BAIJUN XIE

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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, 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: Human-Robot Interaction, Machine Learning, Robotics, Artificial Intelligence

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

Graduate Research Assistant *09/2018 – Present*

Empathetic Robotic Companion for Human-Robot Interaction (HRI)

- Achieved the personalization of the robot agent by employing deep reinforcement learning algorithms with a personalized empathetic reward function.
- Designed HRI scenarios for autistic adolescents and provided intervention that aim to alleviate stress and depression.
- Introduced an affective model to a robotic system's conversational agent to provide natural and empathetic conversation.
- Developed and investigated a multimodal emotion recognition framework for estimating the affective states during HRI.
- Programed on a humanoid robot and achieved multiprocessing to run several deep learning techniques simultaneously.

Microrobots with Haptic Control

- Investigated using reinforcement learning algorithms to apply guidance force for obstacle avoidance when the user is controlling the microrobots.
- Developed control algorithms for solving time-delay issues when remotely controlling the robots in a microscale environment and designed a simulated environment with a haptic device in the local machine.

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

- Developed and implemented a trainable EKF for the localization of ground vehicles.
- Improved the performance of the EKF with a developed attention-based convolutional neural network (CNN) module by fusing the inputs from IMUs.

Deep Learning for Nerve Identification

- Segmented nerve tissues from birefringence medical images by using our developed deep learning model based on U-Net architecture with a transformer-based fusion module.
- Analyzed the effects of the multimodal fusion module in assisting nerve identification.

Deep learning for Musical Emotion Recognition

- Extracted novel spectral features based on a sinusoidal model.
- Employed principal component regression, partial least squares regression, and CNN models to predict the levels of affective states, including arousal and valence.

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

Graduate Researcher *02/2017 - 05/2018*

Multi-Domain Search and Rescue using Cooperative Robots

- Utilized a model-based least squares pose estimation method to predict the pose of the ground robot.
- Achieved the communication between the Raspberry Pi and the Arduino ground robot by using Xbee.
- Trained custom CNN model detector for recognizing the ground robot.
- Designed and simulated a position controller for the Asctec quadrotor.

Practical Numerical Methods with Python for Shallow Water Equations (SWEs)

- Achieved 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. (Demo: SWEs Simulation)

Shenzhen University, Guangdong, China

Undergraduate Researcher *10/2014 - 05/2016*

Design of Perovskite Solar Cells

- Designed an efficient perovskite solar cell with a nano-micro hole transporting layer using the 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 the single-chip microcomputer.
- Programed the automation control for a small intelligent car to collect several 2D images and upload them to the 3D modeling cloud platform to process cloud modeling.

Laboratory Open Fund Project of Shenzhen University

- Used MATLAB to dynamically simulate joint Fourier transform correlation recognition processing.
- Designed 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).
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 Reviews: 3

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

Reviewer for Conferences Reviews: 25

- 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 & INTERNSHIP

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 and spans machine learning, computer vision, haptics, and telepresence robotics.

Graduate Teaching Assistant *09/2018 – 05/2020*

Shenzhen JBT Smart Lighting Co., Ltd., *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., *07/2014 - 08/2014*

Business Assistant Intern

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

TEACHING EXPREIENCE

Teaching Assistant *at the GWU*

SEAS 1001 Engineering Orientation *09/2019 - 05/2020*

- Introduced careers in engineering and computer science knowledge for freshman undergraduates.
- 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.
- Mentored students learn the use of data structures, pointers, and linked lists.

Mentor *at 2019 George Hacks Medical Solutions Hackathon* *01/2019*

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

Undergraduate Group Project Advisor *at Shenzhen University* *04/2016 - 07/2016*

- Organized student's group project for the Challenge Cup competition and advised them to use Arduino and Raspberry Pi to build an autonomous car robot with multiple sensor feedback.
- Instructed undergraduate students on the hardware and software structure of the project.

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 with Emotional Intelligence

2022 GW Technology Commercialization Innovation Competition *at the GWU* *05/2022*
AI-Driven Real-time Nerve Detection and Visualization for Surgical Precision

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, Keras
- **Hardware:** Pepper/Nao Robot, Jetson Nano, Arduino, Raspberry Pi
- **Language:** English (Proficiency), Chinese (Native)