Songpengcheng Xia (夏宋鹏程)

✆ Tel: +86 18162273736 ✉ Email: songpengchengxia@sjtu.edu.cn ☞ Website: https://xspc.github.io/
☆ Birthday: 1998.03.16 ☎ Wechat: xs18162273736

Educational Background

- **Shanghai Jiao Tong University (SJTU)** 2019.06–2025.03 Ph.D.
  - **Ph.D. in Information and Communication Engineering** (Cumulative GPA: 3.91/4.00 | Major GPA: 3.8/4.0)
  - PhD Thesis: Wearable-based human activity recognition and motion estimation (Supervisor: Prof. Ling Pei)
  - Main Research: Motion Capture from Sparse Observations (utilizing IMUs/VR/Radar technologies), Weakly-supervised Activity Segmentation, and Motion Analysis for Health purposes
- **Wuhan University (WHU)** 2015.09–2019.06 B.E.
  - **Bachelor of Navigation Engineering** (GPA: 3.9/4.0 Top-1%)
  - **Finance** (Minor Degree, GPA: 3.75/4.0)
  - Main Research: Inertial navigation, Kalman filtering, Information fusion.
  - Main Course: Optimal estimation, Inertial navigation principle, International finance, etc.

Research Interests

- **My main areas of study include the following:**
  - **My research primarily focuses on the challenges in human motion perception and understanding, robotics, and embodied intelligence.**
  - **Full-body Motion Capture from Sparse Observations**
    - **Human Motion Estimation with Sparse Inertial Sensors (DynaIP):** Research using six IMUs to estimation full-body motion in real-time via deep learning models. The core challenge is modeling local dynamic body characteristics and leveraging acceleration information to enhance motion reconstruction performance for challenging activities. [**CVPR 2024**]
    - **Motion Estimation Using Sparse Tracking Signals from VR device (EnvPoser):** Research focused on estimating full-body motion using tracking signals from a head-mounted display (HMD) and hand controllers. This approach addresses the challenge of missing lower-body observations in VR-based scenarios and constrains full-body motion reconstruction with pre-scanned local scene point clouds from the HMD. [**1 Submission to CVPR 2025, Project with PICO**]
    - **Full-Body Motion Estimation from Sparse Millimeter-Wave Point Clouds (mmBAT, mmDEAR):** Leveraging the privacy and non-contact advantages of millimeter-wave radar, this research addresses the challenges posed by sparse and heterogeneous point clouds for motion reconstruction tasks. We integrate body tracking modules and point cloud enhancement techniques to achieve full-body motion posture estimation based on millimeter-wave data. [**ICASSP2024, 1 Submission to ICRA2025**]
  - **Human Activity Segmentation and Recognition with Wearable Sensors**
    - **Mixed-Reality Human Motion Recognition with Wearable Sensors (MARS):** Research focuses on virtual-to-real transfer learning (pre-training, fine-tuning, and domain adaptation) to ensure robust and accurate recognition on real-world data, particularly under the condition of limited annotated real-world activity samples. [**IEEE IOT-J & TIM**]
    - **Activity Segmentation for Continuous Sensor Data Streams (BASR, TASR):** To tackle the challenges of window-based multi-class classification and over-segmentation in human activity recognition, this work proposes a joint activity segmentation and recognition framework that excels in both fully supervised and weakly supervised settings. [**IEEE TII & TMC**]
  - **Human Motion Understanding and Analysis for Health Purposes**

    - Motion Recognition and Early Warning Methods for Mental Disorder Groups (SMART): This project builds a dataset for recognizing abnormal behavior in special populations. We enhance the understanding of human-scene interactions via a scene perception module, enabling accurate identification and early warning of abnormal behaviors. [**IEEE IOT-J, Lead this project**]
    - **Sarcopenia Risk Diagnosis Based on Wearable Sensing of Gait and Speed:** This project uses wearable sensors to analyze gait and walking speed for assisting in the diagnosis of sarcopenia. [Collaborative Project with Hospital]
    - **Motion Semantic Understanding with Large Language Models:** This research encodes wearable sensor or millimeter-wave point cloud data and aligns it with text encoding, enabling the acquisition of human motion semantic information through sparse sensing for motion health analysis. [**Ongoing**]
  - **Spatial Perception for Humanoid Robotics and Embodied Intelligence**
    - Remote Operation of Humanoid Robots Based on Sparse Inertial/VR Motion Capture. [**Collaborative Project with ByteDance**]
    - Human/Robot Interaction with Dynamic Objects Using First-Person View Images and Inertial Sensors. [**Ongoing**]
    - 3D Reconstruction Algorithms Based on Implicit Neural Radiance Fields (Nerf) - Lidar & Infrared Imaging. [**Project participants, ICCV 2023 & IROS 2024**]
    - Depth Estimation and Scene Reconstruction Algorithms Based on 360° Images. [**Project participants, 1 Submission to CVPR 2025**]
    - Autonomous Robot Multi-Sensor Fusion Localization Using Lidar/Visual/Inertial/GNSS Data. [**Project participants, Sensors Journal & 1 Submission to TIM**]

- Google scholar profile: https://scholar.google.com/citations?hl=zh-CN&user=l0pLaAIAAAAJ
- Citation: 282, H-index: 7 (updated at 2024.12.01)

First Author Papers

- [**Transactions on Mobile Computing(TMC)**] Timestamp-supervised Wearable-based Activity Segmentation and Recognition with Contrastive Learning and Order-Preserving Optimal Transport
- [**CVPR 2024**] Dynamic Inertial Poser (DynaIP): Part-Based Motion Dynamics Learning for Enhanced Human Pose Estimation with Sparse Inertial Sensors
- [**Transactions on Industrial Informatics(TII)**] A Boundary Consistency-aware Multi-task Learning Framework for Joint Activity Segmentation and Recognition with Wearable Sensors
- [**Transactions on Instrumentation and Measurement(TIM)**] Learning Disentangled Representation for Mixed-Reality Human Activity Recognition with a Single IMU Sensor
- [**IEEE Internet of Things Journal(IOTJ)**] MARS: Mixed Virtual and Real Wearable Sensors for Human Activity Recognition With Multidomain Deep Learning Model
- [**Globecom 2022**] Multi-level Contrast Network for Wearables-based Joint Activity Segmentation and Recognition
- [**Journal of Chinese Inertial Technology**] High realistic multi-sensor fused positioning simulation based on GNSS hardware-in-loop
- [**Under Review-CVPR2025**] EnvPoser: Environment-aware Realistic Human Motion Estimation from Sparse Observations with Uncertainty Modeling
- [**Under Review-ICRA2025**] Suite-IN: Aggregating Motion Features from Apple Suite for Robust Inertial Navigation
- [**Under Review-ICRA2025**] mmDEAR: mmWave Point Cloud Density Enhancement for Accurate Human Body Reconstruction

Main Co-author Papers

- [**IROS 2024**] Thermal-NeRF: Neural Radiance Fields from an Infrared Camera
- [**ICASSP 2024**] MMBaT: A Multi-task Framework for mmWave-based Human Body Reconstruction and Translation Prediction
- [**ICASSP 2024**] A Learning-based multi-node fusion positioning method using wearable inertial sensors
- [**ICCV 2023**] Nerf-loam: Neural implicit representation for large-scale incremental lidar odometry and mapping
- [**IEEE Sensors Journal**] Attention-SLAM: A visual monocular SLAM learning from human gaze
- [**IEEE Sensors Journal**]P3-LOAM: PPP/LiDAR Loosely Coupled SLAM With Accurate Covariance Estimation and Robust RAIM in Urban Canyon Environment

Internship Experience

- **Zhongou Asset Management** *Quantitative Research Intern* 2023.06 – 2023.08
  - Research Project: Event-driven quantitative stock selection strategy.
  - Key Responsibilities: Conducted research on leveraging alternative financial data such as analyst reports, company announcements, and industrial chain networks. Applied deep learning algorithms (Transformer, FinBERT, TCN, Graph Neural Networks, etc.) to extract textual information and develop stock selection strategies.

Honors & Awards

- **Ph.D. National Scholarship** 2022
- **Wuhan University Top1% Award** 2019
- **Outstanding Graduates** 2019
- **National Scholarship** 2018

Others

- **Services** Reviewers for ICRA, IROS, RAL, IEEE Sensor Journal, TIM, TII, etc.
- **Interests** Badminton, Basketball, Saxophone.