification of layered pigments from xrf data?, *Journal of Analytical Atomic Spectrometry* (2022).
- [9] **Wu, Yunan**, M. P. Supanich, D. Jie, Ensembled deep neural network for intracranial hemorrhage detection and subtype classification on noncontrast ct images, *Journal of Artificial Intelligence for Medical Sciences* 2 (1-2) (2021) 12–20.
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- [11] **Wu, Yunan**, G. M. White, T. Cornelius, I. Gowdar, M. H. Ansari, M. P. Supanich, J. Deng, Deep learning li-rads grading system based on contrast enhanced multiphase mri for differentiation between lr-3 and lr-4/lr-5 liver tumors, *Annals of Translational Medicine* 8 (11) (2020) 701.
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- [22] X. Zha, F. Yang, **Wu, Yunan**, Y. Liu, S. Yuan, Ecg classification based on transfer learning and deep convolution neural network, Chin. J. Med. Phys 35 (2018) 1307–1312.

## Presentations

- 26th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), Vancouver, Canada, Oct 8-12** Poster  
Smooth Attention for Deep Multiple Instance Learning: Application to CT Intracranial Hemorrhage Detection
- Astro Imaging Workshop 2023, Evanston, IL, USA, Jul 31** Invited Talk  
Gravity Spy: Coupling Astrophysics, Machine Learning and Citizen Science for Gravitational Wave Feature Discovery
- The 21st International Conference on Pervasive Computing and Communications (PerCom 2023), Atlanta, USA, Mar 13-17** Oral  
Cognitive and Emotional Monitoring with Inexpensive Wrist-Worn Consumer-Grade Wearables
- American Society of Neuroradiology (ASNR) 2022, New York City, USA** Oral  
Identification of Intracranial Hemorrhage and Its Subtypes on Head CT Scans Using Transfer Learning and Weakly Supervised Networks
- The 19th IEEE International Symposium on Biomedical Imaging (ISBI) 2022, Kolkata, India.** Poster  
Reconstruction of Resting State fMRI Using LSTM Variational Auto-encoder On Subcortical Surface to Detect Epilepsy.
- The 24th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI), 2021, Strasbourg, France.** Poster  
Combining Attention-Based Multiple Instance Learning and Gaussian Processes for CT Hemorrhage Detection.
- The 17th International Symposium on Medical Information Processing and Analysis (SIPAIM) Virtual.** Oral  
Motion artifact reduction in abdominal MRIs using generative adversarial networks with perceptual similarity loss.
- The 28th European Signal Processing Conference (EUSIPCO), 2020, Amsterdam, Netherlands.** Oral  
Go-selfies: A Fast Selfies Background Removal Method Using ResU-Net Deep Learning.
- American Society of Neuroradiology (ASNR) 2021, Chicago, USA.** Oral  
Automatic Identification of Emergent Findings on Head CT Scan using Deep Learning.
- Radiological Society of North America (RSNA) 2020, Virtual.** Oral  
Geometric Deep Learning on Brain Morphology to Predict Composite Score of Fluid Cognition.
- The 17th IEEE International Symposium on Biomedical Imaging (ISBI) 2020, Iowa City, USA.** Poster  
Deep Learning Method for Intracranial Hemorrhage Detection and Subtype Differentiation.
- American Roentgen Ray Society (ARRS) 2020, Chicago, USA.** Poster  
Fast Breast Cancer MRI Screening Using a Deep Learning Model Combined with Analytical Imaging Features.
- The 40th International Conference of the IEEE in Engineering Medicine and Biology Society (EMBS) 2018, Honolulu, USA.** Poster  
A Comparison of 1-D and 2-D Deep Convolutional Neural Networks in ECG Classification.

## Distinction

Terminal Year Doctoral Fellowship, the Richter Memorial Fund, McCormick School of Engineering, 2023  
Excellent Graduate Student, Department of Biomedical Engineering, Northwestern University, 2020  
Excellent Undergraduate Student, Southern Medical University, 2018  
National Scholarship, Ministry of Education of the People's Republic of China, 2016  
The First Prize Scholarship, Southern Medical University, 2015,2016,2017  
Outstanding Student, Southern Medical University, 2015,2016,2017

## Language

Native Chinese (Mandarin & Sichuan Dialect)  
Professional English

## Technical Skills

### ML Libraries

TensorFlow, Keras, PyTorch, Scikit-learn, Hugging Face Transformers, NumPy, SciPy, Pandas, Matplotlib, Seaborn

### Languages

Python, R, Java, LATEX, C, C++, HTML, CSS, MATLAB, Bash

### Databases

SQL, Oracle, MySQL

### Other

Git, GitHub, Linux, Windows, Adobe Photoshop, Adobe Premiere

**November 7, 2023**