SEENIVASAN LALITHKUMAR

Lalithkumar Seenivasan | Lalithkumar Seenivasan | 0000-0002-0103-1234
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EDUCATION

Doctor of Philosophy (PhD), Biomedical Engineering

2019 – Ongoing | National University of Singapore

- **Scene understanding in robotic surgery** - semantic segmentation, surgical scene graph, surgical action and phase recognition.
- **Natural language processing in robotic Surgery** - surgical visual question answering and surgical scene captioning.
- **Key publications:** Published 2 papers in **MICCAI** and 3 papers (2 concurrently accepted in **IEEE RA-L** Journal) in **IEEE ICRA Conference**.
- Served as **reviewer** for IEEE TMI, IEEE ICRA, DART-MICCAI & IEEE-Sensors.

B.Eng. (Hons) Electrical Engineering

2016 – 2019 | National University of Singapore

- **Design Centric Programme:** Our team worked on a novel tendon-driven actuation mechanism that enabled the miniaturization (diameter: $2-3$ mm) of surgical tools, allowing its deployment through a single-port flexible manipulator (diameter: $8-12$ mm).
- **Exchange Student** at Tampere University of Technology, Finland.

Diploma in Mechatronics

2010 – 2013 | Temasek Polytechnic, Singapore

- **TechX Challange:** Designed and developed 3D simulations of the robot and challenge environments using the ROS and Gazebo simulator, enabling the software team to test the navigation and sensor processing algorithms.
- **Diploma plus** in Life Sciences Fundamentals.

PUBLICATIONS

Top Highlights

- Pang, W., Islam, M., Mitheran, S., Seenivasan, L., Xu, M., & Ren, H. (2022). Rethinking feature extraction: Gradient-based localized feature extraction for end-to-end surgical downstream tasks. ***IEEE Robotics and Automation Letters & ICRA2023***, 7(4), 12623–12630.
- Seenivasan, L., Islam, M., Krishna, A. K., & Ren, H. (2022). Surgical-vqa: Visual question answering in surgical scenes using transformer. In ***International Conference on Medical Image Computing and Computer-Assisted Intervention*** (pp. 33–43). Springer.
- Seenivasan, L., Mitheran, S., Islam, M., & Ren, H. (2022). Global-reasoned multi-task learning model for surgical scene understanding. ***IEEE Robotics and Automation Letters & ICRA2022***, 7(2), 3858–3865.
- Islam, M., Seenivasan, L., Ren, H., & Glocker, B. (2021). Class-distribution-aware calibration for long-tailed visual recognition. ***UDL Workshop, International Conference on Machine Learning***.

AWARDS

National University of Singapore

- Outstanding Undergraduate Researcher Prize AY2017/2018
- FoE 32nd INNOVATION & RESEARCH AWARD (2018)

Temasek Polytechnic, Singapore

- Singapore Manufacturing Federation Metal, Machinery & Engineering Industry Group Project Prize 2013
- Commendation Award for Major Project 2013
- CCA Merit Award in Leadership 2013
- Director's List Award 2013
- Director's List Award 2012

National Service, Singapore Police Force

- Commander's Outstanding Performance Award 2015
- Sword Of Merit, Police Officer Cadet Course 2014

WORK EXPERIENCE

Research Engineer

National University of Singapore

Dec 2020 – Ongoing | Singapore

- Manage and lead projects with research interns

Engineering Manager

Aitech Robotics And Automation Pte Ltd

Aug 2019 – Jul 2020 | Singapore

- Lead and manage the R&D dept
- Technical adviser & Design overall system architecture

Software Engineer (Part-time), R&D Dept

Aitech Robotics And Automation Pte Ltd

Jun 2016 – Jul 2019 | Singapore

Associate Engineer, R&D Dept

Aitech Robotics And Automation Pte Ltd

Jan 2016 – Jun 2016 | Singapore

- Develop robotic solutions in the Robot Operating System (ROS)

- Islam, M., Seenivasan, L., Ming, L. C., & Ren, H. (2020). Learning and reasoning with the graph structure representation in robotic surgery. In ***International Conference on Medical Image Computing and Computer-Assisted Intervention*** (pp. 627–636). Springer.

Extended List

- Islam, M., Seenivasan, L., Sharan, S., Viekash, V., Gupta, B., Glocker, B., & Ren, H. (2023). Paced-curriculum distillation with prediction and label uncertainty for image segmentation. ***International Journal of Computer Assisted Radiology and Surgery***, 1–9.
- Seenivasan, L., Islam, M., Xu, M., Lim, C. M., & Ren, H. (2023). Task-aware asynchronous multi-task model with class incremental contrastive learning for surgical scene understanding. ***International Journal of Computer Assisted Radiology and Surgery***, 1–8.
- Xu, M., Seenivasan, L., Yeo, L. L. L., & Ren, H. (2020). Stent deployment detection using radio frequency-based sensor and convolutional neural networks. ***Advanced Intelligent Systems***, *2*(10), 2000092.
- Ren, H., Chen, C. X., Cai, C., Ramachandra, K., & Lalithkumar, S. (2017). Pilot study and design conceptualization for a slim single-port surgical manipulator with spring backbones and catheter-size channels. In *2017 ieee* ***International Conference on Information and Automation (ICIA)*** (pp. 499–504). IEEE.

Collaborations

- Huaulmé, A., Harada, K., Nguyen, Q.-M., Park, B., Hong, S., Choi, M.-K., … Dou, Q., et al. (2022). Peg transfer workflow recognition challenge report: Does multi-modal data improve recognition? *arXiv preprint arXiv:2202.05821*.
- Nwoye, C. I., Alapatt, D., Yu, T., Vardazaryan, A., Xia, F., Zhao, Z., … Wang, H., et al. (2022). Cholectriplet2021: A benchmark challenge for surgical action triplet recognition. *arXiv preprint arXiv:2204.04746*.
- Lal, R., Swaminathan, R., Seenivasan, L., Qiu, L., & Ren, H. (2021). Scoopnet: 6dof pose estimation pipeline for origami-inspired worm robots. In *2021 ieee* ***International Conference on Development and Learning (ICDL)*** (pp. 1–6). IEEE.

Book Chapters

- Cai, X., Cai, C. J., Seenivasan, L., Tse, Z., & Ren, H. (2023). Untethered soft ferromagnetic quad-jaws cootie catcher with selectively coupled degrees of freedom. In ***Deployable Multimodal Machine Intelligence: Applications in Biomedical Engineering*** (pp. 347–376). Springer.
- Lalithkumar, S., Cai, X., Ramachandra, K., Wong, F., & Ren, H. (2020). Tendon routing and anchoring for cable-driven single-port surgical manipulators with spring backbones and luminal constraints. ***Flexible Robotics in Medicine: A Design Journey of Motion Generation Mechanisms and Biorobotic System Development***, 169.
- Ramachandra, K., Cai, C. J., Lalithkumar, S., Cai, X., Tse, Z. T., & Ren, H. (2020). Tunable stiffness using negative poisson's ratio toward load-bearing continuum tubular mechanisms in medical robotics. In ***Control Theory in Biomedical Engineering*** (pp. 317–358). Elsevier.

- Develop autonomous navigation stack (robot localization, navigation and obstacle avoidance)

Temp Technical Support Officer

Temasek Polytechnic

Oct 2013 – Jan 2014 Singapore

- Involved in a research project in developing an indoor micro-aerial vehicle with autonomous navigation features without the aid of GPS

SKILLS

Python | PyTorch | OpenCV | C / C++ | Gazebo simulator | ROS

LabVIEW | microcontroller programming | CAD Design | Mechanical Prototyping

English
Tamil

NATIONAL SERVICE

Assistant Superintendent of Police
Reservist
2021 – ongoing Singapore Police Force

Inspector
Reservist
2016 – 2021 Singapore Police Force

National Service Inspector
Active
2014 – 2016 Singapore Police Force

LEADERSHIP

Vice-Captain, Touch Rugby

2018 – 2019 NUS Raffles Hall

Captain, Touch Rugby

2017 – 2018 NUS Raffles Hall

Quartermaster, Temasek Polytechnic International Students Group

2012 – 2013 Temasek Polytechnic

CO-CURRICULAR

Touch Rugby | Softball | Photography | International Students Group | Scouts