

JINGPING NIE

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RESEARCH INTERESTS

Human-centric health-oriented privacy-aware intelligent wearable device, Artificial Intelligence of Things (AIoT), Cyber-physical systems, smart grids and power systems employing artificial intelligence, machine learning, and data analytics. My research lies at the intersection of a diverse disciplines including electrical engineering, biomedical engineering, and computer science.

EDUCATION

- 2019–Present **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

HONORS & AWARDS

- 2021 IEEE ITEC Best Paper Award
- 2020 ACM/IEEE IPSN Best Demo Award
- 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

RESEARCH EXPERIENCE

- 2018 – Present **Columbia University**, New York, NY
Research Assistant, Columbia Intelligent and Connected Systems Lab (ICSL)
- Develop a home-based conversational AI therapist that takes advantage of the smart home environment to screen the day-to-day functioning and infer mental well-being of the occupant. In collaboration with licensed therapists, our AI therapist can chat with users through different mediums (e.g., Amazon Alexa and smartphone APP). Our AI therapist additionally leverages smart devices and sensors throughout the home to assess a user's daily functioning and infer mental well-being. In addition, the AI therapist can provide preliminary interventions and professional consoling at home through conversations or through actuating home robots (e.g., vacuum machines or drones).

- Deploy a human-centric data-driven city-scale EV simulator that takes into account user preference, EV mobility, charging price, availability of EV chargers, and grid capacity. The user preferences including historical travel / charging habits and incentives to participate in different energy-saving programs. This simulator aims to provide information for EV drivers, EV charger owners, and grid operators. In particular, this simulator will optimize the strategy for EV dispatches, routing, charging scheduling, and EV charger installation.
- Work on a smart home artificial intelligence system that uses devices available on the home network to provide novel services without requiring users to “program” any logic, unlike existing smart home ecosystems. The system dynamically creates and deploys an execution pipeline based on user preferences and available sensors, actuators, and devices at home, and distributes computation across available compute resources, when a user gives a spoken command. We envision that this system can be incorporated into any current or future smart home ecosystem.
- Design a modular platform for sensing systems that addresses challenges that include high configurability, high scalability, and rapid development. This platform is designed for simple setup and ease of use. Furthermore, the plug-and-play and mix-and-match functionality of the platform makes the sensor modules reusable and allows them to be mixed and matched to serve a variety of needs while reducing cost for users.
- 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 an easily-deployable, self-calibrating, low-cost, portable, and privacy-aware camera network and indoor tracking system, where the cameras can perform self-localization, generate the floor map, and enable real-time indoor object tracking.
- Deployed a low-power, privacy-aware, and audio-based wearable platform to improve the safety of outdoor construction workers, who might be threatened by vehicles on the road. This platform works in extreme scenarios where the near-field sounds from the construction tools (e.g., jackhammers) overwhelm the far-field vehicle sounds and is able to efficiently process the signal on the edge device to protect user privacy.
- Designed and fabricated 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 extensively based on user needs, while being comfortable to wear in situ. Conducted extensive experiments on 20+ subjects to enhance and evaluate a facial expression detection and a real emotion classification (arousal-valence level) model using this platform.

2019 – Present **Columbia University**, New York, NY

Research Assistant, Motor Drives and Power Electronics Lab (MPLab)

- Investigate various methods based on deep reinforcement learning and deep learning to optimize the EV-interfaced microgrid considering the dynamics brought by electric vehicles (EV) and other distributed energy resources (DER). Explore grid optimization with grid service implementation with a data-driven approach.
- Work on mathematics, modeling, and simulation for multiobjective optimization to reduce line loss in the EV-interfaced electrical grid, with the objective of providing information for the optimal power flow model.
- Deployed a human-in-the-loop Peer-to-Peer (P2P) framework for distributed generators and implemented it in custom-designed smart bidirectional transformerless modular DC chargers. This framework aims to provide reliable and secure interfaces and services to power electronics controllers, electrical grids, utilities, and users. And further leverage this framework for smart grid control and optimization.
- 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).

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

TEACHING EXPERIENCE

- Teaching Assistant, Columbia University, New York, NY
- 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

MENTORING

- Master Students
- Lanxiang Hu (2022–Present)
 - Yukai Song (2022–Present)
 - Yian Liu (2022–Present)
 - Xinhua Sun (2022–Present)
 - Jinyao Wu (Spring 2022)
 - Michelle Marie Ray Santiago (Spring 2022)
 - Ria Sharma (Spring 2022)
 - Christine Silveira (2019–2021)
 - Margaret Frances Kaye (2019–2021)
 - Afam Nwokolo (2019–2021)
 - 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
- Alfonso Rivas (Summer 2022)
 - Nia Cole (Summer 2022)
 - Yuanyuting Wang (Summer 2019)
 - Henry Kiem (Summer 2018)
- High Students
- Elvin Ko (Summer 2019)
 - Alina Hassan (Summer 2019)
 - Kevin Huang (Summer 2019)
- Visiting Students
- Yuang Fan (Summer 2022, Undergraduate Student at NYU)
 - Mingyang Chen (Summer 2020, M.S. Student at UPenn)
 - Andrew Gu (Summer 2019, Undergraduate Student at CMU)

PROFESSIONAL ACTIVITIES

- Reviewer Energy Informatics Review 2022
ACM MobiSys 2020
IEEE Transactions on Transportation Electrification 2020
ACM Transactions on Computing for Healthcare 2019
- Volunteer ITEC+EATS'22, Anaheim, Los Angeles, CA
ACM SenSys/BuildSys 2019, New York, NY
- Conference Web Chair, e-Energy'23, Orlando, FL
- Services Session Chair, ITEC+EATS'22, Anaheim, Los Angeles, CA
Social Media Chair, BuildSys'21, Coimbra, Portugal
- Department Columbia University Electrical Engineering Student Ambassadors, 2019–Present
- Services
- Outreach Homework House Holyoke, Smith College, 2014–2015

PUBLICATIONS

- [15] **J. Nie**, H. Shao, M. Zhao, S. Xia, X. Sun, Y. Fan, Y. Song, M. Preimdl, and X. Jiang, "CaiTI: Your Personal AI Therapist for Psychotherapeutic Screenings and Interventions in Smart Home Environments," in submission at *ACM CHI Conference on Human Factors in Computing Systems (CHI 2023)*, 2023
- [14] S. Xia, Y. Liu, M. Zhao, K. Hou, **J. Nie**, and X. Jiang, "DomAIIn: AI Towards Programless Smart Homes," in submission at *The 29th Annual International Conference On Mobile Computing And Networking (MobiCom 2023)*, 2023
- [13] M. Zhao, S. Xia, K. Hou, **J. Nie**, A. Dhupar, and X. Jiang, "SensorHub: A Modular Platform for Rapidly-Deployable Sensing Systems," in submission at *The 20th ACM Conference on Embedded Networked Sensor Systems (SenSys 2022)*, 2022
- [12] **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*, 2022
- [11] **J. Nie**, H. Shao, M. Zhao, S. Xia, M. Preindl, and X. Jiang, "Conversational AI Therapist for Daily Function Screening in Home Environments," in *Proceedings of the 1st ACM International Workshop on Intelligent Acoustic Systems and Applications*, 2022
- [10] 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*, 2022
- [9] **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
- [8] Y. Liu, **J. Nie**, J. Sun, P. Wei, S. Xia, and X. Jiang, "SoFIT: Self-Orient Camera Network for Floor Mapping and Indoor Tracking," in *Proc. IEEE Annual International Conference on Distributed Computing in Sensor Systems (DCOSS'22)*, 2022
- [7] **J. Nie**, Y. Liu, Y. Hu, Y. Wang, S. Xia, M. Preindl and X. Jiang, "SPIDERS+: Low-Cost Wireless Glasses for Continuous In-Situ Bio-Signal Acquisition and Emotion Recognition," *Elsevier Pervasive and Mobile Computing Journal (PMC)*, 2021
- [6] **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
- [5] S. Xia, **J. Nie**, and X. Jiang, "CSafe: An Intelligent Audio Wearable Platform for Improving Construction Worker Safety in Urban Environments," in *Proc. ACM/IEEE Information Processing in Sensor Networks (IPSN'21)*, 2021
- [4] **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*, 2020
- [3] **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
- [2] 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
- [1] GM. Di Liberto, **J. Nie**, J. Yeaton, B. Khalighinejad, S. Shamma, and N. Mesgarani, "Workshop Abstract: Neural biomarkers of language proficiency in second language listeners," in *Nanosymposium for Neuroscience*, 2019