Yunan Wu

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McCormick School of Engineering
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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.

Specialization in Signals and Systems

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

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

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 Emotibit 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

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.]`

AI in Healthcare

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.]`

AI in Art

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.]`

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]

Refereed Conference Articles - [13] [14][15][16][17][18][19][20][21]

References

[1] Y. Wu, 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.

[2] Y. Wu, 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.

[3] Y. Wu, J. Liu, G. M. White, J. Deng, Image-based motion artifact reduction on liver dynamic contrast enhanced mri, Physica Medica 105 (2023) 102509.

[4] Y. Wu, P. Besson, E. A. Azcona, S. K. Bandt, T. B. Parrish, H. C. Breiter, A. K. Katsaggelos, A multicohort geometric deep learning study of age dependent cortical and subcortical morphologic interactions for fluid intelligence prediction, Scientific reports 12 (1) (2022) 1–16.

[5] M. López-Pérez, A. Schmidt, Y. Wu, 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.

[6] Y. Wu, 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.

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[10] Y. Wu, 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.

[11] S. Bahaadini, Y. Wu, S. Coughlin, M. Zevin, A. K. Katsaggelos, Discriminative dimensionality reduction using deep neural networks for clustering of ligo data, arXiv preprint arXiv:2205.13672 (2022).

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[13] Y. Wu, R. Valdez, C. Forlines, Cognitive and emotional monitoring with inexpensive wrist-worn consumer-grade wearables, in: 2023 IEEE International Conference on Pervasive Computing and Communications Workshops and other Affiliated Events (PerCom Workshops), IEEE, 2023, pp. 665–670.

[14] A. Dravid, F. Schiffers, Y. Wu, O. Cossairt, A. K. Katsaggelos, Investigating the potential of auxiliary-classifier gans for image classification in low data regimes, in: ICASSP 2022-2022 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), IEEE, 2022, pp. 3318–3322.

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[21] X. Zha, F. Yang, Y. Wu, Y. Liu, S. Yuan, Ecg classification based on transfer learning and deep convolution neural network, Chin. J. Med. Phys 35 (2018) 1307–1312.

Presentations

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

August 24, 2023