ZIXUN (SEAN) HUANG

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SUMMARY

I am a graduate student researcher at FHL Vive Center, leading the OpenARK team at the EECS Dept at UC Berkeley, advised by the director Dr. Allen Y. Yang. My research interests focus on achieving robust machine perception and more trustworthy autonomous systems adept at executing complex tasks under our dynamic and noisy living environments.

Formerly, I gained experience in the AEC industry and obtained my bachelor's from Zhejiang University, where I managed a robotic fabrication lab and assisted in hosting seasonal undergrad courses and seminars to introduce robotic automation into architectural education.

SUPPLEMENTARY

Portfolio Website And LinkedIn.
- https://huangzixun.com/ (RECOMMEND)
- https://www.linkedin.com/in/zixunhuang/

Videos.
- Robotic Carbon-Fiber Weaving System: https://youtu.be/bJ-8Ytwos4I/ (RECOMMEND)
- Automatic Discrete Construction with Drones: https://youtu.be/d-jheGgC-4k/ (RECOMMEND)
- Robotic Mass Customization with 3D Clay Printing: https://youtu.be/WWiFGQ9dVF4/
- Autonomous Resin Shaping: https://youtu.be/sSoAwbiJ7dw/ (real-world data exploration)

EDUCATION

University of California, Berkeley

Master's Degree, College of Engineering, GPA: 4.0 (CS-related) / 4.0   Dec. 2023
- **Specialized In:** AR Perception, advised by Dr. Allen Y. Yang
- **Relevant Courses:** Computer Vision; Reinforcement Learning; Computational Photography; Deep Neural Network; GenAI & LLM.

Zhejiang University

Bachelor's Degree, School of Architecture and Civil Engineering   Jun. 2020
- **Specialized In:** Architectural Robotics
- **Relevant Courses:** Calculus (I, II, III); Linear Algebra; Ordinary Differential Equations; Wireless Network; Image Analysis and Processing; C Programming; Architectural Robotics; Architectural Mechanics and Building Structure (I, II, III, IV).

PUBLICATIONS

1. **Zixun H.***, Keling Y.*, Seth Z.*, Chuanyu P.*, Tianjian X., Weiyu F., & Allen Y. "Robust Digital-Twin Localization via An RGBD-based Transformer Network and A Comprehensive Evaluation on a Mobile Dataset," *In submission to IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)*, 2023. [preprint]

2. **Zixun H.**, Yukun S., Kathy Z., Rui L., Zoe Z., Jet S., Jackson G., & Allen Y. "Recalling the Robust Digital-Twin Localization on a Non-Rigid Moving Robot Dataset," *In presentation at FHL Vive Center Gala*, 2023. [poster]

3. Xinwei Z.*, **Zixun H.***, Wentao Z., & Luisa C. "MARL: Multi-scale Archetype Representation Learning for Urban Building Energy Modeling," *In Proceedings of the IEEE/CVF International Conference on Computer Vision Workshops (ICCVW)*, 2023. [paper]

4. Xinwei Z.*, **Zixun H.***, Wentao Z., & Luisa C. "Encoding Urban Ecologies: Automated Building Archetype Generation through Self-Supervised Learning for Energy Modeling," *In Conference on Association for Computer Aided Design in Architecture (ACADIA)*, 2023. [paper]

5. Weishun X., & **Zixun H.** "Robotic Fabrication of Sustainable Hybrid Formwork with Clay and Foam for Concrete Casting," *In XXIV International Conference of the Iberoamerican Society of Digital Graphics (SiGraDi)*, 2020. [paper]

6. Sihan W., Kunsheng H., **Zixun H.**, Michele S., Weishun X., & Felix R. "Fabrication of Topology Optimized Concrete Components Utilizing 3D Printed Clay Mould," *In Proceedings of International Association for Shell and Spatial Structures (IASS)*, 2019. [paper]

AWARDS & RECOGNITION

Awards & Scholarships.

1. MIT Reality HACK 2023 Winner - Spatial Audio Track   2023
   Massachusetts Institute of Technology

2. MDes Distinguished Scholar Award ($8962)   2022, 2023
   Jacobs Institute of Design Innovation, University of California, Berkeley

3. Excellent in Student Research Training Project   2018
   School of Civil Engineering and Architecture, Zhejiang University

4. ZJU Merit-based Scholarship   2016
   School of Material Science and Engineering, Zhejiang University

5. Provincial Third Division of the National High School Mathematics League 2015
   Zhejiang Province, China

Invited Talks.

6. A010125: From Robotic Fabrication to 3D Scene Understanding Oct. 2023
   (Online Talk) Dept. of Architecture, Xi'an University of Architecture and Technology

7. Design@Large Panel: Landing a Research Position Sep. 2023
   Jacobs Institute of Design Innovation, University of California, Berkeley

8. Architectural Robotics: From Design to Construction Nov. 2019
   College of Civil Engineering and Architecture, Zhejiang University

Featured in Press.

9. Shrine of Whatslove. *Domus* [link] Jul. 2019

10. Red triangle robotically woven carbon-fiber structure. *ARCH20* [link] May. 2019

11. Structure woven with a red triangle made entirely of carbon fiber. *metalocus* [link] Mar. 2019

12. Shrine of Whatslove / Wutopia Lab. *ArchDaily* [link] Mar. 2019

13. China's first all carbon-fiber structure designed architecture. *Gooood* [link] Mar. 2019

RESEARCH EXPERIENCE

LLM-Enhanced Spacesuit Interface

Algorithm Lead and HMD Dev Co-Lead Dec. 2023 - Present
NASA SUITS Challenge (Ongoing) *Lyndon B. Johnson Space Center*

- Developed the 3D visual perception using template matching and PnP methods to offer astronauts accurate and robust AR interactions with moving robots and UIA panels.
- Implementing the speech recognition to enable a fully voice-controlled interface and to ensure astronauts can have hands-free operation; integrating a RAG-enhanced LLM chat channel to help astronauts get timely advice.

Robust Millimeter-Level Perception

Lead Graduate Researcher in Computer Vision (supervised by Dr. Allen Y. Yang) Sep. 2022 - Present
FHL Vive Center, EECS Dept. *University of California, Berkeley*

- Lead-authored a novel 3D object localization algorithm, fusing RGB and LiDAR-depth data based on self-attention modules; achieved SOTA accuracy based on robust estimation results in mobile AR scenarios involving real-world non-Gaussian depth noise.
- Introduced a Fourier-transform enhanced filtering module into 3D perception tasks, designed to rectify inherent sensor-level measurement errors in a learning-based manner.
- Developed a digital-twin tracking dataset featuring rigid daily objects and non-rigid moving robots (*e.g.*, rovers, drones and robotic arms) captured with an optical motion capture (MoCap) system and multi-type depth sensors (*e.g.*, ZED stereo sensing, iPhone LiDAR).

Efficient Building Energy Estimation

Student Researcher in Machine Learning (supervised by Prof. Luisa Caldas) May. 2023 - Sep. 2023
Immersive Design Club, XR Lab *University of California, Berkeley*

- Co-first authored an efficient VQAE-based method for energy modeling with residential buildings' latent embedding and clustering, reducing the computation time by 133.7 times for NYC's residential energy consumption estimation.

Cloud Design Computation

Research Assistant, Hybrid (supervised by Prof. Hao Zheng) Jun. 2020 - Jul. 2022
Architectural Intelligence Group *City University of Hong Kong*

- Developed a scalable and efficient backend server for the deployment of a learning-based bionic aerofoil 3D structure generation algorithm; the related work was published in *Advanced Science*[1].
- Hand-crafted a cloud urban computing platform with GAN-based heatmap generation and automated urban data crawling for multi-type city perception (*e.g.*, vehicle travel demand) simulations.

Robotic Mass Customization

Lead Student Researcher in Robotic Manufacturing Dec. 2018 - Jun. 2020
Robotic Fabrication Lab *Zhejiang University*

- Authored a rapid additive manufacturing system using high-torque stepper motors, Arduino, and KUKA Robots, designed for the 3D printed clay mold of topology-optimized concrete components.
- Authored an efficient mass customization method, utilizing 3D clay printing and robotic hot-wire cutting, with a comprehensive efficiency evaluation on casting mold manufacturing; enabled robotic non-planar printing with KUKA PRC.

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[1]Zheng, Hao, et al. "Dragonfly-Inspired Wing Design Enabled by Machine Learning and Maxwell's Reciprocal Diagrams." Advanced Science 10.18 (2023): 2370111.

Autonomous Resin Shaping Jul. 2019 - Sep. 2019

2019 Digital Architecture Design Association International Summer Campus (with Dr. Dan Luo) *Tsinghua University*

- Experimented 3D printing in the air where the resin drops and solidifies under the force of gravity; automated image capturing and processing for real-world expert data exploration; trained actors with imitation learning and inverse reinforcement learning to predict robotic behaviors (*e.g.*, end-effector's extrusion speed, robotic arm's motion speed and dwell time).

Automatic Discrete Construction with Drones May. 2019 - Jul. 2019

2019 DigitalFUTURES Summer Workshop (with Prof. Xiang Wang) *Tongji University*

- Developed distributed construction with 2 drones collaborating on gripping and stacking building components; crafted drones from Raspberry Pi, PX4, and 3D printed hardware, etc; developed a visual 3D way point planning interface by seamlessly incorporating the tracking of drones (via MoCap) and their control (via ROS) into Grasshopper3D (via WebSocket).

PROFESSIONAL EXPERIENCE

3D Software Engineer, Server-end Development Lead Jun. 2021 - Apr. 2022

INSOME Technology Co. Ltd *Shenzhen, China*

- Developed a modular building information management (BIM) system from 0 to 1; enabled efficient and scalable structure customization with real-time 3D visualization; achieved an immersive user experience built on Android using Unreal Engine and Blueprints.

Product & Technology Development Lead Jan. 2021 - May. 2021

Hezhu Digital Technology Co. Ltd *Shanghai, China*

- Led and prototyped an urban sustainability mapping system from 0 to 1; enabled cost management and carbon emission optimization for urban design evaluation; specified application into launched urban planning projects.

Robotics Engineer Intern Dec. 2018 - May. 2019

RoboticPlus.AI *Shanghai, China*

- Developed a carbon-fiber weaving and a resin curing system involving mechanical design, KUKA Robot programming, and 3D printed hardware modeling, etc; parameterized the robotic weaving behaviors and generated the simulation for the robotic construction process on all woven modules; applied computer vision using YOLO and OpenCV to reduce robot's collisions caused by flexure and deformation of woven anchors subjected to significant stress.
- Designed and fabricated China's first all-carbon fiber pavilion; achieved the 4-meter high and 3.8-meter wide entire structure weaved with a continuous line of carbon-fiber; density of the structure is controlled at 18KG per cubic meter and the bearing capacity of 400KG is achieved.

TEACHING & LEADERSHIP

Graduate Student Research Mentor Sep. 2023 - Present

FHL Vive Center for Enhanced Reality *University of California, Berkeley*

- Held weekly work sessions and weekly meetings for OpenARK; led regular progress updates and reviews to move research projects forward; held tutorial sessions for new members.
- Led LLM Rover team and held weekly work sessions with UIUX and software team in 2024 NASA SUITS Challenge; managed timelines and checkpoints using Notion / Notion Calendar to ensure team-wise collaboration.
- Mentored Yukun S., Kathy Z., Zoe Z., and Rui L. (Master of Engineering students) on MoCap system and RGBD camera calibration, 3D scanning, and CAD model reconstruction; mentored Jackson G. (5th-year M.S. in CS) in understanding and designing 6DoF pose estimators; supervised Helena S. and Aaron Z. (EECS undergraduates) on AR-enhanced interface for Mars navigation, preparing for the Phrase 2 of 2024 NASA SUITS challenge.

Workshop Teaching Assistant Apr. 2021 - Jul. 2021

The 3rd International Conference on Computational Design and Robotic Fabrication (with Prof. Hao Zheng) *Tongji University*

- Instructed over 100 designers (about 50 in on-site sessions and 50 online) in multi-modal urban data crawling and GAN-based network training; co-designed the workshop syllabus; delivered talks on learning-based urban computing; developed starter codes; prepared and conducted tutorials, etc.

Head Teaching Assistant Spring 2019, Spring 2020

Course: 12195900 Computational Design & Robotic Fabrication *Zhejiang University*

- Conducted course lab sessions with KUKA Robots, Arduino, and Grasshopper3D; worked with students closely to help them develop problem-solving capabilities; reviewed and updated reading materials; held weekly office hours to assist students in mastery of the materials.

Undergrad Student Lecturer Fall 2019

Course: 12122800 Architectural Robotics *Zhejiang University*

- Designed and taught an undergrad course on the intersection of robotics and architectural construction; topics include non-planar 3D clay printing and robotic hot-wire cutting, etc; course approved by the Dean of Architecture Department.

SKILLS

Programming:	Python, C/C++, MATLAB, Java, C#, JavaScript, HTML, CSS, Shell Script, LaTeX.
Frameworks & Tools:	PyTorch, OpenCV, Open3D, ROS, CUDA, TensorRT, ARKit, Nginx, MySQL, AWS, Django, React.
3D Modeling Tools:	Unity, Unreal Engine, Blueprints, Blender, Rhinoceros, Grasshopper3D, Solidworks.
Hardwares:	OptiTrack, LiDAR, KUKA Robots, Stereo Cameras, Raspberry Pi, Arduino, Meta Quest, HoloLens.

REFERENCE

From Civil & Env. Engineering

Dr. Hao Zheng
Assistant Professor
City University of Hong Kong

From Computer Science

Dr. Allen Y. Yang
Director, FHL Vive Center
University of California, Berkeley