

SHAOTONG ZHU

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EDUCATION

PhD, Electrical and Computer Engineering

2020 - 2025 (*expected*)

Northeastern University, Boston, MA, USA

Augmented Cognition Lab (ACLab), Advisor: Prof. Sarah Ostadabbas

Master of Science, Electrical and Computer Engineering

2018 - 2020

George Washington University, Washington, DC

Bachelor of Science, Electrical and Computer Engineering

2013 - 2017

Harbin Institute of Technology, Harbin, China

TECHNICAL & THEORETICAL SKILLS

- Computer Vision and Signal/Image Processing
- Machine Learning and Artificial Intelligence
- Brain-Computer Interfaces

COMPUTER SKILLS

Programming: Python, MATLAB, C#, C/C++, Java, HTML, JavaScript

Software: PyCharm, Matlab, IntelliJ IDEA, Visual Studio, MySQL, Git, Android Studio

SELECTED COURSES

- Machine Learning
- Digital Signal Processing
- Data Mining Techniques
- Linear System Analysis
- Applied Probability & Stochastic Process
- Advanced Computer Vision

RESEARCH PROJECTS

Developing a Novel NeRF Model Expanding the Observation Viewpoint of Dynamic Scenes beyond Constrained Camera Motions

Sep. 2023 - Mar. 2024

- Identified the deficiencies and inadequacies in the rendering results of state-of-the-art monocular dynamic NeRF at largely deviated perspectives.
- Proposed ExpanDyNeRF, an innovative method capable of producing plausible novel view synthesis at largely deviated perspective.
- Incorporated specialized loss functions to enhance NeRF model precision by aligning renderings from novel perspectives in a latent feature space.

- Created the pioneering Synthetic Dynamic Multiviews (SynDM) dataset, the first GTAV-based dynamic multiview dataset that incorporates both camera movement and object motion simultaneously. Providing a comprehensive evaluation platform for expanded view generation. This dataset has the flexible camera motion of a monocular camera while providing corresponding side views for evaluation purposes.

Developing a Vision-based Hazard Detection Framework Enhancing Infant Safety in Cribs

Jul. 2023 - Jan. 2024

- Built an advanced framework integrating SOTA detection and segmentation techniques (e.g. YOLOV8, Detectron2, YOLACT) combined with an infant-specific pose estimation model, to filter out the hazardous objects in crib environments.
- Present CribHD, a novel dataset for hazardous object detection in crib environments, richly annotated with bounding boxes and segmentation masks, filling the existing data gap in crib infant safety research.

Developing a video-based end-to-end pipeline for non-nutritive sucking action recognition in young infants

Jan. 2023 - Jul. 2023

- Engineered an infant state preprocessing system, employing per-frame object detection on the infant's face and pacifier, followed by tracking and saliency-point-flow-based smoothing to precisely crop the region of interest for subsequent detection.
- Implemented a Convolutional Long Short-Term Memory (LSTM) network to analyze spatiotemporal optical flow data, classifying short clips pre-processed in earlier stages for Non-Nutritive Sucking (NNS) action recognition.

Implementing infant facial landmark detection via few-shots domain adaptation

Jan. 2022 - Jan. 2023

- Compiled a dataset of 200 wild infant images and 10 hours of sleeping recordings from 9 participants via a self-designed recording system. All data have meticulous facial landmarks and attribute annotations.
- Conducted a comprehensive qualitative analysis of facial landmarking algorithms (e.g., 3FabRec, HRNet, FAN) on InfAnFace and adult datasets like 300-W. This study quantifies the domain gap, setting benchmarks for future algorithms to surpass.

Developing an AI-Human Co-Labeling Toolbox (AH-CoLT)

Feb. 2022 - May. 2022

- Implementing an AI-guided manual landmark annotation pipeline to efficiently generate ground truth for unlabeled images/videos.
- Employing state-of-the-art pose estimation technologies (HRNet, FAN) to assist the toolbox for producing initial facial landmarks labels.

Developing a dynamical graph-based feature extraction approach to enhance mental task classification in brain-computer interface

Sep. 2021 - Sep. 2022

- Developed a unique approach to graph generation by incorporating temporal dynamics from amplitude and phase instantaneous signals.
- Introduced a novel combination of graph measurements and eigenvalue features derived from EEG data, enhancing the robustness of mental task classification in BCI systems.
- Implemented a fold-wise parameter optimization scheme to adaptively select hyperparameters for each training process, addressing EEG nonstationary and subject-specific neural variability.

- Used Freesurfer software to process the MRI data to extract the partial volume correction values as features selected by LASSO afterward.
- Trained SVM, KNN, and Naive Bayes classifiers to classify the seizure focus lateralization and localize the seizure focus as temporal or extra-temporal.

PUBLICATION

Journals

- **Zhu S**, Wan M, Manne S.K.R., Zimmerman E, Ostadabbas S. Subtle Signals: Video-based Detection of Infant Non-nutritive Sucking as a Neurodevelopmental Cue. *Computer Vision and Image Understanding (under review)*, 2023.
- **Zhu S**, Hosni S, Huang X, Wan M, Borgheai S, McLinden J, Shahriari Y, Ostadabbas S. A Dynamical Graph-based Feature Extraction Approach to Enhance Mental Task Classification in Brain-Computer Interfaces. *Computers in Biology and Medicine*, 2023.
- Duncan L, **Zhu S**, Pergolotti M, Giri S, Salsabili H, Faezipour M, Ostadabbas S, Mirbozorgi S.A. A Graph-Based Nonlinear Dynamic Characterization of Motor Imagery Toward an Enhanced Hybrid BCI. *Neuroinformatics*, 2023.
- Hosni S.M, Borgheai S.B. McLinden J, **Zhu S**, Huang X, Ostadabbas S, Shahriari Y. A Graph-Based Nonlinear Dynamic Characterization of Motor Imagery Toward an Enhanced Hybrid BCI. *Neuroinformatics*, 2022.
- Farnoosh A, Wang Z, **Zhu S**, Ostadabbas S. A bayesian dynamical approach for human action recognition. *Sensors*, 2021.

Conferences/Workshops

- **Zhu S**, Jiang L, Luo Y, Ostadabbas S. ExpanDyNeRF: Expanding the Observation Viewpoint of Dynamic Scenes beyond Constrained Camera Motions. *The 18th European Conference on Computer Vision (ECCV) (under review)*, 2024
- **Zhu S**, Mathew A, Hatamimajoumerd E, Wan M, Ostadabbas S. CribNet: Enhancing Infant Safety in Cribs through Vision-based Hazard Detection. *IEEE International Conference on Automatic Face and Gesture Recognition (FG)*, 2024
- **Zhu S**, Wan M, Hatamimajoumerd E, Jain K, Zlota S, Kamath C.V, Rowan C.B, Grace E.C, Goodwin M.S, Hayes M.J, Schwartz-Mette R.A. A Video-based End-to-end Pipeline for Non-nutritive Sucking Action Recognition and Segmentation in Young Infants. *26th International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2023.
- Manne, S.K.R, **Zhu S**, Ostadabbas S, Wan M. Automatic Infant Respiration Estimation from Video: A Deep Flow-Based Algorithm and a Novel Public Benchmark. *International Workshop on Preterm, Perinatal and Paediatric Image Analysis*, 2023.
- Wan M, **Zhu S**, Luan L, Gulati P, Huang X, Schwartz-Mette R, Hayes M, Zimmerman E, Ostadabbas S. InfAnFace: Bridging The Infant–adult Domain Gap in Facial Landmark Estimation in The Wild. *International Conference on Pattern Recognition (ICPR)*, 2022. **(Best Paper Award)**
- Luan L, Huang X, **Zhu S**, Jiang L, Chen W, Ostadabbas S. An Exploratory Examination of Online Learning During and After the Pandemic: Learning Goal Congruence in Lecturing and Research Activities. *Rethinking Hybrid and Remote Work in Higher Education: Global Perspectives, Policies, and Practices after COVID-19*, 2022. Cham: Springer International Publishing.

- **Zhu S**, Hosni S, Huang X, Borgheai S, McLinden J, Shahriari Y, Ostadabbas S. A Graph-Based Feature Extraction Algorithm Towards A Robust Data Fusion Framework for Brain-Computer Interfaces. *International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, 2021.
- Hosni S.M.I, Borgheai S.B, McLinden J, **Zhu S**, Ostadabbas S, Shahriari Y. A Graph-Based Dynamical Characterization and Inference in Hybrid BCIs. *55th Asilomar Conference on Signals, Systems, and Computers*, 2021.
- Hosni S.M.I, Borgheai S.B, McLinden J, **Zhu S**, Huang X, Ostadabbas S, Shahriari Y. Graph-based Recurrence Quantification Analysis of EEG Spectral Dynamics for Motor Imagery-based BCIs *43rd Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, 2021.

Patents

- Ostadabbas S, **Zhu S**, Wan M, Hatamimajoumerd E, Zimmerman E. Non-nutritive Sucking Action Recognition and Segmentation in Young Infants. *Invention Disclosure, INV-24006, Oct. 2023*.

TEACHING & MENTORING EXPERIENCE

Teaching Assistant in Healthcare Technologies

Spring 2022, Spring 2023

- Organized students' experiments of bio-signal collections and corresponding signal processing.
- Delivered lectures in bio-signal.
- Running lab sections of the class.

Teaching Assistant in Special Topics in Artificial Intelligence

- Instructed students to build up neural networks for action classification tasks.
- Organized students' individual presentation and group discussions.