

Yunfei Luo

Ph.D. Student in the Halicioğlu Data Science Institute at the University of California San Diego

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Research Interests

General Applied AI/ML, Digital Health, Signal Processing, Multimodal Learning, Multitask Learning, Foundation Model, Reinforcement Learning

Specific Yunfei's research focuses on applied machine learning in the field of digital health, signal processing, multimodal modeling, and multitask learning. He aims to develop a robust and well-generalized methodology that enhances intelligent monitoring, supports timely interventions, and is deployable on edge devices.

Applications Mental Health, Substance Usage, Kidney Dialysis, Digital Health Monitoring

Education

09.2023 - present GPA : 3.60/4.0	Ph.D. Student in the Halicioğlu Data Science Institute University of California, San Diego, CA <ul style="list-style-type: none">➤ Advisor : 📧 Tauhidur Rahman➤ Research : Applied Machine Learning, Multimodal Learning, Multitask Learning, Digital Health
09.2021 - 05.2023 GPA : 3.92/4.0	Master of Science in Computer Science University of Massachusetts Amherst, Amherst, MA <ul style="list-style-type: none">➤ Advisor : Ina Fiterau Brostean 📧 Information Fusion Lab➤ Courses Taken : Advanced Machine Learning, Neural Networks, Probabilistic Graphical Models, Reinforcement Learning, Advanced Natural Language Processing, Advanced IoT
09.2017 - 05.2021 GPA : 3.84/4.0	Bachelor of Science in Computer Science Bachelor of Science in Mathematics University of Massachusetts Amherst, Amherst, MA <ul style="list-style-type: none">➤ Machine Learning and Computing Specializations

Fellowships, Scholarships, Awards, and Honors

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| 2023 - 2024 | • Institute Fellowship Halicioğlu Data Science Institute, UCSD |
| 2021 - 2023 | • Bay State Fellowship Full Tuition Scholarship |
| 2017 - 2021 | • Outstanding Undergrad Course Assistant Award, College of Information & Computer Sciences, UMass
• Chancellor's Award, UMass Amherst |

Teaching Experience

Fall 2021 to Spring 2023	Graduate Teaching Assistant, CICS, UMass Amherst <ul style="list-style-type: none">➤ CS 311 Introduction to Algorithm in Fall 2021 and Spring 2023➤ CS 590OP Applied Numerical Optimization, and CS 108 Foundation of Data Science in Fall 2022➤ CS 220 Programming Methodology in Spring 2022➤ Held office hours, led weekly discussion sessions, graded course works, answered questions on course forum, attended weekly TA meeting for discussing the progress/improvements of the course <div>Javascript Algorithms Numerical Optimization Data Science Teaching</div>
Spring 2020 to Spring 2021	Undergraduate Course Assistant, CICS, UMass Amherst <ul style="list-style-type: none">➤ CS 240 Reasoning under Uncertainty in Spring 2021, CS 311 Introduction to Algorithms in Fall 2020, CS 220 Programming Methodology in Spring 2020➤ Helped with weekly discussion session, graded course works, and answered questions on Piazza <div>Javascript Algorithms Probability Teaching</div>

Professional Experience

03.2023 to 03.2024	Machine Learning Scientist, Co-Founder , ONTO, Startup <ul style="list-style-type: none">➤ Designed and developed a comprehensive framework for creating customizable virtual AI characters, incorporating key architectural components such as memory management, contextual awareness, prompt optimization, tone/style transformation, and robust jail-break defense mechanisms.➤ Researched and implemented a Retrieval-Augmented Generation (RAG) framework to enhance the realism and fidelity of virtual AI characters.➤ Conducted rigorous testing to evaluate character robustness against jail-break attacks, identifying vulnerabilities and iteratively improving the framework's defense strategies.➤ Collaborated with core team members through regular meetings to align on progress, address challenges, and strategize future directions for the company. <div>Natural Language ProcessingLarge Language ModelVirtual CharacterInformation RetrievalSearch EngineMachine LearningResearch and Development</div>
Summer 2022 to 06.2023	Machine Learning Engineering Intern , Center for Data Science, UMass Amherst <ul style="list-style-type: none">➤ Developed platform for Building Segmentation and Damage Assessment based on Satellite Imagery➤ Integrated the Machine Learning pipeline along with User Interface for Imagery Fetching and Labelling➤ Conducted Research and Experiments with various Finetuning setting and Machine Learning techniques to support selections of final-deployed hyper-parameters and models➤ Delivered a presentation of the project to the Red Cross (funder and client), resulting in exceptional satisfaction and securing an additional year of funding for the initiative➤ Worked as Research Assistant after internship <div>Computer VisionMachine LearningDisaster ResponseSoftware DevelopmentFull-Stack Development</div>
Summer 2020 to 06.2021	Data Engineering Intern , Institute for Applied Life Sciences, UMass Amherst <ul style="list-style-type: none">➤ Built pipelines for fMRI data preprocessing and statistical analysis➤ Conducted Research and Experiments with Machine Learning models for Stroke Detection : Autoencoders, CNNs, and GANs➤ Worked as Undergraduate Research Assistant after internship <div>Machine LearningfMRIData Preparation</div>

Publications

2025 Under Revision	Toward Foundation Model for Multivariate Wearable Sensing of Physiological Signals, -, Conference Yunfei Luo, Yuliang Chen, Asif Salekin, Tauhidur Rahman <ul style="list-style-type: none">➤ Developed NormWear, a foundational model for wearable sensing physiological signals, achieving state-of-the-art performance across 18 healthcare applications spanning 11 public datasets by leveraging generalizable and informative representations.➤ Proposed a novel representation-alignment framework that aligns physiological and text embeddings, enabling zero-shot inference for previously unseen health applications in wearable sensing.➤ Conducted comprehensive nonlinear dynamic analysis of intermediate model representations, offering quantifiable insights into internal processes and fostering trust in healthcare-related inferences. <div>Signal ProcessingFoundation ModelNatural Language ProcessingMachine LearningNeural NetworksDigital Health</div>
2025 Under Revision	Dynamical States Underpinning Opioid Misuse : Deep Learning of Entropy in Addictive Behavior, Nature Mental Health, Journal Yunfei Luo, Iman Deznabi, Bhanu Gullapalli, Mark Tuomenoksa, Eric Garland, Madalina Fiterau, Tauhidur Rahman <ul style="list-style-type: none">➤ Leveraging transformer based time series model and dynamic branching to predict the stress, pain, and craving of Opioid users based on heart beat data collected from wearable sensor.➤ Leveraging topological features from trajectory of inferential affective states across days and natural language processing technique to predict the risk of having opioid misuse behavior. <div>Signal ProcessingNatural Language ProcessingHeart Rate VariabilityAffective StatesOpioidClinical TreatmentMachine LearningMultimodal FusionDigital Health</div>

2025 Under Review	<p>Real Time Intradialytic Hypotension Forecasting Leveraging Modern Deep Learning Method with Fusion of Physiological Data and Electronic Health Record, npj Digital Medicine, Journal</p> <p>Yunfei Luo, Siwei Zhao, Subhasis Dasgupta, Rakesh Malhotra, Tauhidur Rahman</p> <ul style="list-style-type: none"> > Novel multimodal modeling on physiological data, dialysis machine parameter, and electronic health records. Aiming to accurately forecasting hypotension 1 hour ahead in dialysis patient, and to provide comprehensive insights to nurse for intervention recommendation. <p>Signal Processing Nephrology Clinical Treatment Machine Learning Multimodal Fusion Digital Health</p>
2025 In Prepare	<p>Automated Dysphagia Screening Using Noninvasive Neck Acoustic Sensing, -, Conference</p> <p>Jade Chng, Rong Xing (Co-1st Author), Yunfei Luo (Co-1st Author), Andrew Yousef, Kristen Linnemeyer-Risser, Philip A Weissbrod, Tauhidur Rahman</p> <ul style="list-style-type: none"> > We present a noninvasive, acoustic-based machine learning framework that detects dysphagia with high accuracy, offering a scalable tool for monitoring pharyngeal health. <p>Signal Processing Acoustic Signal Data Collection Clinical Treatment Applied Machine Learning Digital Health</p>
2025 Published	<p>Sounding out Dysphagia : Using a Digital Stethoscope to Assess Audiometric Differences in Swallowing, The Laryngoscope, Journal</p> <p>Andrew Yousef, Sacha Moufarrej, David Zeng, Bao Luu, Rong Xing, James S. Crook, Yunfei Luo, Kristen Linnemeyer-Risser, Tauhidur Rahman, Philip A Weissbrod</p> <ul style="list-style-type: none"> > We demonstrated that digital stethoscope-based audiometric analysis can objectively distinguish normal and dysfunctional swallows during FEES. > We identified key acoustic biomarkers, including duration, amplitude, and frequency, that correlate with swallow dysfunction severity, enhancing clinical evaluation accuracy. <p>Signal Processing Digital Health Dysphagia Acoustics Non-invasive</p>
2025 Published	<p>Opioid Misuse Detection from Cognitive and Physiological Data with Temporal Fusion Deep Learning, Drug and Alcohol Dependence, Journal</p> <p>Bhanu Gullapalli, Yunfei Luo, Tauhidur Rahman, Eric L. Garland</p> <ul style="list-style-type: none"> > We used deep learning to detect opioid misuse from cognitive and physiological data. > Behavioral responses were stronger predictors of misuse than physiological signals. > Our model accurately detected opioid misuse. <p>Signal Processing Machine Learning Digital Health Addiction Psychophysiology Chronic Pain</p>
2024 Published	<p>Start Simple : Progressive Difficulty Multitask Learning, NAACL 2024 SRW Proceedings, Conference</p> <p>Yunfei Luo, Yuyang Liu, Rukai Cai, Tauhidur Rahman</p> <ul style="list-style-type: none"> > Introducing sub-tasks with progressive difficulties to improve the performance on main task. Inspired by how people learn. Experimented on text classification, sentiment analysis, and argument mining <p>Natural Language Processing Multi-task Learning Machine Learning Neural Networks</p>
2024 Published	<p>Dynamic Clustering via Branched Deep Learning Enhances Personalization of Stress Prediction from Mobile Sensor Data, Nature Scientific Report, Journal</p> <p>Yunfei Luo, Iman Deznabi, Abhinav Shaw, Tauhidur Rahman, Madalina Fiterau Brostean</p> <ul style="list-style-type: none"> > Proposed a novel approach to modeling the Multimodal data, got results that outperform SOTA > Modeled personalized and populational characteristics with Multitask Learning and Dynamic Clustering Method respectively > Evaluated the performance under cold-start setting, to support the robustness of our method <p>Multi-modal Fusion Methods Mental Health Machine Learning Neural Networks Time Series</p>
2023 Published	<p>Agent Performing Autonomous Stock Trading under Good and Bad Situations, AI for Agent-Based Modelling (AI4ABM) in International Conference on Learning Representations (ICLR), Workshop</p> <p>Yunfei Luo, Zhangqi Duan</p> <ul style="list-style-type: none"> > Researched and experimented with different reinforcement learning algorithms to train agents to perform stock trading. The methods are evaluated under scenarios with stable and non-stable market <p>Reinforcement Learning Machine Learning Neural Networks</p>

Patents

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- 2025 US2025/016369 - System and Method for Personalized Closed-Loop Opioid Addiction Management with Mobile and Wearable Sensing of Administrations, Affective States, and Misuse Risk Scores (**Full US Utility patent application filed on Feb 18, 2025**)

Talks

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- 2025 • “Foundation Model for Multivariate Wearable Sensing of Physiological Signals”, **Google Research Journal Club**, May 27th
• “Health AI, foundation models, agents, and related research”, **Dexcom Journal Club**, April 18th
- 2023 • “Integrating Machine Learning Models to Your Applications”, **Workshop at SackHacks V**, November

Professional Services

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- Reviewer** • Workshop on Foundation Models for Structured Data, International Conference on Machine Learning (ICML FMSD), 2025
• Conference on Computational Natural Language Learning (CoNLL), 2024, 2025
• PACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT), 2024

Professional Certifications

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- 2022 IBM Artificial Intelligence Engineering Professional Certificate
2022 Neuroscience and Neuroimaging Specialization Certificate
2020 TensorFlow Developer Professional Certificate

References

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