

# SEENIVASAN LALITHKUMAR

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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 3 papers in MICCAI and 3 papers (2 concurrently accepted in IEEE RA-L Journal) in IEEE ICRA Conference.
- Served as **reviewer** for MICCAI, 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

- **Major Project (TechX Challenge):** 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

- Seenivasan, L., Islam, M., Kannan, G., & Ren, H. (2023). Surgical-gpt: End-to-end language-vision gpt for visual question answering in surgery. In *Accepted in: International Conference on Medical Image Computing and Computer-Assisted Intervention*.
- Pang, W., Islam, M., Mitharan, 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., Mitharan, 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.

## 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

#### The Chinese University of Hong Kong

📅 Mar 2023 – Ongoing    📍 Hong Kong

### Research Engineer

#### National University of Singapore

📅 Dec 2020 – Feb 2023    📍 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

- 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*.
- 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

- Bai, L., Islam, M., Seenivasan, L., & Ren, H. (2023). Surgical-vqla: Transformer with gated vision-language embedding for visual question localized-answering in robotic surgery. *arXiv preprint arXiv:2305.11692*.
- 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.
- Seenivasan, L., Islam, M., Ng, C.-F., Lim, C. M., & Ren, H. (2022). Biomimetic incremental domain generalization with a graph network for surgical scene understanding. *Biomimetics*, 7(2), 68.
- 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.
- 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.

## Book Chapters Highlights

- 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.



## Challenges

- Huaulmé, A., Harada, K., Nguyen, Q.-M., Park, B., Hong, S., Choi, M.-K., ... Dou, Q., et al. (2023). Peg transfer workflow recognition challenge report: Do multimodal data improve recognition? *Computer Methods and Programs in Biomedicine*, 107561.
- Nwoye, C. I., Alapatt, D., Yu, T., Vardazaryan, A., Xia, F., Zhao, Z., ... Wang, H., et al. (2023). Choelectriple2021: A benchmark challenge for surgical action triplet recognition. *Medical Image Analysis*, 86, 102803.

- Develop robotic solutions in the Robot Operating System (ROS)
- 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 – 2023

 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