JINGPING NIE

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RESEARCH INTERESTS

Human-centric health-oriented privacy-aware intelligent wearable devices, Artificial Intelligence of Things (AIoT), Internet of Medical Things (IoMT), ubiquitous sensing for health and sustainability, and machine learning- (ML-) driven smart grids optimization. My research lies at the intersection of diverse disciplines, including electrical engineering, biomedical engineering, computer science, and data science.

EDUCATION

2019–2025 **Columbia University**, New York, NY
Ph.D. Student, Electrical Engineering
Advisors: Prof. Xiaofan Jiang and Prof. Matthias Preindl

2017–2019 **Columbia University**, New York, NY
M.S., Electrical Engineering
M.S. Honors Student

2013–2017 **Smith College**, Northampton, MA
B.S., Engineering Science
Magna cum laude with High Honors

Fall 2015 **Columbia University**, New York, NY
Visiting Student

PROFESSIONAL EXPERIENCE

July 2025 – Present **University of North Carolina at Chapel Hill**, Chapel Hill, NC, USA
Assistant Professor

Summer 2024 **Apple Inc.**, Cupertino, CA, USA
Machine Learning Research Intern
Mentor: Vikramjit Mitra

Summer 2023 **Apple Inc.**, Cupertino, CA, USA
Machine Learning Research Intern
Mentor: Vikramjit Mitra

HONORS & AWARDS

2025 **Columbia Engineering Morton B. Friedman Memorial Prize**
2025 Columbia University Eli Jury Award
2025 **CPS Rising Star**
2024 **Best Paper Award, *ACM MobiSys*** *(out of 263 submissions)*
2024 People's Choice Demo Award, *ACM MobiSys*
2023 **EECS Rising Star**
2023 **Apple Scholars in AI/ML PhD Fellowship** *(only 22 fellows were selected worldwide)*
2023 Columbia University Jacob Millman Award *(outstanding teaching assistant)*
2022 Best Demo Award Runner-up, *ACM SenSys*
2021 **Best Paper Award, *IEEE ITEC*** *(out of 226 submissions)*
2020 **Best Demo Award, *ACM/IEEE IPSN***

2018 Columbia Electrical Engineering M.S. Honors Student

2017 Phi Beta Kappa Honor Society, Smith College

2017 Sigma Xi Honor Society, Smith College

2013–2017 Dean's List, All Semesters at Smith College

2016 Tau Beta Kappa Honor Society, Smith College

GRANTS AND PREPARATION

Apple Scholars in AI/ML PhD Fellowship
2023–2025, Apple Inc., "Enabling Machines to *Understand* and *Take Care of* Humans: Intelligent and Privacy-Aware Wearable Devices and AIoT Systems" (amount awarded: annual tuition of $52,010 and stipend of $40,000, and $5,000 in conference travel support).
Contribution: I envisioned and wrote this proposal.

NSF CAREER
2020–2025, National Science Foundation, "CAREER: A Scalable Occupant-Driven Energy Optimization System for Commercial Buildings" (amount awarded: $535,838).
Contribution: Assisted PI Prof. Xiaofan Jiang in writing and preparing the grant proposal.

Columbia SEAS
2020–2022, Columbia SEAS, "Low-Cost Continuous Multi-Person Fever Detection for a Safer COVID-19 and Post-COVID-19 World" (amount awarded: $85,000).
Contribution: Assisted PI Prof. Xiaofan Jiang in writing and preparing the grant proposal.

Industry
2018, Sino-US Cyber-Physical Technology Co., "Gift: Smart Cities Research at Columbia Intelligent and Connected Systems" (amount awarded: $150,000).
Contribution: Assisted PI Prof. Xiaofan Jiang in writing and preparing the grant proposal.

Travel Grants
CPS-IoT Week 2025, CPS-IoT Week 2023, ACM MobiSys 2022, CPS-IoT week 2020

PUBLICATIONS

Journals

[6] **J. Nie**, Y. Fan, Z. Xuan, M. Zhao, R. Wan, M. Preindl, and X. Jiang, "SoundTrack: A Contactless Mobile Solution for Real-Time Running Metric Estimation for Treadmill Running in the Wild," *ACM Interact. Mob. Wearable Ubiquitous Technol.*, vol. 9, no. 2, 2025

[5] **J. Nie**, H. Shao, Y. Fan, Q. Shao, H. You, M. Preindl, and X. Jiang, "LLM-based Conversational AI Therapist for Daily Functioning Screening and Psychotherapeutic Intervention via Everyday Smart Devices," *ACM Transactions on Computing for Healthcare (HEALTH), Special Issue on Large Language Models, Conversational Systems, and Generative AI in Health*, 2025

[4] **J. Nie**, L. Zhou, M. F. Kaye, C. C. Silveira, A. Nwokolo, X. Jiang, and M. Preindl, "High-Performance Optimal Power Flow Estimation for EV-Interfaced Microgrids with Standardized Grid Services," *IEEE Transactions on Industry Applications*, vol. 59, no. 1, pp. 1199–1211, Jan. 2023

[3] Y. Liu, S. Xia, **J. Nie**, P. Wei, Z. Shu, J. Chang, and X. Jiang, "aiMSE: Towards an AI-based Online Mental Status Examination," *IEEE Pervasive Computing*, vol. 21, no. 4, pp. 46—54, 2022

[2] **J. Nie**, Y. Liu, Y. Hu, Y. Wang, S. Xia, M. Preindl and X. Jiang, "SPIDERS+: A Light-Weight, Wireless, and Low-Cost Glasses-based Wearable Platform for Emotion Sensing and Bio-signal Acquisition," *Elsevier-Pervasive and Mobile Computing Journal (PMC)*, vol. 75, pp. 101424, Aug. 2021

[1] **J. Nie**, GM. Di Liberto, J. Yeaton, B. Khalighinejad, S. Shamma, and N. Mesgarani, "Neural Representation of Linguistic Feature Hierarchy Reflects Second-Language Proficiency," *Elsevier NeuroImage*, vol. 227, pp. 117586, Feb. 2021

Conference Proceedings

[12] **J. Nie**, D. T. Dung, K. Thakkar, V. Kowtha, J. Huang, C. Avendano, E. Azemi, V. Mitra, "Foundation Model Hidden Representations for Heart Rate Estimation from Auscultation," in *Proc. of Interspeech 2025 (Interspeech'25)*, 2025

[11] **J. Nie**, Y. Fan, M. Zhao, R. Wan, Z. Xuan, M. Preindl, and X. Jiang, "Multi-Modal Dataset Across Exertion Levels: Capturing Post-Exercise Speech, Breathing, and Phonocardiogram," in *Proc. ACM Conference on Embedded Networked Sensor Systems (SenSys'25)*, 2025

[10] Q. Shao, J. Liu, E. Bejerano, H. M. Colman, **J. Nie**, X. Jiang, and X. Zhou, "Joey: Supporting Kangaroo Mother Care with Computational Fabrics," in *Proc. ACM International Conference on Mobile Systems, Applications, and Services (MobiSys'24)*, 2024
Best Paper Award and **People's Choice Demo Award**

[9] V. Mitra, **J. Nie**, and E. Azemi, "Investigating Salient Representations and Label Variance in Dimensional Speech Emotion Analysis," in *Proc. IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP'24)*, 2024

[8] S. Xia, M. Zhao, C. Adhivarahan, K. Hou, Y. Chen, **J. Nie**, E. Wu, K. Dantu, and X. Jiang, "Anemoi: A Low-cost Sensorless Indoor Drone System for Automatic Mapping of 3D Airflow Fields," in *Proc. ACM International Conference on Mobile Computing and Networking (MobiCom'23)*, 2023

[7] **J. Nie**, S. Xia, Y. Liu, S. Ding, L. Hu, M. Zhao, Y. Fan, M. Aty, M. Preindl, and X. Jiang, "A Data-Driven and Human-Centric EV Charging Recommendation System at City-Scale," in *Proc. ACM International Conference on Future Energy Systems (ACM e-Energy'23)*, 2023

[6] M. Zhao, S. Xia, K. Hou, **J. Nie**, A. Dhupar, and X. Jiang, "LegoSENSE: An Open and Modular Sensing Platform for Rapidly-Deployable IoT Applications," in *Proc. ACM/IEEE International Conference on Internet of Things Design and Implementation (IoTDI'23)*, 2023

[5] **J. Nie**, Y. Liu, L. Zhou, M. Preindl, and X. Jiang, "Deep Reinforcement Learning Based Approach for Optimal Power Flow of Microgrid with Grid Services Implementation," in *Proc. IEEE/AIAA Transportation Electrification Conference and Electric Aircraft Technology Symposium (ITEC+EATS'22)*, 2022

[4] Y. Liu, **J. Nie**, J. Sun, P. Wei, S. Xia, and X. Jiang, "SoFIT: Self-Orienting Camera Network for Floor Mapping and Indoor Tracking," in *Proc. IEEE Annual International Conference on Distributed Computing in Sensor Systems (DCOSS'22)*, 2022

[3] **J. Nie**, L. Zhou, M. F. Kaye, C. C. Silveira, A. Nwokolo, X. Jiang, and M. Preindl, "Optimal Power Flow Estimation of Microgrid Considering the Grid Services of EV Batteries," in *Proc. IEEE Transportation Electrification Conference and Expo (ITEC'21)*, 2021
Best Paper Award

[2] S. Xia, **J. Nie**, and X. Jiang, "CSafe: An Intelligent Audio Wearable Platform for ImprovingConstruction Worker Safety in Urban Environments," in *Proc. ACM/IEEE Information Processing in Sensor Networks (IPSN'21)*, 2021

[1] **J. Nie**, Y. Hu, Y. Wang, S. Xia, and X. Jiang, "SPIDERS: Low-Cost Wireless Glasses for Continuous In-Situ Bio-Signal Acquisition and Emotion Recognition," in *Proc. ACM/IEEE International Conference on Internet of Things Design and Implementation (IoTDI'20)*, 2020

Workshops

[6] Y. Sui, Y. Zhang, Y. Liu, M. Zhao, K. Hou, **J. Nie**, X. Jiang, and S. Xia, "DomAIn: Towards Programless Smart Homes," in *Proc. of the 3rd International Workshop on Human-Centered Sensing, Modeling, and Intelligent Systems (HumanSys'25)*, 2025

[5] **J. Nie**, R. Liu, B. Mahasseni, E. Azemi, and V. Mitra, "Model-driven Heart Rate Estimation and Heart Murmur Detection based on Phonocardiogram," in *Proc. IEEE International Workshop on Machine Learning for Signal Processing (MLSP'24)*, 2024

[4] Y. Fan, **J. Nie**, X. Sun, and X. Jiang, "Exploring Foundation Models in Detecting Concerning Daily Functioning in Psychotherapeutic Context Based on Images from Smart Home Devices," in *Proc. IEEE International Workshop on Foundation Models for Cyber-Physical Systems & Internet of Things (FMSys'24)*, 2024

[3] R. Liu, E. L. Zippi, H. Pouransari, C. Sandino, **J. Nie**, H. Goh, E. Azemi, and A. Moin, "Frequency-Aware Masked Autoencoders for Multimodal Pretraining on Biosignals," in *Proc. ICLR Time Series for Health Workshop (ICLR'24 TS4H)*, 2024

[2] Z. Xuan, M. Liu, **J. Nie**, M. Zhao, S. Xia, and X. Jiang, "CaNRun: Non-Contact, Acoustic-based Cadence Estimation on Treadmills using Smartphones," in *Proc. ACM International Workshop on Intelligent Acoustic Systems and Applications (IASA'23)*, 2023

[1] **J. Nie**, H. Shao, M. Zhao, S. Xia, M. Preindl, and X. Jiang, "Conversational AI Therapist for Daily Function Screening in Home Environments," in *Proc. ACM International Workshop on Intelligent Acoustic Systems and Applications (IASA'22)*, 2022

Demos and Posters

[4] **J. Nie**, Y. Fan, Z. Xuan, M. Preindl, and X. Jiang, "Poster Abstract: Real-Time Non-Contact Estimation of Running Metrics on Treadmills using Smartphones," in *Proc. ACM International Conference on Mobile Computing and Networking (MobiCom'24)*, 2024

[3] **J. Nie**, M. Zhao, S. Xia, X. Sun, H. Shao, Y. Fan, M. Preindl, and X. Jiang, "Demo Abstract: AI Therapist for Daily Functioning Assessment and Intervention Using Smart Home Devices," in *Proc. ACM Conference on Embedded Networked Sensor Systems (SenSys'22)*, 2022
Best Demo Runner-up Award

[2] **J. Nie**, L. Hu, Y. Liu, Y. Fan, M. Preindl, and X. Jiang, "Poster Abstract: Human-centric data-driven optimization and recommendation in EV-interfaced grid at city scale," in *Proc. ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys'22)*, 2022

[1] Y. Hu, **J. Nie**, Y. Wang, S. Xia, and X. Jiang, "Demo Abstract: Wireless Glasses for Non-contact Facial Expression Monitoring," in *Proc. ACM/IEEE Conference on Information Processing in Sensor Networks (IPSN'20)*, 2020
Best Demo Award

Teaching Experience

Teaching Assistant, Columbia University, New York, NY

Spring 2023	ELEN 6908: Embedded AI
Spring 2021	ELEN 6767: Internet Economics, Engineering, and Society
Fall 2019	EECS 4764: IoT – Intelligent and Connected Systems
Spring 2018	ELEN 6767: Internet Economics, Engineering, and Society

Professional Activities

Associate Editor	ACM Transactions on Computing for Healthcare Elsevier Smart Health
Conference Services	Technical Program Committee, ACM SenSys 2026 Program Chair, ACM IASA 2025 Program Chair, ACM HumanSys 2025 Social Media Chair, ACM SenSys 2025 Program Chair, ACM HumanSys 2024 Social Media Chair, ACM BuildSys 2024 Publicity and Social Media Chair, IEEE FMSys 2024 Social Media Chair, ACM SenSys 2023 Web Chair, ACM e-Energy 2023 Session Chair, IEEE/AIAA ITEC+EATS 2022 Social Media Chair, ACM BuildSys 2021

Reviewer	ACM Transactions on Sensor Networks 2025 ACM CHI 2025 ACM Transactions on Internet of Things 2025 ACM Transactions on Computing for Healthcare 2025 ACM FMSys 2024 ACM CHI 2024 ACM Transactions on Computing for Healthcare 2024 ACM Transactions on Computing for Healthcare 2023 ACM IMWUT 2023 ACM Energy Informatics Review 2022 IEEE Transactions on Transportation Electrification 2020
Volunteer	ACM SIGCOMM 2023 CPS-IoT Week 2023 ITEC+EATS 2022 ACM SenSys/BuildSys 2019
Panelist	Ph.D. Internship, Fellowships, Awards Panel, Northwestern University, Oct. 2024 Life After Smith Panel, Smith College, MA, Oct. 2022
Outreach	Girls Science Day, Columbia University, Nov. 2023 Science Expo at The School of Columbia (TSC), The School at Columbia University, May 2023 Girls Science Day, Columbia University, Nov. 2022 Women in Science at Columbia (WISC) Undergraduate Mentoring Program, 2022–2023 Homework House Holyoke, Smith College, 2014–2015
Department Services	Columbia University Electrical Engineering Student Ambassadors, 2019–Present

Research Experience

2018 – 2025 **Columbia University**, New York, NY
Research Assistant, Columbia Intelligent and Connected Systems Lab (ICSL)

- Develop a soft mechano-acoustics wearable device-based system deep learning to monitor running metrics (cadence, ground contact time, imbalance) and vital signs (heart rate and respiratory rate) during long-duration cardio exercises, particularly running, using a deep learning approach. The system maintains high accuracy despite continuous motion artifacts, sweating, and challenging environmental conditions, including treadmill and outdoor running with significant environmental noise.
- Develop a contactless, acoustic-based system that uses sound captured by a mobile device placed on a treadmill to accurately estimate running metrics, such as cadence, ground contact time, and footstrike types (heel strike, midfoot, forefoot). Design the human-computer (human-smartphone) interface in collaboration with certificated coaches to assist users in understanding their running performance and provide recommendations to novice or experienced runners.
- Develop a conversational "AI therapist" that leverages large language models (LLMs), vision language models (VLMs), and the smart home environment to screen the day-to-day functioning and infer the mental well-being of the occupant. In collaboration with licensed therapists, our AI therapist can chat with users (e.g., via Amazon Alexa and smartphone apps), leverage in-home smart devices and sensors to assess a user's daily functioning, and provide preliminary psychotherapeutic interventions through conversations or actuating home robots.
- Design and deploy a conductive fabric-based approach to continuously monitor Kangaroo Mother Care (KMC) (chest-to-chest skin contact) duration and two vital signs essential to an infant's well-being: heart rate and respiration rate. The proposed approach is a soft fabric necklace worn by the caregiver on her chest. Our approach exploits the observation that electrocardiogram (ECG) signals transmit across individuals with skin-to-skin contact and detects the chest-to-chest skin contact during KMC and vital signs via the presence of mixed ECG signals.

- Deployed a human-centric, data-driven city-scale EV recommender system using deep reinforcement learning, accounting for user preferences, EV mobility, charging price, availability of EV chargers, and grid capacity. User preferences include historical travel and charging habits, along with incentives to participate in energy-saving programs. The system aims to provide actionable insights and co-optimize welfare for EV drivers, EV charger owners, and grid operators.
- Deployed an AI-based personal online mental status examination (MSE), which allows users to self-administer MSEs at home through a web browser, using only a camera and microphone. The system uses multimodal image, speech and natural language processing algorithms to detect signs of abnormalities in mental functioning and recommend them for further examination by a mental health specialist.
- Designed and implemented a wireless wearable eyeglass platform for collecting biosignals from five different sensor modalities, which can provide pupillometry, eye shape, electroencephalogram (EEG), acceleration, heart rate, and movements of zygomaticus based on user needs.

2019 – 2025 **Columbia University**, New York, NY
Research Assistant, Motor Drives and Power Electronics Lab (MPLab)

- Developed deep reinforcement learning-based optimization methods for EV-interfaced microgrids considering the dynamics brought by electric vehicles (EV) and other distributed energy resources. Developed models and a simulation platform for multi-objective optimization to reduce line loss in these microgrids.
- Developed and implemented a communication platform for a smart, fast EV charging network consisting of power electronics control modules, an EV battery management system, and cloud services. The platform supports different charging services (e.g., data storage/visualization, remote control, and web services) and grid services (e.g., demand-response and scheduling).

Summer 2023 **Apple Inc.**, Cupertino, CA
Machine Learning Research Intern, Body-sensing Intelligence Group (BIG)

- Developed a model-driven approach for heart rate estimation and murmur detection using a publicly available phonocardiogram (PCG) dataset. Leveraged a 2D convolutional neural network (2dCNN) to estimate heart rate with a mean absolute error (MAE) of 1.312 bpm, using acoustic features like Mel spectrograms, cepstral coefficients, and power spectral density. Extended the model to a multi-task learning framework (2dCNN-MTL), achieving over 95% accuracy in murmur detection while maintaining a satisfying MAE.
- Developed a dimensional speech emotion recognition method using pre-trained BERT and HuBERT models, identifying lower-dimensional subspaces to reduce model complexity without sacrificing performance. Integrated label uncertainty to improve generalization and robustness, and demonstrated resilience to acoustic degradations with minimal performance loss.
- Developed a frequency-aware masked autoencoder that learns biosignal representations in the frequency space to address distributional shifts in multimodal biosignals between pretraining and inference. This masked autoencoder employs a frequency-aware transformer with a Fourier-based operator for global token mixing, enabling effective pretraining across varying input sizes and sampling rates.

2017 – 2018 **Columbia University**, New York, NY
Research Assistant, Neural Acoustic Processing Lab (NAPLab)

- Designed the experiment and recorded electroencephalography (EEG) signals from native English (22 subjects) and native Chinese speakers with different English proficiency (50 subjects) while listening to natural English speech. Applied multivariate linear regression to quantify the coupling between the EEG signals of each participant and the properties of the corresponding speech stimulus at the level of acoustics, phonemes, and semantics. Investigated the effect of language skills on brain responses to speech at various processing levels.

2016 – 2017 **Smith College**, Northampton, MA
Research Assistant, Susan Voss' Lab

- Researched using Time Domain Reflectance to calculate the cross-sectional geometry of the ear canal and measured the hearing impedance and reflectance by three devices in 172 human subjects. Accomplished the honor thesis, Wideband Acoustic Immittance Measurements and Time Domain Reflectance.

2016 – 2017 **Smith College & Medtronic**, Northampton, MA & New Haven, CT
Project Leader, Smith College Design Clinic

- Led a four-student research group collaborating with Medtronic's professional engineers for a one-year non-disclosure project related to a minimal invasive surgery device testing system.

MENTORING

Master Students
Wuyue Xia (2025–present)
Yuyu Wang (2025–present)
Yuang Fan (2023–2025)
Hongyi Huo (Fall 2023, now at Palo Alto Networks)
Ziyi Xuan (2023–2024, now a Ph.D. student at Lehigh CSE)
Ming Liu (2023, now at EdgeTrace)
Gudmundur Mar Jonasson (Summer 2023, now at Better)
Lanxiang Hu (2022–2023, now a Ph.D. student at UCSD CSE)
Xinhua Sun (2022–2023, now a Ph.D. student at UW ECE)
Yukai Song (Summer 2022, now a Ph.D. student at University of Pittsburg ECE)
Yian Liu (Summer 2022)
Jinyao Wu (Spring 2022)
Michelle Marie Ray Santiago (Spring 2022)
Ria Sharma (Spring 2022, now at Pure Power Engineering)
Srivatsan Raveendran (Fall 2021, now at Tesla)
Santanab Mukhopadhyay (Fall 2021)
Avik Dhupar (2021–2022, now at STMicroelectronics)
Christine Silveira (2019–2021, now at Mott MacDonald)
Margaret Frances Kaye (2019–2021, now at Con Edison)
Afam Nwokolo (2019–2021, now at Clarapath)
Yanchen Liu (2019–2020, now a Ph.D. student at Columbia EE)
Jiajing Sun (2019–2020)
Peter Luca Malinverni (2019–2020)
Yuqing Zhu (Fall 2019)
Yigong Hu (2018–2020, now a Ph.D. student at UIUC ECE)

Undergraduate Students
Kexin Gen (2025 – Present) Mille Chen (Fall 2023)
Thilina Navod Balasooriya (Summer 2023)
Alfonso Rivas (Summer 2022, now an undergraduate student at Syracuse University)
Nia Cole (Summer 2022, now at JPMorgan Chase)
Mingyang Chen (Summer 2020, Visiting Student, M.S. student at UPenn)
Yuanyuting Wang (Summer 2019, now at Meta)
Andrew Gu (Summer 2019, Visiting Student, now an undergraduate student at CMU)
Henry Kiem (Summer 2018, now at Amazon Web Services

High School Students
Runxi Wan (Summer 2024–2025)
Elvin Ko (Summer 2019, now an undergraduate student at Columbia)
Alina Hassan (Summer 2019)
Kevin Huang (Summer 2019)

CERTIFICATIONS

2024 **Road Runner Club of America**
RRCA Level 1 Coaching

2023 **American Red Cross**
Adult, Child and Baby First Aid/CPR/AED