JIAN SUN

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EDUCATION

Ph.D. Candidate in Computer Science September 2018 -- Present
University of Denver, Denver, CO
Master of Science in Statistics May 2017
The George Washington University, Washington, DC
Bachelor of Science in Mathematics and Applied Mathematics July 2014
Shandong Agricultural University, Tai'an, China

RESEARCH INTERESTS

My research emphasizes improving the classification result in the Computer Vision and Natural Language Processing field via the Deep Learning-based model. The contributions also involve addressing Data Imbalance issues and optimizing the model. The applications in the published papers involve Facial Expression Recognition, Suicide Intention Detection, Mild Cognitive Impairment Detection, and Violence Detection.

RESEARCH EXPERIENCE

Doctoral Researcher September 2018 – Present
Department of Computer Science, University of Denver
- Develop algorithms to improve classification in Computer Vision and Natural Language Processing fields.
- Design HP loss and CBS loss to solve data imbalance issues.
- Contribute to detecting Mild Cognitive Impairment and violent behavior by analyzing interview videos.
- Research on referring to video quality during video classification.
- Response to writing academic papers and drawing posters.
- Contributions include XnODR/XnIDR (Fully Connected layer), Combined-SSL, MC-ViViT, and SSL-V3.

Journal and Conference Reviewer 2020 – Present
- Reviewed papers for the bellowed journals:
  IEEE Transactions on Affective Computing (TAFFC) IEEE Access
  IEEE Journal of Biomedical & Health Informatics (JBHI) Gerontology
  Computational Intelligence
- Reviewed papers for the bellowed conferences:
  2025 AAAS Annual Meeting
  2024 IEEE RAS EMBS 10th International Conference on Biomedical Robotics and Biomechatronics (BioRob 2024)
  2020, 2023 IEEE International Conference on Robotics and Automation (ICRA)
  2020, 2023 IEEE International Conference on Automatic Face and Gesture Recognition (FG)

TEACHING AND MENTORING EXPERIENCE

Instructor March 2024 – December 2024
Code Advantage, Denver, CO
- Course: Scratch Junior, Web Development, Minecraft Code
- Teach elementary students to understand the concept of code through game programming.

Graduate Teaching Assistant April 2019 – November 2024
Department of Computer Science, University of Denver
- Course: Algorithms for Data Science.
- Guided students on coursework, graded assignments and exams.

Department of Electrical and Computer Engineering, University of Denver
- Courses: Machine Learning, Python for Engineers, Intro to Mechatronic Systems I and II, VLSI Design, Network Design.
- Designed lectures, quizzes, homework, and exams.
- As guest lecturer, taught Transformer models, Graph Neural Networks, and Traditional Machine Learning Algorithms.
- Guided students on coursework, graded assignments and exams.

Department of Business Information & Analytics, University of Denver
- Courses: Python Programming, Automating Business Processes, Complex Data Analytics, Predictive Analytics.
- Presented as a guest lecturer on Intro to Machine Learning and Intro to Computer Vision.
- Guided students on coursework.

STEM Tutor December 2019 – March 2022
Learning Effectiveness Program, University of Denver

- Helped college students with Learning Disabilities, and/or Attention Deficit Hyperactivity Disorder (ADHD), students on the Autism Spectrum, and students who have a history of learning differences to learn better.
- Taught students mathematics, statistics, and computer science courses such as calculus, programming language, algebra, mathematical statistics, etc.

Student-Athlete Tutor September 2021 – June 2022

Division of Athletics & Recreation, University of Denver

- Taught and helped NCAA Athletes study Business Analytics-related courses from Business School.

PUBLICATIONS

Sun, Jian and Mahoor, Mohammad (2025), Video Quality Assessment-Jointed Video Classification. Available at SSRN: http://dx.doi.org/10.2139/ssrn.5174457

M. Alsuhaibani, A. Pourramezan Fard, J. Sun, F. Far Poor, P. S. Pressman and M. H. Mahoor, "A Review of Machine Learning Approaches for Non-Invasive Cognitive Impairment Detection," in *IEEE Access*, vol. 13, pp. 56355-56384, 2025, doi: 10.1109/ACCESS.2025.3555176.

E. Lin, J. Sun, H. Chen and M. H. Mahoor, "Data Quality Matters: Suicide Intention Detection on Social Media Posts Using RoBERTa-CNN," 2024 46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Orlando, FL, USA, 2024, pp. 1-5, doi: 10.1109/EMBC53108.2024.10782647.

Sun, J., Dodge, H. H., & Mahoor, M. H. (2024). MC-ViViT: Multi-branch classifier-ViViT to detect mild cognitive impairment in older adults using facial videos. *Expert Systems with Applications, 238*, 121929. https://doi.org/10.1016/j.eswa.2023.121929. Epub 2023 Oct 4. PMCID: PMC11375964.

Sun, J., Fard, A.P. & Mahoor, M.H. XnODR and XnIDR: Two Accurate and Fast Fully Connected Layers for Convolutional Neural Networks. *J Intell Robot Syst* 109, 17 (2023). https://doi.org/10.1007/s10846-023-01952-w

CONFERENCE PRESENTATIONS

J. Sun and J. Zhao, "Deep Learning for Enhanced 5DoF Electromagnetic Navigation in Interventional Procedures", 2025 44th Annual Medtronic Science & Technology Conference: U.S. Session, MN, USA, Nov 3rd, 2025 (Oral Presentation).

"Data Quality Matters: Suicide Intention Detection on Social Media Posts Using a RoBERTa-CNN", IEEE EMBC 2024, Orlando, FL, July 15 – 19, 2024

"MC-ViViT: Multi-branch classifier-ViViT to detect mild cognitive impairment in older adults using facial videos", STEM Poster Day at the Capital, Denver, CO, March 13, 2024

"Review of State-of-the-Art Deep Learning Approaches for Visual Object Recognition and Tracking: Applications to Unmanned Aircraft Systems", 2023 Int'l Conference On Unmanned Aircraft Systems (ICUAS 2023), Warsaw, Poland, June 6 – 9, 2023

HONORS AND AWARDS

The University of Denver

- GSA Scholarship 2020 - 2024
- Deans Scholarship 2018

2014 American Mathematical Contest in Modeling. 2014

- 3rd Prize

"HEP Cup" China Undergraduate Mathematical Contest in Modeling 2013

- 2nd Prize in Shandong

PROFESSIONAL EXPERIENCE

Navigation Engineer January 2025 – Present

Medtronic, Lafayette, CO

EM Localization

- Developed a real-time deep learning-based **Electromagnetic Localization System** for catheter-based tasks used in Hugo Surgical Robotic. This system is designed for critical tasks like lung cancer biopsies and cardiac valve placement.
- Trained **MS-ResNet+MHSA** models on **HPC** clusters and deployed on **NVIDIA Jetson Orin Nano** with **TensorRT** acceleration, achieving real-time inference of catheter position and orientation.
- The model's performance is highly competitive with existing methods. The distance error's 25% to 75% quantile is [2.44mm,

5.57mm], and the angle error is 0.49 to 1.22 degrees.
- Generated large-scale simulated training data through interpolation, using a base map of electromagnetic field values.

3D Cardiac Reconstruction

- Designed a **NeRF-based 3D cardiac reconstruction** pipeline by analyzing multi-modal data, including Clarius ultrasound image, IMU, optical tracker data, and Computerized Tomography (CT) scan image.
- Developed an efficient method for synchronizing the start times of the **Clarius probe** and optical tracker.

Workflow & Conference

- Standardized EM Localization and 3D reconstruction workflows, from model training on HPC to embedded deployment on the Jetson board, and synchronized data collection.
- The work on EM Localization was accepted for an oral presentation at the **2025 44th Annual Medtronic Science & Technology Conference: U.S. Session**.

Used Skills

- **Programming & Libraries**: Python, Bash, Pytorch, TensorRT.
- **Project Management**: Git (Bitbucket)
- **Theory & Model:** Biot-Savart Law, CNNs, Transformers, Gaussian Mixture Model.
- **Computation & Embedded Systems**: High Performance Computing (HPC), Jetson Orin Nano, Signal Transmit.
- **Medical Data & Devices:** Clarius Ultrasound Probe, Medtronic Optical Tracking System.
- **Research Areas:** Electromagnetic Localization, Inverse Problems for Partial Differential Equations, 3D Reconstruction.

Project Supervisor June 2023 – January 2024

Vision and Robotic Lab at the University of Denver, Denver, CO

- **Supervised a research project** using the RoBERTa-CNN model to detect suicidal ideation from social media posts.
- Guided dataset cleaning, model training, and academic writing; results published in **IEEE EMBC 2024** [IEEE Xplore].

Used Skills

- **Programming & Libraries**: Python, Bash, Pytorch
- **Theory & Model**: CNNs, BERTs
- **Computations:** GPUs
- **Research Directions:** NLP, Suicidal Intention Detection

Software Engineering Intern June 2022 – August 2022

Dream Face Technologies, LLC, Denver, CO

- Developed deep learning models to analyze visual data of older adults to distinguish Mild Cognitive Impairment from healthy controls.
- Collaborated with the engineering team to analyze I-CONECT video dataset and integrate the model with other systems (Ryan Apps).
- **Published paper**, MC-ViViT: Multi-branch Classifier-ViViT to Detect Mild Cognitive Impairment in Older Adults Using Facial Videos.

Used Skills

- **Programming & Libraries**: Python, Bash, Pytorch
- **Theory & Model**: CNNs, ViViT
- **Computations**: GPUs
- **Research Directions**: Computer Vision, Video Recognition, Intra- and Inter-Class Imbalanced Issues, MCI

Database Consultant February 2021 – November 2021

Colorado Municipal Clerks Association, Denver, CO

- Modified and Optimized User Interface and User Experience in MS Access.
- Addressed potential bugs and accelerated the visiting speed of the backend database.

Computer Vision Engineer Intern July 2019 – August 2019

Tsinghua University Big Data Laboratory at Qingdao Center, Qingdao, China

- Developed models to classify different rat species from blurred videos and recognize small objects in pictures (around 63% accuracy).
- **Used Models & Libraries**: Tensorflow, Keras, SVM, GrabCut, alpha matte, Poisson Matting, CNNs, LibSVM.

Placement Intern, Data Analyst July 2017 – January 2018

United States Peace Corps, Washington, DC

- Developed models to evaluate qualified candidates, whether they would accept or decline the invitation, reduced the padding rate in the delivery process, and evaluated candidates' language level.
- Prediction Accuracy is 98.37%; R Shiny Data visualization link: http://keepcreation.shinyapps.io/summerize/.

- **Used Models & Libraries**: R, R Shiny, SQL, Pivot Tables; random forest, weighted linear regression, Naïve Bayes Classifier.

UNIVERSITY SERVICE

Student Actor 2021 – 2022

Division of Marketing & Communications, University of Denver

- Joined in filming the University Marketing Video in May 2022.
- Joined the University Television Commercial Shoot in July 2021

TECHNICAL SKILLS AND CERTIFICATIONS

Programming Languages: Python, Bash, C++, Java, R, MATLAB, Haskell, Racket
Deep Learning & ML Frameworks: PyTorch, TensorFlow, Keras, TensorRT, OpenCV
Embedded & Edge AI: NVIDIA Jetson Series, TensorRT, Signal Processing
Cloud & HPC: AWS (EC2, S3, DynamoDB, Lambda, EBS), Google Cloud Platform, Docker, HPC
MLOps & DevOps: WandB, Streamlit, FastAPI, Postman, CI/CD (Github Actions)
Version Control: Git, Github, Gitlab, Bitbucket
SQL & NoSQL: SAS, SPSS, MySQL, PostgreSQL, MongoDB, Neo4J, Redis
Big Data & Distributed Systems: Spark, Hadoop/MapReduce, HBase
Data Visualization: Tableau,
Certifications: SAS Base Programming for SAS 9; SAS Advanced Programming for SAS 9, Certificate Number: AP020919v9; HackerRank Python (Intermediate) Certificate (14BA6D47EC75), 5-star Gold Badge (SQL & Python).

PROFESSIONAL MEMBERSHIPS

- Institute of Electrical and Electronics Engineers (IEEE)
- IEEE Engineering in Medicine and Biology Society (EMBS)
- American Association for the Advancement of Science (AAAS)

REFERENCES

Mohammad H. Mahoor, Professor
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