LIU Jiahang

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Research Interests: Human–Robot Interaction, Dexterous Teleoperation, Robotics, Computer Vision, Multimodal Fusion

EDUCATION

Dalian University of Technology **Dalian, China**
B.Eng in Mechanical Design, Manufacturing and Automation *2020.09 – 2024.07*
GPA: 3.35 / 4.00 (83.5 / 100) | **Award:** Social Practice Scholarship

Dalian University of Technology **Dalian, China**
M.S. Student in Mechanical Engineering, School of Mechanical Engineering *2024.09 – 2027.07*

University of Tokyo **Tokyo, Japan**
Special Research Student, Mechanical Engineering, Graduate School of Engineering *2025.10 – 2026.04*

PUBLICATIONS

- **Liu J.**, Li Z., Le R., et al. "Precise Hand-Arm Teleoperation of a Dexterous Robotic Manipulator via Markerless Vision and High-Density sEMG Fusion." *IEEE Robotics and Automation Letters*, 2025, 11(2), 1938–1945.
- Ying Z., Zhang W., **Liu J.**, et al. "VEMG-TeleGrasp: A Stiffness-Aware Teleoperation Framework for Dexterous Manipulation via Multimodal Fusion." *IEEE/ASME Transactions on Mechatronics*, 2026. Accepted.

EXPERIENCE

Continuous Multi-Joint Hand Angle Estimation via Single RGB Image and High-Density sEMG Fusion
Dalian University of Technology / University of Tokyo ***(manuscript in preparation)*** *2025.09 – present*

- Proposed a vision-EMG fusion framework for continuous estimation of 20 hand joint angles, addressing the limitations of single-modality methods: vision-based approaches are vulnerable to occlusion, while sEMG-based methods often lack spatial precision.
- Designed a DoF-query Transformer decoder that uses learnable joint-specific queries to attend to EMG temporal tokens encoded by a Transformer and visual spatial tokens extracted by a ViT encoder, enabling specialized representation learning for individual hand joints.
- Built a synchronized data acquisition and processing pipeline to collect RGB images, high-density sEMG signals, and ground-truth joint angles obtained from a Vicon optical motion capture system.

Precise Hand–Arm Teleoperation System via Markerless Vision and High-Density sEMG Fusion
Dalian University of Technology *2024.09 – 2025.07*

- Developed a markerless vision-based hand tracking method to estimate global hand position and angles from an RGB-D camera, validated against Vicon optical motion capture ground truth.
- Proposed a dual-input CNN fusion model that combines markerless hand keypoints and high-density sEMG signals for hand gesture recognition, achieving higher accuracy than single-modality baselines.
- Designed a hybrid finger-force regression network based on 1D-CNN and Bi-LSTM to estimate finger interaction forces during grasping tasks, enabling adaptive manipulation of fragile objects.
- Built a wireless hand-arm teleoperation system in ROS2, enabling real-time mapping of hand posture, gestures, and grasp force to a robotic manipulator through multimodal RGB-D and EMG inputs.

A Distributed High-Density sEMG-driven Soft Glove System for Stroke Rehabilitation
Dalian University of Technology (Bachelor graduation thesis) *2023.10 – 2024.07*

- Developed a pneumatic soft rehabilitation glove system using Arduino, enabling independent finger flexion and abduction.
- Designed a high-density sEMG acquisition sleeve and optimized electrode placement based on sEMG energy distribution mapping and impedance analysis.
- Implemented and evaluated multiple machine learning and deep learning models for EMG-based hand gesture classification, ultimately adopting a PSO-optimized neural network to classify five hand gestures.

Industrial & Mechanical Structure Design
Design Director, Venture Electronics, Shenyang, China (High Definitive Audio Amplifier and DAC) *2021.09 – present*
Product Manager, Dalian University of Technology (Wireless High-Density sEMG acquisition system) *2023.11 – present*

SKILLS

Languages: Mandarin (Native); English (CET6: 535)
Programming: MATLAB, Python, PyTorch, PyTorch Lightning, OpenCV, ROS2
Design Software: Curved surface modeling (Rhino), Engineering modeling (Inventor), Rendering (KeyShot)
Interests: Soccer, HiFi, Singing, Billiards, Coffee