Thien-Minh Nguyen

S1-B4C-14, School of EEE, Nanyang Technological University, 50 Nanyang Ave, 639798

(+65) 94473163 | thienminh.npn@ieee.org | brytsknguyen.github.io | brytsknguyen | Google Scholar

Research Interests

Robust Intelligent Perception

I am dedicated to advancing the perception capability of autonomous systems, which is a fundamental prerequisite for autonomy. My vision is to achieve robust and intelligent perception capability for autonomous systems in complex and large-scale real world scenarios, enabled by the synergy of complementary sensing modalities under a common mathematical framework (sensor-level), together with distilled prior knowledge inspired by human cognition processes (intelligence-level).

Cooperative Autonomous Systems

I am interested in decentralized cooperation schemes between homogeneous and heterogeneous multi-robot systems. I have extensive experience with Unmanned Aerial Vehicles (UAV), with past and current works related to multi-UAV swarm in various projects such as inspection, mapping, and recreation. Aerial robots are also the test bed for robustness of my proposed perception systems.

Education

Nanyang Technological University *Singapore*

Doctor of Philosophy in Robotics *Aug. 2015 - Aug. 2019*

- NTU Research Scholarship.
- Best Thesis Award: Ranging-Based Adaptive Navigation for Autonomous Micro Aerial Vehicles.

Vietnam National University - Ho Chi Minh City University of Technology *Ho Chi Minh, Viet Nam*

B.Eng in Electrical and Electronic Engineering (Honors) *Sep. 2009 - Apr. 2014*

- Major in Automation and Control.

Appointments

Research Assistant Professor

Centre for Advanced Robotics Technology Innovation - Nanyang Technological University (May. 2023 - Present)

Wallenberg-NTU Presidential Postdoctoral Fellow

Nanyang Technological University & KTH Royal Institute of Technology (Dec. 2020 - Feb 2023)

Grants, Honors and Awards

Wallenberg-NTU Presidential Postdoctoral Fellowship PI Research Grant, SGD100,000 + SEK300000

Hilti SLAM Challenge, 2nd Prize, International Conference on Intelligent Robots and Systems (IROS), 2021

Best Thesis, Doctorate Innovation Award, School of EEE, NTU 2020

Best Paper Awards Finalist, International Micro Aerial Vehicles Competition and Conference (IMAV), 2016

1st Prize in Go Green in the City Contest, by Schneider Electric Viet Nam, 2013

Intel Vietnam Engineering Scholarship, VNU-HCMUT, 2012

Professional Activities

Guest Lecturer

Optimization-based Localization and Mapping (6-credit PhD-level Course), Division of Robotics, Perception and Learning (RPL), KTH, Autumn 2023. All lecture recordings and course materials are shared to public at KTH Canvas.

Invited Talks

Ranging-Aided Navigation for Mobile Robots, Hangzhou Institute of Technology - Beihang University, China, 2020, invited by Associate Professor Guo Kexin.

The SLAM-craft of Aerial Robots: Theory, Practice, and Challenges, Workshop on Autonomous Unmanned Systems Technologies and Applications, 2023 Control and Decision Conference, Singapore.

Reviewer

IEEE Transactions on Robotics (TRO)
IEEE Robotics and Automation Letters (RA-L)
International Journal of Robotics Research (IJRR)
IEEE Transactions on Vehicular Technology (TVT)
IEEE Transactions on Industrial Robotics (TIE)
IEEE International Conference on Robotics and Automation (ICRA)
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)

Organizer

IROS 2024 Workshop and Competition on Multi-Robot Perception and Navigation Challenges in Logistics and Inspection Tasks: A workshop to address the challenges and innovations of robotic systems in *logistics and inspection* tasks, in conjunction with an updated iteration of the CARIC competition. The workshop is a collaboration between the Centre for Advanced Robotics Technology Innovation (CARTIN) and Hong Kong Center for Logistics Robotics.

CDC 2023 Cooperative Aerial Robot Inspection Challenge (CARIC): A benchmark based on Gazebo, RotorS and Robot Operating System to accelerate the adoption of multi-UAV systems in inspection operation. Adopted as a challenge at CDC 2023, Singapore. The resources and latest updates are provided at CARIC Website.

CVPR 2024 UG2+ UAV Tracking and Pose-Estimation Challenge: A comprehensive multi-modal perception datasuite to facilitate research on early detection and tracking of potentially harmful UAVs, addressing the recent international attention on security issues related to small commercial drones. Approved to become the benchmark for the CVPR 2024 UG2+ Track 5 Challenge.

Industry Collaboration Projects

CARTIN WP1.3 Navigation in Repetitive and Dynamic Environment

Research Assistant Professor (May. 2023 - Present)

A project under the logistics thrust of Centre for Advanced Robotics Technology Innovation (CARTIN), NTU.

UAV Localization and Safe Navigation Around Container Cranes During Inspection

Research Fellow (Sep. 2019 - 2021)

A joint research program by National Research Foundation (NRF) – Singapore Technologies Engineering (STE) – Nanyang Technological University (NTU) under NRF's Corporate Lab @ University Scheme.

Drone Inspection for Building Façade

Research Fellow (Sep. 2019 - 2021)

A joint research & development program by research institutions NTU, A*STAR and industry partners Xjera Labs, Tuv Sud Asia Pacific, MTech Imaging under the sponsorship of Singapore Building and Construction Authority (BCA).

GPS-less Localization and Path Planning for UAV Inspection of 3D Structures

PhD Candidate (Aug. 2015 - Apr. 2019)

- A joint research project in the area of Collaborative Teaming (C-RP10A), under NRF-STE-NTU Corporate Lab.
- Accomplished Deliveries: (a) Accurate and efficient Ultra-wideband (UWB) based localization system for UAV navigation in indoor environment; (b) Path planning strategies for 3D object inspection taking into account 5DoF camera model, safety clearance and flight time constraints.

Autonomous Vision-UWB Aided Landing UAV System

PhD Candidate (Aug. 2015 - Apr. 2019)

- A project in collaboration with STE Land Systems to develop an autonomous landing system for UAV in both indoor and outdoor operations using a novel combination of visual navigation and tracking with UWB-based ranging techniques.

2016 Singapore Airshow - STE-Aerospace's Unmanned System Solutions Exhibition

PhD Candidate (Aug. 2015 - Apr. 2019)

- A collaborative project between STE Aerospace and NTU to showcase GPS-less localization technology, where the UWB-based localization system is integrated on STE Aerospace's USTAR-Y UAV platform.

Publications (Selected)

Please visit the full list of my publications and the citation report at my Google Scholar Page.

Journal Articles

[J1] Eigen Is All You Need: Efficient Lidar-Inertial Continuous-Time Odometry with Internal Association
Thien-Minh Nguyen, Xinhang Xu, Tongxing Jin, Yizhuo Yang, Jianping Li, Shenghai Yuan, and Lihua Xie
In *IEEE Robotics and Automation Letters*, 2024

[J2] HCTO: Optimality-aware LiDAR inertial odometry with hybrid continuous time optimization for compact wearable mapping system
Jianping Li, Shenghai Yuan, Muqing Cao, **Thien-Minh Nguyen**, Kun Cao, and Lihua Xie
In *ISPRS Journal of Photogrammetry and Remote Sensing*, 2024

[J3] SLICT: Multi-input Multi-scale Surfel-Based Lidar-Inertial Continuous-Time Odometry and Mapping
Thien-Minh Nguyen, Daniel Duberg, Patric Jensfelt, Shenghai Yuan, and Lihua Xie
In *IEEE Robotics and Automation Letters*, 2023

[J4] NTU VIRAL: A visual-inertial-ranging-lidar dataset, from an aerial vehicle viewpoint
Thien-Minh Nguyen, Shenghai Yuan, Muqing Cao, Yang Lyu, Thien Hoang Nguyen, and Lihua Xie
In *The International Journal of Robotics Research*, 2022

[J5] VIRAL-Fusion: A Visual-Inertial-Ranging-Lidar Sensor Fusion Approach
Thien-Minh Nguyen, Muqing Cao, Shenghai Yuan, Yang Lyu, Thien Hoang Nguyen, and Lihua Xie
In *IEEE Transactions on Robotics*, 2022

[J6] MILIOM: Tightly Coupled Multi-Input Lidar-Inertia Odometry and Mapping
Thien-Minh Nguyen, Shenghai Yuan, Muqing Cao, Yang Lyu, Thien Hoang Nguyen, and Lihua Xie
In *IEEE Robotics and Automation Letters*, 2021

[J7] Persistently excited adaptive relative localization and time-varying formation of robot swarms
Thien-Minh Nguyen, Zhirong Qiu, Thien Hoang Nguyen, Muqing Cao, and Lihua Xie
In *IEEE Transactions on Robotics*, 2019

[J8] Distance-Based Cooperative Relative Localization for Leader-Following Control of MAVs
Thien-Minh Nguyen, Zhirong Qiu, Thien Hoang Nguyen, Muqing Cao, and Lihua Xie
In *IEEE Robotics and Automation Letters*, 2019

[J9] Single landmark distance-based navigation
Thien-Minh Nguyen, Zhirong Qiu, Muqing Cao, Thien Hoang Nguyen, and Lihua Xie
In *IEEE Transactions on Control Systems Technology*, 2019

[J10] SPINS: A structure priors aided inertial navigation system
Yang Lyu, **Thien-Minh Nguyen**, Liu Liu, Muqing Cao, Shenghai Yuan, Thien Hoang Nguyen, and Lihua Xie
In *Journal of Field Robotics*, 2023

[J11] Neptune: nonentangling trajectory planning for multiple tethered unmanned vehicles
Muqing Cao, Kun Cao, Shenghai Yuan, **Thien-Minh Nguyen**, and Lihua Xie
In *IEEE Transactions on Robotics*, 2023

[J12] Range-focused Fusion of Camera-IMU-UWB for Accurate and Drift-reduced Localization
Thien Hoang Nguyen, **Thien-Minh Nguyen**, and Lihua Xie
In *IEEE Robotics and Automation Letters*, 2021

[J13] Tightly-coupled ultra-wideband-aided monocular visual SLAM with degenerate anchor configurations
Thien Hoang Nguyen, **Thien-Minh Nguyen**, and Lihua Xie
In *Autonomous Robots*, 2020

[J14] Loosely-coupled ultra-wideband-aided scale correction for monocular visual odometry
Thien Hoang Nguyen, **Thien-Minh Nguyen**, Muqing Cao, and Lihua Xie
In *Unmanned Systems*, 2020

[J15] Graph Optimization Approach to Range-Based Localization, early access
Xu Fang, Chen Wang, **Thien-Minh Nguyen**, and Lihua Xie
In *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, 2020

Conference Proceedings

[C1] MCD: Diverse Large-Scale Multi-Campus Dataset for Robot Perception
Thien-Minh Nguyen, Shenghai Yuan, Thien Hoang Nguyen, Pengyu Yin, Haozhi Cao, Lihua Xie, Maciej Wozniak, Patric Jensfelt, Marko Thiel, Justin Ziegenbein, and Noel Blunder
In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, 2024

[C2] A Cost-Effective Cooperative Exploration and Inspection Strategy for Heterogeneous Aerial System
Xinhang Xu, Muqing Cao, Shenghai Yuan, Thien Hoang Nguyen, **Thien-Minh Nguyen**, and Lihua Xie
In *2024 18th IEEE International Conference on Control and Automation (ICCA)*, 2024

[C3] MMAUD: A Comprehensive Multi-Modal Anti-UAV Dataset for Modern Miniature Drone Threats
Shenghai Yuan, Yizhuo Yang, Thien Hoang Nguyen, **Thien-Minh Nguyen**, Jianfei Yang, Fen Liu, Jianping Li, Han Wang, and Lihua Xie
In *2024 IEEE International Conference on Robotics and Automation (ICRA)*, 2024

[C4] Outram: One-shot Global Localization via Triangulated Scene Graph and Global Outlier Pruning
Pengyu Yin, Haozhi Cao, **Thien-Minh Nguyen**, Shenghai Yuan, Shuyang Zhang, Kangcheng Liu, and Lihua Xie
In *2024 IEEE International Conference on Robotics and Automation (ICRA)*, 2024

[C5] LIRO: Tightly Coupled Lidar-Inertia-Ranging Odometry
Thien-Minh Nguyen, Muqing Cao, Shenghai Yuan, Yang Lyu, Thien Hoang Nguyen, and Lihua Xie
In *2021 IEEE International Conference on Robotics and Automation (ICRA)*, 2021

[C6] Tightly-coupled single-anchor ultra-wideband-aided monocular visual odometry system
Thien Hoang Nguyen, **Thien-Minh Nguyen**, and Lihua Xie

In *2020 IEEE International Conference on Robotics and Automation (ICRA)*, 2020

[C7] Integrated UWB-vision approach for autonomous docking of UAVs in GPS-denied environments
Thien-Minh Nguyen, Thien Hoang Nguyen, Muqing Cao, Zhirong Qiu, and Lihua Xie
In *2019 International Conference on Robotics and Automation (ICRA)*, 2019

[C8] Post-Mission Autonomous Return and Precision Landing of UAV
Thien Hoang Nguyen, Muqing Cao, **Thien-Minh Nguyen**, and Lihua Xie
In *2018 15th International Conference on Control, Automation, Robotics and Vision (ICARCV)*, 2018

[C9] Model-free Approach for Sensor Network Localization with Noisy Distance Measurement
Xu Fang, Chen Wang, **Thien-Minh Nguyen**, and Lihua Xie
In *2018 15th International Conference on Control, Automation, Robotics and Vision (ICARCV)*, 2018

[C10] Robust Target-relative Localization with Ultra-Wideband Ranging and Communication
Thien-Minh Nguyen, Abdul Hanif Zaini, Chen Wang, Kexin Guo, and Lihua Xie
In *2018 IEEE International Conference on Robotics and Automation (ICRA)*, 2018

[C11] Correlation flow: robust optical flow using kernel cross-correlators
Chen Wang, Tete Ji, **Thien-Minh Nguyen**, and Lihua Xie
In *2018 IEEE International Conference on Robotics and Automation (ICRA)*, 2018

[C12] Ultra-wideband aided fast localization and mapping system
Chen Wang, Handuo Zhang, **Thien-Minh Nguyen**, and Lihua Xie
In *2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2017

[C13] Barrier coverage by heterogeneous sensor network with input saturation
Thien-Minh Nguyen, Xiuxian Li, and Lihua Xie
In *2017 11th Asian Control Conference (ASCC)*, 2017

[C14] Relative localization for quadcopters using ultrawideband sensors
Kexin Guo, Zhirong Qiu, Wei Meng, Thien Minh Nguyen, and Lihua Xie
In *Proceedings of International Micro Air Vechicle Competition and Conference (IMAV), 2016*, 2016

[C15] An Ultra-Wideband-based Multi-UAV Localization System in GPS-denied environments
Thien-Minh Nguyen, Abdul Hanif Zaini, Kexin Guo, and Lihua Xie
In *International Micro Air Vehicle Competition and Conference 2016*, 2016

Intellectual Properties

WO2022045982 - UAV And Localization Method For UAV

Patent

Authors: Thien-Minh Nguyen, Lihua Xie, Shenghai Yuan, Muqing Cao.

TD 2019-007 - Autonomous Vision-UWB-Aided Landing UAV System

Copy-righted Software

Authors: Thien-Minh Nguyen, Lihua Xie, Thien Hoang Nguyen, Muqing Cao. **Licensed by: STE - Land Systems.**

TD 2019-008 - Hardware Design For UWB-Aid Autonomous Landing UAV System

Know-how

Authors: Thien-Minh Nguyen, Lihua Xie, Thien Hoang Nguyen, Muqing Cao. **Licensed by: STE - Land Systems.**

TD 2019-246 - UAV Localization Using UWB Ranging and Onboard Sensors

Copy-righted Software

Authors: Thien-Minh Nguyen, Lihua Xie, Thien Hoang Nguyen, Muqing Cao.

TD 2019-247 - A UWB-Based Localization System

Copy-righted Software

Authors: Kexin Guo, Lihua Xie, Thien-Minh Nguyen.

TD 2019-248 - Model Based Path Planning Method

Copy-righted Software

Authors: Thien-Minh Nguyen, Lihua Xie.

TD 2019-249 - Self-Localization of a UWB Network

Copy-righted Software

Authors: Thien-Minh Nguyen, Lihua Xie.

Contacts for Reference

Dr. Xie Lihua - PhD supervisor, Wallenberg-NTU Presidential Postdoctoral Fellowship Mentor
Professor, School of Electrical & Electronic Engineering
Director for Centre for Advanced Robotics Technology Innovation (CARTIN)
Nanyang Technological Unversity, 50 Nanyang Avenue, Singapore 639798
Tel: +65 6790 4524
Fax: +65 6793 3318.
Email: elhxie@ntu.edu.sg
Office location: S2-B2c-94, Block S2.

Dr. Patric Jensfelt - Wallenberg-NTU Presidential Postdoctoral Fellowship Mentor
Professor, Head of Division
Division of Robotics, Perception and Learning
KTH Royal Institute of Technology, Brinellvägen 8, 114 28 Stockholm, Sweden
Tel: +46 8790 6731
Email: patric@kth.se
Office location: Room 714, Lindstedtsvägen 24

Dr. Wang Chen - Colleague, Research Collaborator
Assistant Professor, Department of Computer Science and Engineering,
The University at Buffalo, State University of New York, 12 Capen Hall, Buffalo, New York 14260-1660
Tel: +1 716 645 0566
Email: cwx@buffalo.edu
Office location: 304 Davis Hall

Dr. Yuan Shenghai - Colleague, Research Collaborator
Senior Research Fellow, Centre for Advanced Robotics Technology Innovation (CARTIN)
Nanyang Technological Unversity, 50 Nanyang Avenue, Singapore 639798
Tel: +65 9710 8795
Email: shyuan@ntu.edu.sg
Office location: S1-B4C-14