Hamid Roodabeh

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EDUCATION

University of Virginia
Ph.D. in Electrical and Computer Engineering *2022 – Present*
– **Research Focus:** Teleoperated robotic surgery, medical AI, machine learning, and computer vision.

Amirkabir University of Technology
Bachelor of Science in Electrical and Control Engineering *2021*

TECHNICAL SKILLS

AI & Machine Learning: Deep Learning, Spatiotemporal Modeling, Surgical Activity Recognition, Sequence Modeling (RNN/LSTM), Computer Vision, Multiclass Classification.
Architectures & Models: Multimodal Transformers, Vision Foundation Models (SAM, DINO, VLMs), Large Language Models (LLMs).
Robotics & Domain Expertise: Robotic Telesurgery, Real-Time Sensing & Perception, Human-Machine Interfaces (HMI), Kinematics, Clinical User Studies.
Frameworks & Tools: PyTorch, TensorFlow, OpenCV, HuggingFace, Git, Linux.
Programming Languages: Python (Advanced), C++, R, SQL, LaTeX.

RESEARCH EXPERIENCE

Graduate Research Assistant Charlottesville, VA
University of Virginia *2022 – Present*

– Co-Designed a **multimodal framework for executional error detection** in robotic surgery by integrating video, kinematics, and text prompts. Leveraged vision-language models (CLIP) and CNN (ResNet) embeddings to achieve state-of-the-art F1 score improvements of over 11.7% on standard surgical datasets (JIGSAWS, SAR-RARP50).
– Co-developed a **multimodal Transformer architecture** for real-time recognition and prediction of surgical gestures, fusing kinematic and spatial video features to achieve 89.5% accuracy and an ultra-low 1.1–1.3ms inference time.
– Designed an **activity-aware, dual-mode shared control framework** for teleoperated robotic surgery to ensure operational continuity during network failures. Utilized a context-aware Transformer and a library of Dynamic Movement Primitives (DMP) to reduce trajectory deviation from 26 mm to 3.62 mm under severe packet loss.
– Co-developed **MIDAS**, an open-source, platform-agnostic multimodal data acquisition system. Successfully integrated electromagnetic plus RGB-D tracking and video capture across both open-source (Raven-II) and clinical (da Vinci Xi) robotic platforms.
– Engineered **NetFI**, a novel network fault injection tool for emulating stochastic QoS models. Integrated the tool into a surgical simulation platform and led a 15-participant user study to analyze the impact of network degradation on fine-grained surgical motion primitives.

SELECTED PUBLICATIONS

** Denotes equal contribution*

- **S. H. R. Roodabeh** and H. Alemzadeh. *"Multimodal Activity-Aware Error Detection in Robot-Assisted Surgery."* Submitted to IEEE Robotics and Automation Letters (RA-L), 2024.
- K. Weerasinghe*, **S. H. R. Roodabeh***, A. Hawkins, Z. Zhang, Z. Schrader, and H. Alemzadeh. *"MIDAS: A Multimodal Data Acquisition System and Dataset for Robot-Assisted Minimally Invasive Surgery."* arXiv preprint arXiv:2602.12407, 2026.
- Z. Zhang*, **S. H. R. Roodabeh***, and H. Alemzadeh. *"A Comprehensive Analysis of the Effects of Network Quality of Service on Robotic Telesurgery."* International Conference on Robotics and Automation (ICRA), 2026.
- **S. H. R. Roodabeh** and H. Alemzadeh. *"Activity-Aware Recovery from Network Communication Loss in Teleoperated Robotic Surgery."* Submitted to IEEE for possible publication, 2025.
- K. Weerasinghe*, **S. H. R. Roodabeh***, K. Hutchinson, and H. Alemzadeh. *"Multimodal Transformers for Real-Time Surgical Activity Prediction."* International Conference on Robotics and Automation (ICRA), 2024.