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RESEARCH INTERESTS	Multimodal Learning, Computer Vision, Event Camera-Based Vision (Dynamic Vision Sensor), Human Pose Estimation, Hyperspectral Imaging, Smart Health.	
LAB INTRODUCTION	The Mobile Sensing and Ubiquitous Computing Laboratory (MOSAIC Lab) at UC San Diego focuses on developing scalable, energy-efficient sensor systems for health and behavioral modeling. We leverage diverse sensor modalities and platforms to tackle real-world problems through advanced networking and data analytics.	
EDUCATION	<p>Ph.D. in Halicioğlu Data Science Institute, University of California, San Diego San Diego, CA, USA Present</p> <ul style="list-style-type: none"> • GPA: 4.0/4.0 • Awarded the Halicioğlu Data Science Institute (HDSI) DataPlanet Fellowship. • Received the Qualcomm Gift Funding for the project “Neuromorphic High-Frequency 3D Dancing Pose Estimation in Dynamic Environment” • Mentored over 10 master’s students on research projects, demonstrating extensive collaboration and management skills. • Featured Courses: Advanced Data Mining, Probability & Statistics for Data Science • Advisor: Tauhidur Rahman <p>Ph.D. in Manning College of Information & Computer Sciences, University of Massachusetts Amherst Amherst, MA, USA August 2022</p> <ul style="list-style-type: none"> • GPA 3.84/4.0 • Transferred to UCSD due to a lab relocation. • Featured Courses: Machine Learning, Computer Vision, Advanced Natural Language Processing, Neural Networks, Advanced Algorithms, Computer Architecture • Advisor: Tauhidur Rahman <p>Huazhong University of Science and Technology (HUST) Wuhan, Hubei, China June 2019</p> <ul style="list-style-type: none"> • GPA 3.83/4.0 • Major: Electronic and Information Engineering. • Thesis: “Deep Reinforcement Learning-based Far-end Crosstalk Suppression in DDR5 RAM Design” • Featured Courses: Online Machine Learning, Digital Image Processing, Digital Signal Processing, Signal and Linear System; Embedded System Design, SOC Hardware/Software Codesign, Principals of Microcomputer, Fundamentals of Linux; Circuit Theory, Analog Electronic Technology, Digital Circuit and Logic Design; Linear Algebra, Calculus, Complex Analysis and Integral Transformation; Software Engineering and Project Management, Critical Thinking. • Awarded the title of “Outstanding Graduate”. • Interned at the Electromagnetic Compatibility Laboratory at Missouri University of Science and Technology, USA, from July to October 2018. • Engaged in short-term exchange studies at the University of Tokyo and Doshisha University, Japan, in July 2017. • Joined the top technology team at Huazhong University of Sci & Tech, “Dian Team”, in 2017. 	

- Selected to join the “Enterprise-level Project-Based Information Major Education Experimental Class” (Seed Class) in 2017.
- Awarded the title of “Outstanding Individual in Overseas Exchange” by the School of Optical and Electronic Information in October 2017.
- Awarded the first prize in the “Telling the Story of HUST” game category in 2018 with the creation “Vibrant Life at HUST”.

PROFESSIONAL SKILLS

- **Artificial Intelligence:** Deep Learning, Computer Vision, Natural Language Processing (NLP), Multimodal Fusion, 3D Human Pose Estimation (HPE) and Tracking, Super-Resolution (SR), Dynamic Vision Sensor/Event Camera (DVS) Vision, Hyperspectral Image Processing (HSI), Satellite Image Processing, Graph Neural Networks (GNN), Deep Reinforcement Learning (DRL), AI Chatbots
- **Deep Learning Frameworks:** Pytorch, TensorFlow, Pytorch Lightning
- **Programming Languages:** Python, Matlab, C, C++, Java, SQL
- **Application Development:** Android, iOS, Game Development
- **Server and Cluster:** Linux, Bash, Kubernetes, Slurm Cluster, Docker, Git
- **Hardware Platform Experience:** Arduino, Raspberry Pi, Jetson Nano
- **Other:** Web Scraping, Simulation, Blender, Dataset Collection, Human Behavior Analysis, ArcGIS, Teaching

LANGUAGE PROFICIENCY

- **Chinese:** Native speaker.
- **English:** Scored 103 on the TOEFL in May 2018.
- **Japanese:** Passed the Japanese Language Proficiency Test (JLPT) N1 level in August 2016.
- **French:** Obtained the French DELF A2 certificate in June 2019.
- **Russian:** Achieved a high score of 98/100 in the Russian (I) course, earning 4 credits at Huazhong University of Science and Technology in January 2017.

PROFESSIONAL EXPERIENCE

Data Science Intern

Intel Cooperation, San Diego, CA, USA

December 2022 to Present

- Led a collaborative project with Intel Corporation, focusing on developing a model for predicting gaming duration of the coming game session.
- Preprocessed over a **billion units** of game telemetry data from Intel Cooperation and innovatively incorporated **LLM** to assist in data cleansing and organization.
- Collected a game-centric dataset from IGDB to aid the model in better understanding the intrinsic characteristics of each game.
- Proposed and trained a novel heterogeneous graph neural network (GNN) model to extract embedding features of each user and each game for customized prediction.
- Technologies used include AWS, Redshift database, SQL, Pytorch, and Python-based web scraping.

Graduate Research Assistant

UC San Diego, San Diego, CA, USA

August 2022 to Present

- Collaborated with Dr. Tauhidur Rahman on studies related to Event Camera (or Dynamic Vision Sensor, DVS) imaging and game-related research, utilizing technologies such as Pytorch, Pytorch Lightning, and Kubernetes (K8S).
- Partnered with Dr. Haojian Jin to explore the taxonomy and analysis of folk models in Lootbox games. Responsibilities included designing questionnaires, conducting human studies, and performing interviews to gather insightful data.

Graduate Research Assistant

Umass Amherst, Amherst, MA, USA

September 2019 to August 2022

- Collaborated with Dr. Tauhidur Rahman, focusing on hyperspectral imaging, satellite

imaging, and DVS imaging, utilizing technologies such as Python, Pytorch, Java, Slurm cluster, and ArcGIS Pro.

- Partnered with Dr. Adam S Grabell on a data-driven project aimed at monitoring and predicting psychopathology in preschool children, employing Matlab and Python for various analytical tasks.

Customer Service AI Chatbot Development Team Leader

Hangzhou Beigou Technology Co., Ltd., China

October 2017 to May 2018

- Executed comprehensive data cleaning and labeling processes to ensure the accuracy and reliability of the dataset.
- Developed an innovative model, integrating TextCNN and LSTM, designed to support online learning, achieved comparable results to commercial-level competitors.
- Constructed a customer service chatbot from the ground up, which was subsequently deployed for commercial use, demonstrating practical applicability and functionality.

iOS Software Engineer

Shanghai Qi Yi Electronic Technology Co., Ltd. **September 2017 to November 2017**

- Successfully completed the development of an iOS app for a live-line tester for surge protectors, ensuring high performance and user-friendly interface.
- Aligned the iOS app with its Android counterpart, ensuring consistency and seamless user experience across platforms.
- Conducted comprehensive testing to identify and rectify bugs, improve functionality, and enhance overall app performance, contributing to a robust and reliable product.

RESEARCH
EXPERIENCE

Mobile Sensing and Ubiquitous Computing Lab, UMass Amherst & UCSD

Research Assistant, Advisor: Prof. Tauhidur Rahman

January 2020 to Present

- **Fusion and Generation of Event Cameras and Mainstream Modalities Based on Embedding Matching and LLM**
 - Event cameras represent an emerging visual modality; their output resembles a point cloud in xyt space, and thus far, there has been no large-scale model capable of linking event streams with other modalities such as text, RGB, and audio.
 - We designed a novel reversible neural network-based converter from event voxels to dense embeddings, allowing event encoders to be trained using existing pre-trained ViT.
 - By aligning the event embeddings with the corresponding RGB frame embeddings in ImageBind, we can incorporate event streams as a new modality into mainstream modal embeddings, enabling mutual conversion or overlay.
 - This is an ongoing project where we are currently training a diffusion model based on events, combined with LLM, to achieve the objective of generating event streams from text.
- **Video to Continuous Event Streams**
 - Introduced a specialized suite of loss functions specifically tailored for the video-to-event voxel task, achieving state-of-the-art (SOTA) performance.
 - Developed a novel, statistics-based, local dynamics-aware timestamp inference algorithm, enabling smooth transitions from event voxels to event streams and surpassing existing baseline methods.
 - Established the inaugural set of metrics rooted in DVS event characteristics, facilitating robust quantitative evaluations in both the video-to-event voxel and the voxel-to-event stream phases.
 - Attained SOTA on the video-to-event task through rigorous evaluations against established baselines, providing a premier option for generating continuous event streams.

- **Event Camera-based Human Pose Estimation**
 - Pioneered the first neuromorphic camera-based 3D human pose estimation (HPE) solution that is specifically tailored for dance motion. This solution functions robustly under challenging conditions such as low lighting and occlusion, overcoming the limitations of neuromorphic cameras while leveraging their strengths.
 - Developed an end-to-end simulator that offers precise, low-level control over generated events, producing the first and largest neuromorphic camera dataset for dance HPE, named *Yelan-Syn-Dataset*. This synthetic dataset surpasses existing resources in both quantity and variability.
 - Conducted a human subject study to collect a real-world dance HPE dataset, *Yelan-Real-Dataset*, considering low-light conditions and dynamic background content. Both the datasets and the code are released to the public.

- **Hyperspectral Image Super-resolution Based on Meta-Learning Supporting Arbitrary Input and Output Bands**
 - Developed a meta-learning-based multispectral image super-resolution algorithm using Pytorch, capable of handling HSI images with **arbitrary input** channel numbers and generating high-resolution HSIs with **arbitrary output** bands.
 - Even with only five input bands, we achieved a **3.19%** improvement in PSNR on the NTIRE2020 dataset, while maintaining excellent compatibility.
 - Designed a recursive hyperspectral image super-resolution algorithm, specifically tailored for the fusion of satellite and drone imagery.

- **Prefrontal Modulation of Frustration-related Physiology in Preschool Children**
 - We conducted a multimodal study on 94 participants aged 3.5 to 5 years, recording neural activation via functional near-infrared spectroscopy (fNIRS) during tasks designed to induce frustration, along with video recordings of facial expressions, gaze, and movement.
 - We proposed a novel machine learning framework—multiscale instance fusion—utilizing coarsely labeled video data to predict neural activation and parameters β values strongly correlated with psychopathology.
 - We demonstrated how the proposed model uses facial action units (AUs) to classify individuals with normal versus low prefrontal cortex (PFC) activation levels, with results consistent with widely used symptom-based clinical diagnostic tools.
 - We differentiated clinical and non-clinical individuals' psychopathological risk using facial AUs and movement-related features, showing correlations between our model predictions and various commonly used clinical assessment scales.

Electromagnetic Compatibility (EMC) Laboratory, Missouri University of Science and Technology, Rolla, MO, USA

Visiting Scholar, Advisor: Prof. Jun Fan

July 2018 to June 2019

- **Solving the Poisson Equation in PN Junction Particle Simulation Using Deep Learning**
 - Simulating the dynamic characteristics of PN junctions at the microscopic level requires solving the Poisson equation at every time step.
 - Using traditional finite difference methods (FDM) at each time step is necessary but time-consuming.
 - Deep learning, a powerful technique for fitting complex functions, is employed in this work to accelerate the solution of the Poisson equation in PN junctions.
 - An edge-aware loss function was designed to improve estimation accuracy at boundaries, reducing cumulative error during iterations and achieving better long-term matching.
 - The I-V curves of the PN junction obtained using the deep learning solver introduced

in this work perfectly match those obtained using finite difference methods, with a tenfold speed increase at each time step.

- **Decoupling Capacitor Selection Algorithm for PDN Based on Deep Reinforcement Learning**
 - The selection of decoupling capacitors is crucial for the design of power distribution networks (PDN), aimed at reducing impedance and saving costs.
 - Good PDN design typically means meeting target impedance with as few decoupling capacitors as possible. In this project, port priorities are initially calculated using an inductance-based method, then a deep reinforcement learning (DRL) optimization of decoupling capacitor allocation at priority locations is applied using deep neural networks (DNN).
 - The DRL algorithm can explore autonomously without any prior physical knowledge, with the DNN trained through exploration experience and eventually converging to an optimal state. The proposed hybrid method was tested on a printed circuit board (PCB) example.
 - After several iterations of training, the DNN successfully achieved optimal design—meeting the target impedance with the minimum number of decoupling capacitors. The use of DRL and DNN makes this approach promising for future applications, where more variables can be introduced as inputs to handle more complex situations.

PUBLICATIONS

Refereed Conference and Journal Publications

[C7] Zhongyang Zhang, Shuyang Cui, Kaidong Chai, Haowen Yu, Subhasis Dasgupta, Upal Mahbub, Tauhidur Rahman. “V2CE: Video to Continuous Events Simulator” (**ICRA 2024**.)

[C6] Yi Xiao, Harshit Sharma, Zhongyang Zhang, Dessa Bergen-Cico, Tauhidur Rahman, Asif Salekin. “”Reading Between the Heat”: Co-Teaching Body Thermal Signatures for Non-intrusive Stress Detection” (**IMWUT 2023**)

[C5] Zhongyang Zhang, Kaidong Chai, Haowen Yu, Ramzi Majaj, Francesca Walsh, Edward Wang, Hava Siegelmann, Donghyun Kim, Tauhidur Rahman. “Neuromorphic High-Frequency 3D Dancing Pose Estimation in Dynamic Environment” (**Neurocomputing, 547, 2023**).

[C4] Adam S Grabell, Adrelys Mateo Santana, Kari N Thomsen, Katie Gonzalez, Zhongyang Zhang, Zachary Bivins, Tauhidur Rahman. “Prefrontal Modulation of Frustration-related Physiology in Preschool Children Ranging from Low to Severe Irritability” (**Developmental Cognitive Neuroscience, Volume 55, 2022**.)

[C3] Manasa Kalanadhabhatta, Adrelys Mateo Santana, Zhongyang Zhang, Deepak Ganesan, Adam S Grabell, Tauhidur Rahman. “EarlyScreen: Multi-scale Instance Fusion for Predicting Neural Activation and Psychopathology in Preschool Children” Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (**IMWUT 2022, Best Paper Award**).

[C2] Ling Zhang, Zhongyang Zhang, Chenxi Huang, Han Deng, Hank Lin, Bin-Chyi Tseng, James Drewniak, Chulsoon Hwang. “Decoupling capacitor selection algorithm for pdn based on deep reinforcement learning” 2019 IEEE International Symposium on Electromagnetic Compatibility, Signal & Power Integrity (**EMC+ SIPI 2019**)

[C1] Zhongyang Zhang, Ling Zhang, Ze Sun, Nicholas Erickson, Ryan From, Jun Fan.

“Solving Poisson’s Equation using Deep Learning in Particle Simulation of PN Junction” 2019 Joint International Symposium on Electromagnetic Compatibility, Sapporo and Asia-Pacific International Symposium on Electromagnetic Compatibility (**EMC Sapporo/APEMC 2019**).

Workshop & Adjunct Publications

[W1] Zhongyang Zhang, Zhiyang Xu, Zia Ahmed, Asif Salekin, Tauhidur Rahman. “Hyperspectral Image Super-Resolution in Arbitrary Input-Output Band Settings” WACV 2022 Workshop on Applications of Computational Imaging) (**WACI 2022**).

Book Chapters

[B1] Md Sakib Hasan, Catherine D. Schuman, Zhongyang Zhang, Tauhidur Rahman, Garrett S. Rose. “Spike-based Neuromorphic Computing for Next-Generation Computer Vision”

Thesis

[D1] Zhongyang Zhang, “Deep reinforcement learning-based far-end crosstalk suppressing in DDR5 RAM design”, *B.Sc. Thesis, Huazhong University of Science and Technology*, 2019.

TEACHING EXPERIENCE

Teaching Assistant

Mobile and Ubiquitous Computing February 2020 to May 2020

- Location: University of Massachusetts, Amherst, MA
 - Designed instructional Android application for COVID monitoring.
 - Helped conduct lab tutorial on signal processing and machine learning for Ubiquitous Computing.
 - Mentored students on their development of mobile applications for preventing the spread of COVID-19.

Teaching Assistant

Embedded Computing Systems September 2020 to December 2020

- Location: University of Massachusetts, Amherst, MA
 - Designed new lecture material covering ARM instruction set architecture, data representation, and analog electronics.
 - Built an instructional Arduino NANO app running a TensorFlow Lite program and gave lectures to students on this topic.
 - Advised students for their final projects.
 - Jetson Nano and Raspberry Pi were also used.

Teaching Assistant

Computer System Principles February 2021 to May 2021

- Location: University of Massachusetts, Amherst, MA
 - C++ and memory management were taught in this course.
 - Designed quizzes and organized labs.
 - Helped to manage students’ affairs.

Teaching Assistant

Introduction to Problem Solving with Computers May 2020 to August 2020

- Location: University of Massachusetts, Amherst, MA
 - Java programming basic is taught in this course.
 - Organized labs, and tutored students on debugging Java programs.

OTHERS

Student Volunteer

- IEEE Symposium on Electromagnetic Compatibility, Signal and Power Integrity, 2018

Membership IEEE, ACM