

Tianyi Hu

Ph.D. student in Electrical & Computer Engineering
Duke University

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[Github](#)

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Education

- **Duke University** Durham, USA
Ph.D. student in Electrical & Computer Engineering 2022 - Now
 - **Advisor:** Prof. Maria Gorlatova, Intelligent Interactive Internet of Things Lab
 - **Research Interests:** Simultaneous Localization and Mapping, Edge Computing, Augmented Reality
 - **GPA:** 3.93/4.00
- **University of California, Irvine** Irvine, USA
M.S. in Computer Engineering 2020 - 2022
 - **Advisor:** Prof. Nikki Dutt
 - **Research Interests:** Edge Computing, Resource optimization, Deep Reinforcement Learning
 - **GPA:** 3.95/4.00
- **University of Edinburgh** Edinburgh, UK
2+2 Dual Bachelor's Degree: B.Eng(Hons, first class) Electronics & Computer Science 2018 - 2020
 - **GPA:** 3.78/4.00
- **South China University of Technology** Guangzhou, China
2+2 Dual Bachelor's Degree: B.Eng Information Engineering 2016 - 2018
 - **GPA:** 3.54/4.00

Recent Research Experience

- **SLAM pose error estimation project** Durham, USA
Research Assistant at [Intelligent Interactive Internet of Things Lab](#), Duke University Aug. 2022 - Now
 - This work will be presented in **ACM MobiCom 2023 Demo Session**.
 - Implement a feature collection module using **C++** and **multi-threading** on top of ORB-SLAM3 to collect internal status at runtime with low overhead.
 - Design an **attention-based neural network** to estimate SLAM pose error using the collected SLAM internal status and sensor input as **multivariate time series**.
 - Use **Unity** game engine to create a 3D emulator to evaluate the model in virtual environments.
 - Achieve a $RMSE \leq 0.085m$, outperform related work, which uses random forest regression, by 38.8%.
 - Supervisor: Prof. Maria Gorlatova
- **Surgical gesture recognition in AR-assisted Neurosurgery Training** Durham, USA
Research Assistant at [Intelligent Interactive Internet of Things Lab](#), Duke University Aug. 2022 - Now
 - Train and deploy a **CNN+GRU** model on **Nvidia Jetson Xavier NX** to recognize surgeon's hand gestures using 3D landmarks collected from AR headset and motion capture system.
 - Conduct 15 user studies with data collection and labeling for model training and evaluation.
 - Achieve a classification accuracy score of 0.76 and an F1 score of 0.77 on AR Neurosurgery consisting of four gestures in the external ventricular drain procedure.
 - Supervisor: Prof. Maria Gorlatova
- **Online learning for end-edge-cloud system orchestration** Irvine, USA
Research Assistant at [Dutt Research Group](#), University of California - Irvine June. 2021 - June. 2022
 - This work is presented in **IEEE TECS 2022, IEEE ISQED 2022, IEEE ICCD 2022**.
 - Exploit and train **deep reinforcement learning** (Deep Q Learning, Deep Dyna-Q Learning) to optimize task allocation in **end-edge-cloud system**, which jointly consider CPU utilization, available memory, and network bandwidth.
 - Achieve significant reduction in computation and number of interactions required to learn an optimal offloading policy (4.4x and 9.4x, respectively) compared with related works.
 - Supervisor: Prof. Nikil Dutt, Dr. Sina Shahhosseini

• [Patient Initiated Controlled Analgesic Recording Dispenser](#)

Research Assistant at *ETAD Lab*, University of California - Irvine

Irvine, USA

July. 2019 - June. 2022

- To appear in **IEEE 9th World Forum on Internet of Things, 2023**.
- Design **printed circuit boards (PCB)** for an intelligent pill box, equipped with ESP32, fingerprint sensor, servo motor, and OLED screen, to mitigate prescription opioid drug overdose crisis.
- Conduct PCB assembly, software-hardware co-design, debug, and prototype.
- Supervisor: Prof. Sergio Gago, Linyi Xia

Publications

Conference Proceedings

- [\[ISMAR23\] SiTAR: Situated Trajectory Analysis for In-the-Wild Pose Error Estimation](#)
T. Scargill, Y. Chen, **T. Hu**, and M. Gorlatova
In Proc. IEEE International Symposium on Mixed and Augmented Reality, 2023
- [\[WFIOT23\] A Smart Patient Initiated Controlled Analgesic Recording Dispenser \(PICARD\) for Prescription Abuse Prevention](#)
M. Segura, **T. Hu**, B. Neda, L. Xia, R. Wei, P. Gulur, S. Liao, G. Li, S. Gago
In Proc. IEEE 9th World Forum on Internet of Things, 2023
- [\[ICCD22\] Hyperdimensional hybrid learning on end-edge-cloud networks](#)
M. Issa, S. Shahhosseini, Y. Ni, **T. Hu**, D. Abraham, A. Rahmani, N. Dutt, and M. Imani
In Proc. IEEE International Conference on Computer Design, 2022
- [\[ISQED22\] Hybrid learning for orchestrating deep learning inference in multi-user edge-cloud networks](#)
S. Shahhosseini, **T. Hu**, D. Seo, A. Kanduri, B. Donyanavard, A. Rahmani, and N. Dutt
In Proc. IEEE International Symposium on Quality Electronic Design, 2022

Journal Publications

- [\[NeuroFocus24\] Augmented reality-guided twist-drill craniostomy improves the accuracy of external ventricular drain placement](#)
S. Eom, T. Ma, N. Vutakuri, **T. Hu**, A. P. Haskell-Mendoza, D. W. Sykes, M. Gorlatova, J. Jackson.
Neurosurgical Focus (special issue for January 2024)
- [\[TECS22\] Online learning for orchestration of inference in multi-user end-edge-cloud networks](#)
S. Shahhosseini, D. Seo, A. Kanduri, **T. Hu**, S. Lim, B. Donyanavard, A. Rahmani, and N. Dutt
ACM Transactions on Embedded Computing Systems, 2022.

Workshop Proceedings

- [\[CVPR19\] Scan-Flood Fill \(SCAFF\): an Efficient Automatic Precise Region Filling Algorithm for Complicated Regions](#)
Y. He, **T. Hu**, and D. Zeng
In Proc. IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops, 2019

Conference Demonstrations

- [\[MobiCom23\] DNN-based SLAM Tracking Error Online Estimation](#)
T. Hu, T. Scargill, Y. Chen, M. Gorlatova
In Proc. ACM MobiCom 2023

Scholarship, Awards, Grants & Honours

ISQED22 Best Paper Award	2022
South China University of Technology Scholarship - Second Prize	2018
CaiJianZhong Scholarship - Third Prize	2017
Undergraduate Electronic Design Contest, Guangdong Province - Second Prize	2018
Undergraduate Electronic Design Contest, Guangzhou - First Prize	2018
Merit Student of South China University of Technology	2017
Excellent Student Leader of South China University of Technology	2017

Professional Activities

Teaching Experience

- **[EECS240P] Random Processes** Spring, 2022
Teaching Assistant, University of California - Irvine

Mentoring Experience

- **Fan Yang** Pose Tracking Project
Fall 2023
Master student, ECE, Duke University
- **Kaijian Huang** Pose Tracking Project
Fall 2023
Master student, ECE, Duke University
- **Ryleigh Byrne** Unity Emulator Project
Fall 2023
Undergraduate student, ECE & CS, Duke University

Conference Review Service

- IEEE INFOCOM 2023
- ACM SenSys 2023
- ACM MobiHoc 2023
- ACM MobiCom 2023
- ACM HotMobile 2023

Technical Skills

- **Programming Languages:** Python, C++, C#, MATLAB
- **Scientific Computing:** PyTorch, Numpy, Pandas
- **Game Engine:** Unity
- **Hardware:** Nvidia Jetson, Raspberry Pi, ESP32