

EDUCATION

The George Washington University, Washington, DC, U.S.A.

09/2018 – 11/2023

- *Doctor of Philosophy* in Biomedical Engineering
- Advisor: *Chung Hyuk Park*
- Dissertation: *Empathetic Robotic Companion for Autistic Adolescents with Multimodal Human-Robot Interaction*

The George Washington University, Washington, DC, U.S.A.

09/2016 – 05/2018

- *Master of Science* in Mechanical Engineering
- Advisor: *Adam Wickenheiser*

Shenzhen University, Guangdong, China

09/2012 - 06/2016

- *Bachelor of Engineering* in Photoelectric Information Engineering
- Advisor: *Jun Song*
- Thesis: *Photovoltaic Performance perovskite solar cells with a nano-micro hole transporting layer*

RESEARCH EXPERIENCE

Research Focus: Machine Learning, Multimodal Learning, Human-Robot Interaction, Robotics, Natural Language Processing, Computer Vision, Medical Imaging

The George Washington University, Department of Biomedical Engineering*Doctoral Researcher*

09/2018 – Present

Empathetic Robotic Companion for Human-Robot Interaction (HRI)

- Achieved the personalization of the robot agent by employing deep reinforcement learning (RL) algorithms.
- Designed interactive HRI scenarios for autistic users and provided robot-assisted intervention in mental health.
- Adapted an affective model to the dialogue agent of the robot to assist in providing empathetic conversation.
- Developed a multimodal emotion recognition framework incorporating transfer learning and fusion techniques.
- Attained multiprocessing to run several deep learning techniques simultaneously on a humanoid robot.
- Programmed a system that includes real-time pose estimation and action recognition for users during HRI.
- Analyzed physiological signals during HRI and utilized them for action selection with reinforcement learning.

Medical Image Segmentation for Automated Nerve Identification

- Created software applications for experts to annotate the nerves from the collected medical imaging dataset.
- Segmented nerves from birefringence images using a U-Net architecture with a transformer-based fusion module.
- Evaluated the effects of the multimodal fusion module in assisting nerve identification.

Trainable Extended Kalman Filter (EKF) for Dead Reckoning in Autonomous Ground Vehicles

- Implemented a trainable EKF for the localization of ground vehicles utilizing the inputs from IMUs.
- Improved the EKF with a developed attention-based convolutional neural network (CNN) module.
- Designed real-world scenarios where trainable the EKF is a complementary process to SLAM when it fails.

Microrobots with Haptic Control

- Investigated utilizing RL algorithms to apply guidance force for obstacle avoidance in microrobots.
- Researched control algorithms for solving time-delay issues when remotely controlling the microrobots.
- Established a simulated environment with a haptic device to simulate the contact force.

Multi-Domain Search and Rescue using Cooperative Robots

- Applied a model-based least squares pose estimation method to predict the pose of the ground robot.
- Trained a custom CNN model detector for recognizing the ground robot.
- Experimented and simulated a position PID controller for the Asctec quadrotor.

Practical Numerical Methods with Python for Shallow Water Equations (SWEs) ([Simulation](#))

- Derived the full vectorization of a system of partial differential equations, SWEs, with conservative form.
- Simulated the numerical results of SWEs and analyzed the grid convergence with different numerical schemes.

Design of Perovskite Solar Cells

- Constructed a perovskite solar cell with a nano-micro hole transporting layer using a fast crystallization method.
- Tested the devices and performed data analysis to evaluate their performance.

Shenzhen University 2015 Challenge Cup University Student Venture Contest

- Captured image based on the WIFI video from a single-chip microcomputer.
- Programmed the automation control for a small intelligent car to collect 2D images for 3D modeling.

Laboratory Open Fund Project of Shenzhen University

- Used MATLAB to dynamically simulate joint Fourier transform correlation recognition processing.
- Visualized and programmed the GUI of the system.

PUBLICATIONS

Journal Articles

1. Milam, G., **Xie, B.**, Liu, R., Zhu, X., Park, J., Kim, G., & Park, C. H. (2022). Trainable Quaternion Extended Kalman Filter with Multi-Head Attention for Dead Reckoning in Autonomous Ground Vehicles. *Sensors*, 22(20), 7701.
2. **Xie, B.**, Milam, G., Ning, B., Cha, J., & Park, C. H. (2022). DXM-TransFuse U-net: Dual cross-modal transformer fusion U-net for automated nerve identification. *Computerized Medical Imaging and Graphics*, 99, 102090.
3. **Xie, B.**, Sidulova, M., & Park, C. H. (2021). Robust multimodal emotion recognition from conversation with transformer-based crossmodality fusion. *Sensors*, 21(14), 4913. (*Feature Paper*)
4. **Xie, B.**, Kim, J. C., & Park, C. H. (2020). Musical emotion recognition with spectral feature extraction based on a sinusoidal model with model-based and deep-learning approaches. *Applied Sciences*, 10(3), 902.

Conference Papers

1. **Xie, B.**, & Park, C. H. (2023). Multi-Modal Correlated Network with Emotional Reasoning Knowledge for Social Intelligence Question-Answering. In *Proceedings of the IEEE/CVF International Conference on Computer Vision* (pp. 3075-3081). (*Oral Presentation*)
2. **Xie, B.**, & Park, C. H. (2023, March). "Can You Guess My Moves? Playing Charades with a Humanoid Robot Employing Mutual Learning with Emotional Intelligence. In *Companion of the 2023 ACM/IEEE International Conference on Human-Robot Interaction* (pp. 667-671).
3. **Xie, B.**, & Park, C. H. (2021). A MultiModal Social Robot Toward Personalized Emotion Interaction. *arXiv preprint arXiv:2110.05186*. (**submitted to AAAI 2021 Fall Symposium**)
4. **Xie, B.**, & Park, C. H. (2021, July). Empathetic robot with transformer-based dialogue agent. In *2021 18th International Conference on Ubiquitous Robots (UR)* (pp. 290-295). IEEE.
5. **Xie, B.**, & Park, C. H. (2020, March). Dance with a Robot: Encoder-Decoder Neural Network for Music-Dance Learning. In *Companion of the 2020 ACM/IEEE International Conference on Human-Robot Interaction* (pp. 526-

528).

Patent

1. Milam, G., **Xie, B.**, Park, C. H., “Real Time Automated Nerve Identification System.” International Publication No. WO2023/183930, published on 9/28/2023.

ACADEMIC SERVICES

Reviewer for Journals

- IEEE Transactions on Cybernetics
- Frontiers in Robotics and AI
- International Journal of Human-Computer Interaction

Reviewer for Conferences

- ACM/IEEE International Conference on Human Robot Interaction (HRI)
- International Conference on Robotics and Automation (ICRA)
- IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- International Conference on Robot and Human Interactive Communication (RO-MAN)
- International Conference on Ubiquitous Robots (UR)
- AAAI 2021 Fall Symposium
- Joint 12th IFAC Conference on Control Applications in Marine Systems, Robotics, and Vehicles 1st IFAC Workshop on Robot Control (Joint CAMS and WROCO 2019)

JOBS & INTERNSHIPS

The George Washington University, Washington, DC, U.S.A.

Graduate Research Assistant

06/2020 – Present

- Research focuses on collaborative innovation between human intelligence and robotic technology.

Graduate Teaching Assistant

09/2018 – 05/2020

Shenzhen JBT Smart Lighting Co., Ltd., Guangdong, China

07/2015 - 08/2015

Intern

- Mastered the circuit design principle and designed the application of power circuit of LED lamps and lanterns.

Shenzhen Marine Shipping & Engineering Service Co., Ltd., Guangdong, China

07/2014 - 08/2014

Intern

- Learned various shipping operations, the agency business of shipping equipment, and the underwater robot.

TEACHING EXPERIENCE

Teaching Assistant, the George Washington University

SEAS 1001 Engineering Orientation

09/2019 - 05/2020

- Instructed students to use MATLAB to analyze data and use the symbolic toolbox to solve differential equations.

BME 2825 Biomedical Engineering Programming II

09/2018 - 05/2019

- Instructed and helped undergraduate students understand the fundamentals of C programming with a focus on biomedical engineering problems.

Mentor, 2019 George Hacks Medical Solutions Hackathon

01/2019

- Assisted the participants in the Hackathon to analyze and realize their ideas of innovation.

Undergraduate Group Project Advisor, Shenzhen University

04/2016 - 07/2016

- Organized and advised student group projects for the Challenge Cup competition.

AWARDS & ACCOMPLISHMENTS

- 2022 Collins Distinguished Doctoral Fellowship in the Department of Biomedical Engineering at the GWU
- 2022 GW Technology Commercialization Innovation Competition (**Audience's choice posters Prize**)
- 2021 Collins Distinguished Doctoral Fellowship in the Department of Biomedical Engineering at the GWU
- 2016 A Hundred Excellent Final Year Theses Prize in Shenzhen University
- 2015 Shenzhen University Challenge Cup University Student Venture Contest (**2nd Prize**)
- 2014 Laboratory Open Fund Project of Shenzhen University (**3rd Prize**)

PRESENTATIONS

Oral Presentation

- 2023 IEEE/CVF International Conference on Computer Vision (ICCV) Workshops at Paris, France** 10/2023
Multi-Modal Correlated Network with Emotional Reasoning Knowledge for Social Intelligence Question-Answering
- 2022 BME Day in the Department of Biomedical Engineering at the GWU** 11/2022
Empathetic Robotic Companion with Personalized Social Games
- 2021 the Artificial Intelligence for Human-Robot Interaction AAAI Fall Symposium (online)** 11/2021
A Multimodal Social Robot Toward Personalized Emotion Interaction ([Link](#))
- 2020 ACM/IEEE International Conference on Human-Robot Interaction (online)** 04/2020
Dance with a Robot: Encoder-Decoder Neural Network for Music-Dance Learning ([Link](#))

Poster Presentation

- 2023 GW SEAS R&D Showcase at the GWU** 04/2023
Empathetic Robotic Companion with Personalized Social Games
- 2023 ACM/IEEE International Conference on Human-Robot Interaction at Stockholm, SE** 03/2023
"Can You Guess My Moves?" Playing Charades with a Humanoid Robot Employing Mutual Learning
- 2022 GW Technology Commercialization Innovation Competition at the GWU** 05/2022
AI-Driven Real-time Nerve Detection and Visualization for Surgical Precision ([Link](#))
- 2021 18th International Conference on Ubiquitous Robots (online)** 07/2021
Empathetic Robot with transformer-based dialogue agent
- 2019 Biomedical Engineering Society (BMES) Annual Meeting at Philadelphia** 10/2019
Deep Spectrogram Learning of Emotional States in Music and Application to ASD Therapies
- 2019 Research and Development Showcase at the GWU** 10/2019
Virtual Reality for Children with Autism
- 2019 Research Day at the GWU** 04/2019
Physiological Analysis and Modeling of Stress during Human-UAV interaction
- 2018 GW SEAS R&D Showcase at the GWU** 02/2018
PTA. BOT: A SAR Physical Therapy Assistant for Cardiac Rehabilitation Patients

SKILLS

- **Programming:** Python, MATLAB, C/C++, C#
- **Computer Skills:** Linux/Ubuntu, Latex, Microsoft Office (Word, Excel, PowerPoint)
- **Simulation:** MATLAB Simulink, Choregraphe (SoftBank), ROS, SolidWorks
- **Framework:** Pytorch, OpenCV, HuggingFace, OpenPose, Pandas, Scikit-learn, Numpy
- **Hardware:** Pepper/Nao Robot, Jetson Nano, Arduino, Raspberry Pi
- **Language:** English (Proficiency), Chinese (Native)